No.

MINISTRY OF ENVIRONMENTAL PROTECTION
THE REPUBLIC OF KAZAKHSTAN

THE STUDY ON CAPACITY DEVELOPMENT ON POLLUTION PREVENTION AND CONTROL IN THE PETROLEUM INDUSTRY IN THE CASPIAN SEA AND ITS COASTAL AREAS IN THE REPUBLIC OF KAZAKHSTAN

FINAL REPORT

Volume I : Summary

August 2007

JAPAN INTERNATIONAL COOPERATION AGENCY
NIPPON KOEI CO., LTD.
JAPAN OIL ENGINEERING CO., LTD.

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PREFACE

In response to a request from the Government of the Republic of Kazakhstan, the Government of Japan decided to conduct "The Study on Capacity Development on Pollution Prevention and Control in the Petroleum Industry in the Caspian Sea and its Coastal Areas in the Republic of Kazakhstan" and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Dr. Itaru Okuda of Nippon Koei Co., Ltd. and composed of experts from Nippon Koei Co., Ltd. and Japan Oil Engineering Co., Ltd. between April 2006 and July 2007. The study team conducted field surveys in the study area and held discussions with the officials concerned of the Government of the Republic of Kazakhstan. This final report was completed in August 2007.

I hope that this report will contribute to pollution control in the Northern Caspian Sea and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Kazakhstan for their close cooperation with the study.

Ariyuki Matsumoto
Vice President
Japan International Cooperation Agency

August 2007

August 2007

Mr. Ariyuki Matsumoto
Vice President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

Dear Sir,

We are pleased to submit herewith the final report of "The Study on Capacity Development on Pollution Prevention and Control in the Petroleum Industry in the Caspian Sea and its Coastal Areas in the Republic of Kazakhstan".

Oil and gas development is being vigorously pursued in the Northern Caspian Sea raising the potential threat of environmental degradation in the area, which is famous for its rich biodiversity and fishery resources. In order to tackle these problems, the study team and Kazakh counterparts conducted a series of field surveys including a pilot project during April 2006 and July 2007 leading to the formulation of a Pollution Control Master Plan in August 2007.

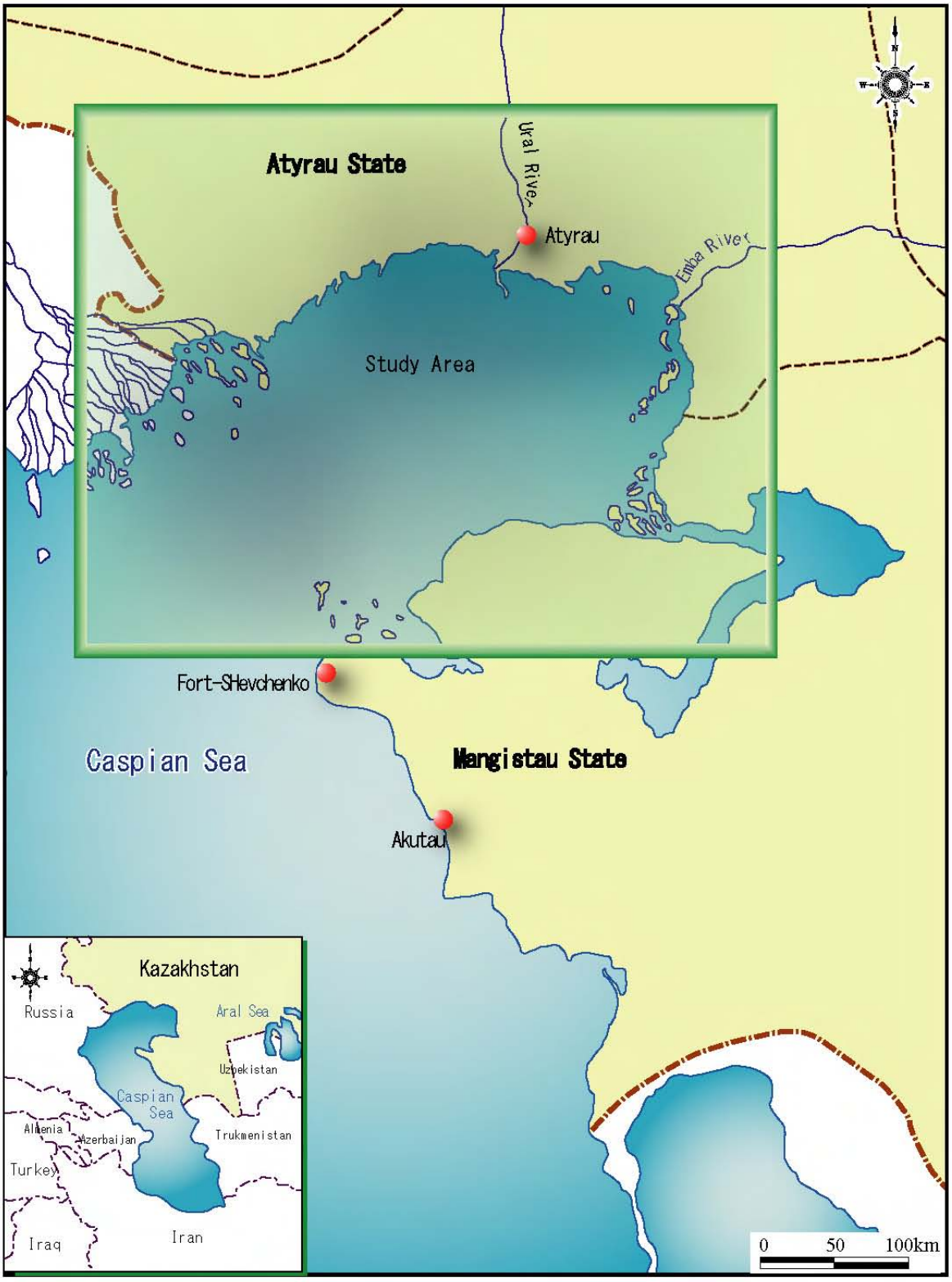
Although the oil and gas enterprises in Kazakhstan are aware of the importance of environmental issues, the sector is growing rapidly and the risk of environmental degradation is increasing. The team hopes the Kazakhstan Government, after thorough review of this report, will adopt the activities and recommendations of the Master Plan and effectively prevent environmental degradation in the Caspian region.

We would like to express our great appreciation to the people of Kazakhstan for their active participation in the Study, especially the Ministry of Environmental Protection, KAZHYDROMET, other relevant organizations and the members of the Steering Committee for the Study. We are also deeply indebted to the officials of JICA, the Ministry of Economy, Trade and Industry, the Ministry of Foreign Affairs, the Embassy of Japan in Kazakhstan, and the JICA Kazakhstan Liaison Office for their continuous support throughout the Study.

Finally, we hope that our outputs will contribute to achieving pollution control in the Northern Caspian Sea and to fostering a long-lasting partnership and friendship between Japan and Kazakhstan.

Yours faithfully,

Itaru OKUDA
Leader of the JICA Study Team



Location Map of Study Area

THE STUDY ON CAPACITY DEVELOPMENT ON POLLUTION PREVENTION AND CONTROL IN THE PETROLEUM INDUSTRY IN THE CASPIAN SEA AND ITS COASTAL AREAS IN THE REPUBLIC OF KAZAKHSTAN

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SUMMARY

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Abbreviations

Abbreviation	Term
API	Air Pollution Index
BAT	Best Available Technique
BOD_5	Biological Oxygen Demand
CEP	Caspian Environment Programme
CIDA	Canadian International Development Age
COD	Chemical Oxygen Demand
DFID	Department for International Development
DO	Dissolved Oxygen
DUCER	Departments of Use and Control of Environmental Resources
EAP	Environmental Action Programme for Central and Eastern Europe
EBRD	European Bank for Reconstruction and Development
EIA	Environmental Impact Assessment
EMS	Environmental Management System
EU	European Union
FRG	Federal Republic of Germany
FRT	Floating Roof Tank
FT-IR	Fourier Transform Infrared Spectrometer
GC-FID	Gas Chromatograph-Flame Ionization Detector
GIS	Geographic Information System
GTZ	German Agency for Technical Cooperation
HSE-MS	Health, Safety and Environment Management System
IPIECA	International Petroleum Industry Environmental Conservation Association
IPPC	Integrated Pollution Prevention and Control
ISO	International Organization for Standardization
JBIC	Japan Bank International Cooperation
JICA	Japan International Cooperation Agency
KCTS	Kazakhstan Caspian Transport System
MCSST	Multi Channel Sea Surface Temperature
MoEP	Ministry of Environmental Protection
MPC	Maximum Permissible Concentration
MPD	Maximum Permissible Discharge
MPE	Maximum Permissible Emission
NGO	Non Governmental Organization
NMHC	Non-methane hydrocarbon
NNR	National Nature Reserve
NOAA	National Oceanic and Atmospheric Administration
NOSRP	National Oil Spill Response Plan
OECD	Organisation for Economic Co-operation and Development
OHSAS	Occupational Health & Safety Management Advisory Services
OSCE	Organization for Security and Co-operation in Europe
PAHs	Polycyclic Aromatic Hydrocarbons

PEL	Probable Effects Level
PM	Particulate Matter
PSA	Production Sharing Agreement
SER	State Ecological Review
SS	Suspended Solid
TACIS	Technical Assistance to the CIS
TCO	TengizChevrOil
TPH	Total Petroleum Hydrocarbon
UNDP	United Nations Development Program
USAID	United States Agency for International Development
USEPA	United States Environmental Protection Agency
USMS ENR	Unified State Monitoring System of Environment and Natural Resources
WB	World Bank

CHAPTER 1 INTRODUCTION

1.1 Introduction

The Caspian Sea and its coast with Kazakhstan are endowed with oil resources, and about 47% of the resources in the country are concentrated in the coastal states (oblasts) of Atyrau and Mangystau. With the development of offshore wells, oil and gas production in the area is expected to increase significantly in the next a few decades. However, development of an environmental management system in the area is still lagging behind, and degradation of air, soil and water quality is becoming a concern. These problems might affect environmental conditions of the northern Caspian Sea, which is famous for its rich biodiversity and fishery resources. In order to deal with such environmental issues, the Government of Kazakhstan in 2003 requested that the Government of Japan implement a development study with the aim being to build local capacity to manage the environment in the region. In response, the Government of Japan sent preparatory missions, and both sides agreed on the Scope of the Work for this study in November 2005.

1.2 Objectives and Study Area

1.2.1 Objectives

The objective of the study is to develop capacity and capability in environmental management to mitigate the environmental degradation caused by petroleum industrial activities in the Caspian Sea and its coastal area.

1.2.2 Study Area

The study area is the shallow and ecologically important northeastern Caspian Sea and its coast, covering the Atyrau oblast and the northern part of the Mangistau oblast (see the location map after the title page above).

1.3 Participating Organizations

1.3.1 Kazakh Organizations

The main counterpart organizations of the study were the Ministry of Environmental Protection (MoEP) and KAZHYDROMET under MoEP. Because environmental issues related to the petroleum industry involve various stakeholders, a steering committee represented by the following organizations was organized for the study: the Ministry of Environmental Protection, KAZHYDROMET, Ministry of Energy and Mineral Resources, Ministry of Emergency Response, Ministry of Agriculture, and Ministry of Economy and Budget Planning. The steering committee was chaired by Mr. A. Braliev, vice-Minister for Environmental Protection. The committee met four times during the course of the study. In addition to organizations affiliated with the ministries mentioned above, the Atyrau oblast government, various oil companies, local laboratories and other organizations have participated in the study.

1.3.2 JICA Study Team

JICA dispatched the JICA Study Team, a team of 12 international experts, to Kazakhstan (hereinafter called JICA Study Team or the team).

1.4 Implementation of the Study

This study was for 1.5 years from March 2006 until August 2007. Figure 1.4.1 shows the general flow of the study. The study had the following three phases, as illustrated in the figure

below:

- Analysis of the current situation (Phase 1)
- Implementation of the Pilot Project (Phase 2), and
- Development of the Master Plan (Phase 3).

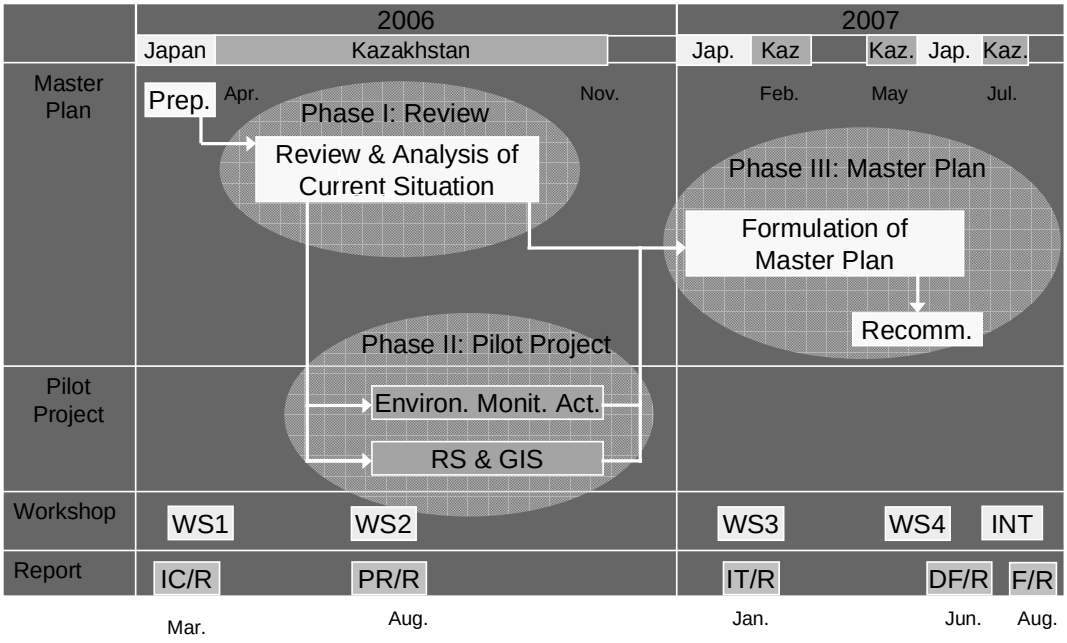


Figure 1.4.1 Overall Flow of the Study

CHAPTER 2 CURRENT CONDITIONS OF THE STUDY AREA

2.1 Environmental Conditions

2.1.1 General Features of the Caspian Sea

The Caspian Sea, 371,000 km^2, is the world's largest natural lake that spreads from southern Russia to northern Iran. Although the depth of water exceeds 200 m in the central and south part, it is considerably shallower in the north. In particular, the northeastern region where the oil development in Kazakhstan is taking place has the average water depth of merely 2 to 5 meters. Due to the very gentle slope of the seabed, the fluctuation of the sea water level has significant impacts on environmental conditions as well as economic activities in the coastal region. The recent extended rise in the Caspian Sea level began in 1978 and continued for 18 years (1978-1996). During the period, the sea water level has increased by 2.4m, and since 1996, the water level has been stable at approximately ASL-27m. Aside from the long-term fluctuations of the sea level, surges caused by storms, cause significant impact on the coastal area. Another important feature of the Caspian Sea is ice formation, which typically lasts for 3-4 months. Usually, the northeast part of Caspian Sea is entirely covered with ice in winter. The average long-term ice thickness in the northeast Caspian varies from 25-60 cm, and reaches 130 cm during severe winters.

2.1.2 Water/Sediment Quality

(1) Water Quality

The monitoring of ambient environmental conditions is the responsibility of KAZHYDROMET. KAZHYDROMET revised its water quality monitoring plan in 2004 and the sampling frequency is supposed to be four-times per year (see Chapter 5 for the details of KZHYDROMET's program). However, so far regular water monitoring has been carried out only once, in February 2005, near the shore because of a problem with the sampling boat. The average values of water quality parameters at four points monitored by KAZHYDROMET in February 2005, are shown in Table 2.1.1.

Table 2.1.1 Water Quality Survey Result in February 2005 (Average among A4, A6, A8 and A10))

Parameter	Temperature	pH	SS	DO	BOD_5	NO_3	Salinity	SO_4	Ca	Mg	Phosphate	Fe
-	°C	-	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
USEPA		6.5-8.5										0.3
MPC	-	-	-	6	3	40	11900	3500	610	940		0.1
Result	0.1	7.3	3.75	6.9	1.675	0.97	800	495	99.5	346.1	0.04	0.29
Year	Phenolic compounds	Oil Products	Mn	Hg	As	Cr6+	Cu	Zn	Pb	Cd	Ni	Na+K
-	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
USEPA			0.05	0.00094	0.0036	0.005	0.0031	0.081	0.0081	0.0088	0.0082	
MPC	0.001	0.05	0.05	0.001	0.01	0.001	0.005	0.05	0.01	0.005	0.01	7100
2005	0.0006	0.054	0.029	ud	0.019	0.006	0.0097	0.108	0.038	0.002	0.0237	488

Source: KAZHYDROMET

pH was 7.3, dissolved oxygen (DO) was 6.9 mg/L, biochemical oxygen demand (BOD_5) was 1.7 mgO_2/L, sulphate was 496 mg/L. Oil products was 0.054 mg/L and it exceeded Kazakhstan's maximum permissible concentration (MPC) slightly. Heavy metals tend to exceed MPCs. These are 0.038 mg/L of lead, 0.019 mg/L of arsenic, 0.0065mg/L of hexavalent chromium and so on. However, the MPCs that were compared with the data are the (deep) seawater standard, and if the analysed values were compared with the MPC for river water, the values for heavy metals do not exceed the MPCs. The northeast Caspian Sea has low salinity (approximately 3‰) and is a relatively closed water area. Therefore, the fact that some parameters exceed the MPCs for deep seawater does not necessarily mean that the water is contaminated. KAZHYDROMET also carried out a non-regular study in June 2006 around inundated abandoned wells and an oil well under construction. The concentrations of phenolic compounds were less than 0.0005 mg/L and oil products were 0.031 to 0.087 mg/L. These are

less than the MPCs. As the value of oil products were less than the MPC level, it can generally be said that a high concentration of oil products was not detected, unless the sampling was conducted at the point of an oil spill.

(2) Sediment Quality

Sediment quality is a good indicator of environmental conditions because pollutants are usually accumulated in sediment. A sediment quality survey was conducted by CEP in 2001 and 2005. As a whole, no serious pollution was revealed by the results. All parameters were below the PELs (Probable Effects Level) of the National Oceanic and Atmospheric Administration (NOAA-USA). Another bottom sediment quality survey was conducted by KAZHYDROMET in June 2006. This study also could not find any significant pollution. pH was 7.5-9.1 and oil products were 0.079 to 0.280 g/kg. Regarding heavy metals, cadmium was 0.053-0.623 mg/kg, lead was 1.77-3.26 mg/kg, and nickel was 1.77-6.79 mg/kg. These results are generally consistent with the results of the sediment survey conducted in this study (see section on Pilot Project). Judging from these results, the sediment in the northern Caspian Sea has not been seriously contaminated, presumably because pollution sources in the area are sparsely located over a wide area, and most on-shore pollution sources use evaporation ponds (or re-injection into oil reservoirs) to treat wastewater, and do not discharge wastewaters to the Caspian Sea.

2.1.3 Air Quality in the Coastal Area

According to the air quality survey conducted by KAZHYDROMET in 2005, the average values of air pollutants in Atyrau are as shown in Table 2.1.2.

Table 2.1.2 Air Quality Survey Result in 2005

Unit: mg/m^3

Parameter	PM	SO_2	CO	NO_2	H_2S	Ammonia
MPC (24 hr. ave)	0.15	0.05	3	0.04	-	0.04
MPC (20 min. ave)	0.5	0.5	5	0.85	0.008	0.2
Ave. concentration	0.1624	0.0043	0.91	0.02	0.0006	0.0088
Max. concentration	0.8	0.009	3	0.07	0.004	0.03

Source: KAZHYDROMET

Both average and maximum values were below the MPCs (Maximum Permissible Concentration) except for PM (particulate matter), which exceeded the MPC slightly. To assess the air pollution level in Kazakhstan, an integrated indicator known as "Atmospheric Pollution Index" (API), which is calculated from the concentrations of priority pollutants (PM, SO_2, CO, NO_2, H_2S), is often used. According to the observed data during the period from 1990 through 2002 in Atyrau, the API decreased from 3.3-4.6 in 1990-1991 to 2.5-1.8 in 2000-2002. They are the lowest values of API in Kazkhstan cities where air quality monitoring is conducted.

2.1.4 Ecological Sensitivity

The northeast Caspian Sea is an important habitat for Caspian seal (estimated 415-435 thousand individuals in 1999) and sturgeons (estimated 11,000 tonnes in late 1990s), and also the seasonal migration route of various species of fish. Furthermore the coast is the nesting and resting area of migratory birds. The area is also important to the fishing industry, and the reserves of valuable commercial fish in the north Caspian exceed 1 million tonnes, worth about 1 billion dollars. For these reasons, there is a need to identify seasonal distributions of key species, distributions of ecologically fragile areas like wetlands, distributions of environmentally polluted areas, etc., and integrate such information into an environmental

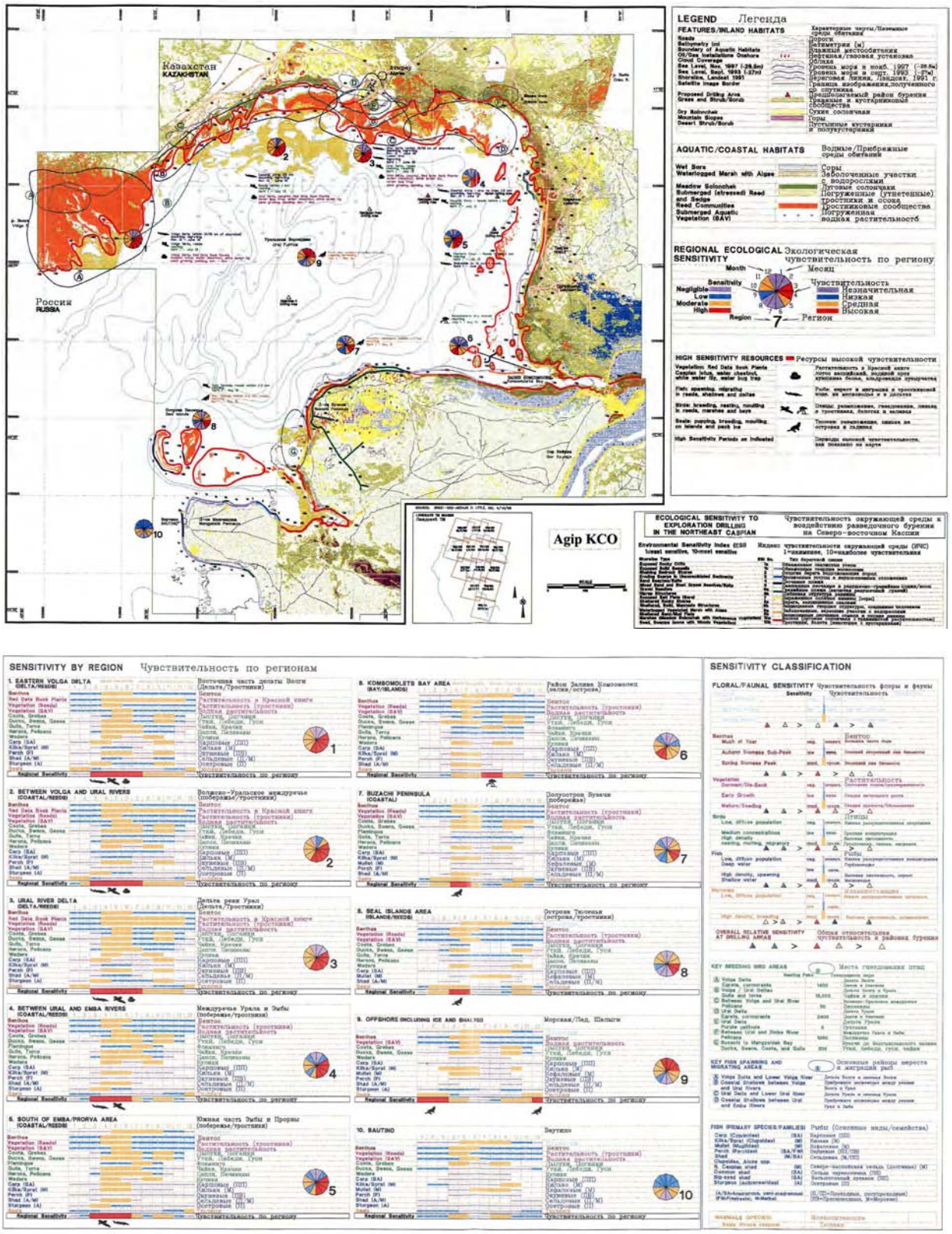
sensitivity index map, which shows biological resources and social facilities that may be greatly influenced by oil pollution. There have been a number of attempts to produce an ecological sensitivity map in the area. For example, CEP has carried out a number of technical studies on environmental sensitivity in the area (Caspian National Thematic Centre on Emergency Response, 2001[1]; Mitrofanov, 2001[2]). Based on these studies, Forestry, Fishing and Hunting Committee of the Ministry MoA has established a working group and is going to implement a detailed study. Agip KCO has developed an environmental sensitivity index map of the Northeast Caspian Sea (Figure 2.2.1) in the EIA study of the Kashagan oil development project (Agip KCO, 2002[3]).

It was noted that there have been occasional reports of mass deaths of Caspian seals and sturgeons. The records of mass deaths of Caspian seals exist since 1968, when 2000 individuals perished. In 1997, a mass death of up to 6,000 head of seals was recorded on the Apsheron Peninsula. In April-August 2000, about 11,000 individuals died. In May 2006, mass deaths of Caspian seals (337 heads) and sturgeons were recorded at Kalamkas. The connection between the mass deaths and oil development is often speculated, but there has been no conclusive evidence.

2.2 Socio-Economy

The total population of Atyrau oblast on January 1, 2005 was 463.5 thousand persons, and the average population density of the Atyrau oblast is 3.9 persons per km^2. The population of Atyrau city on January 1, 2005 was 198.5 thousand persons, which was 42.8% of the total population of the oblast. The total population of Mangistau oblast on January 1, 2000 was 317.1 thousand people, and the average population density is considered the lowest in Kazakhstan, 1.9 persons per km^2. Population of Aktau city on January 1, 2000 was 157.3 thousand people, which was 49.4% of the total population of the oblast. The Gross Domestic Product (GDP) of Kazakhstan and Gross Regional Domestic Product (GRDP) of Atyrau in 2004 were KZT 5.0 trillion and KZT 0.64 trillion, respectively. GDP and GRDP per capita were KZT 333,700 for Kazakhstan and KZT 1396,300 for Atyrau respectively in 2004.

[1] Caspian National Thematic Centre on Emergency Response, 2001, Report on acquisition of information related to sensitive points as part of national and regional Action Plan on Oil Spill Response, GEF-UNDP.
[2] Mitrofanov, I. V., 2001, Review and Evaluation of Impact on fauna of invertebrates, fish, birds and marine mammals of Kazakhstan Part of the Caspian Sea by Heavy Metals, Pesticides and Hydrocarbons, Caspian Environment Programme.
[3] Agip KCO, 2002, Kashagan Experimental Program Technical Substantiation for Selection of Construction Options Volume 4 Preliminary Environmental Impact Assessment.



Source: Kashagan Experimental Program, Technical Substantiation for Selection of Construction Options, Volume 4, Preliminary Environmental Impact Assessment, 2002

Figure 2.2.1 Ecological Sensitivity in the Northeast Caspian Region

CHAPTER 3 EXISTING AND PLANNED OIL AND GAS FACILITIES

3.1 Oil and Gas Companies

The oil and gas companies in Atyrau and Mangistau oblast are summarized in Table 3.1.1. Except for Tengizchevroil (TCO) and Agip KCO, most oil and gas development is executed by KazMunayGas and its joint companies. Embamunaigaz in Atyrau oblast and Uzenmunaigaz in Mangistau oblast are under KazMunayGas.

Table 3.1.1 Oil and Gas Companies in Atyrau and Mangistau

Field of Operation	Company name	
	Atyrau oblast	Mangistau oblast
Oil and Gas Development (Onshore)	・**Embamunaigaz**	・**Uzenmunaigaz**
	・Tengizchevroil (TCO) ・Matin ・Arna oil ・Sazankurak	・Karakudukmunai ・Arman ・Khazakhmunai
Oil and Gas Development (Offshore)	**Kazmunaiteniz**	
	・Agip KCO	―
Oil Refinery	・Atyrau refinery	―
Gas Refinery	・Tengizchevroil (TCO)	―
Oil and Gas Transport (Terminal)	**Kaztransoil**	
	・ CPC pipeline ・ Karachaganak pipeline	―
	Kaztransgas	

Note) Bold letters indicate subsidiary companies of KazMunayGas

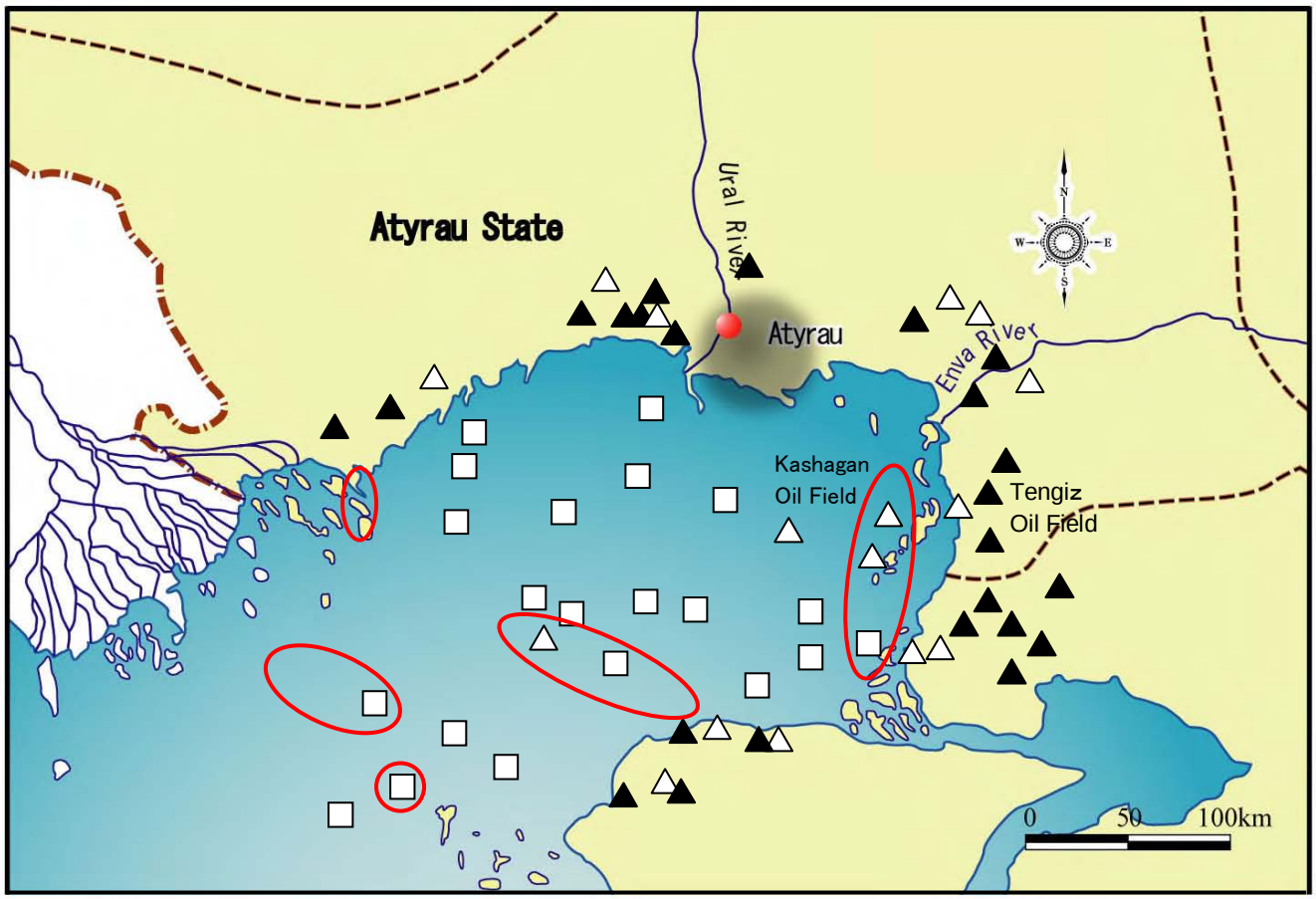
3.2 Oil Reserves and Oil & Gas Production

The recoverable reserve of the Tengiz field is 1.06 billion tonnes, that of the Kashagan field is 2.02 billion tonnes, and the total recoverable reserve owned by KazMunayGas is 0.27 billion tonnes. The oil production volume of each company is shown in Table 3.2.1. The total oil production of Atyrau and Mangistau oblasts was 32,411,000 tonnes in 2006. The total gas production by KazMunayGas was 1.3 billion m^3 in 2003.

Table 3.2.1 Oil Productions by Companies

Atyrau oblast（2006）		Mangistau oblast (2006）	
Company	Production (thousand tonne)	Company	Production (thousand tonne)
Embamunaigaz	2,801	Uzenmunaigaz	6,750
Matin	173	Mangistaumunaigaz	5,742
Arna oil	257	Karakudukmunai	702
Sazankurak	198	Arman	164
Tengizchevroil（TCO）	13,300	Kazazhanbasnunai	2,324
Total	16,729	Total	15,682

Source：MEMR



Legend

- □ Undeveloped oil & gas field
- △ Under developing oil & gas field
- ▲ Operating oil &gas field
- ○ Planned oil & gas field

Source : JICA Study Team

Figure 3.2.1 Oil and Gas Development in North Caspian Sea Region

3.3 Oil and Gas Production Facility

The oil and gas production facilities, refineries and transport facilities are as shown in Tables 3.3.1-3. The locations of these facilities are shown in Figure 3.3.1.

Table 3.3.1 Oil and Gas Production Facilities Under Operation

Type	Atyrau oblast		Mangistau oblast	
	Onshore	Offshore	Onshore	Offshore
Oil field	38+14	1（Kashagan）+1	10＋21	1
Gas field	—	—	5	—
Production base	8/8	4/4	11/11	1/1
Oil refinery	1/1	—	—	—
Gas refinery[Note]	1/1	—	—	—
Terminal	3/3	—	1/1	

Note: TCO facility, Data source: CEP Industrial Survey Part 1 Pollution Loads May 2000

Table 3.3.2 Oil and Gas Refineries

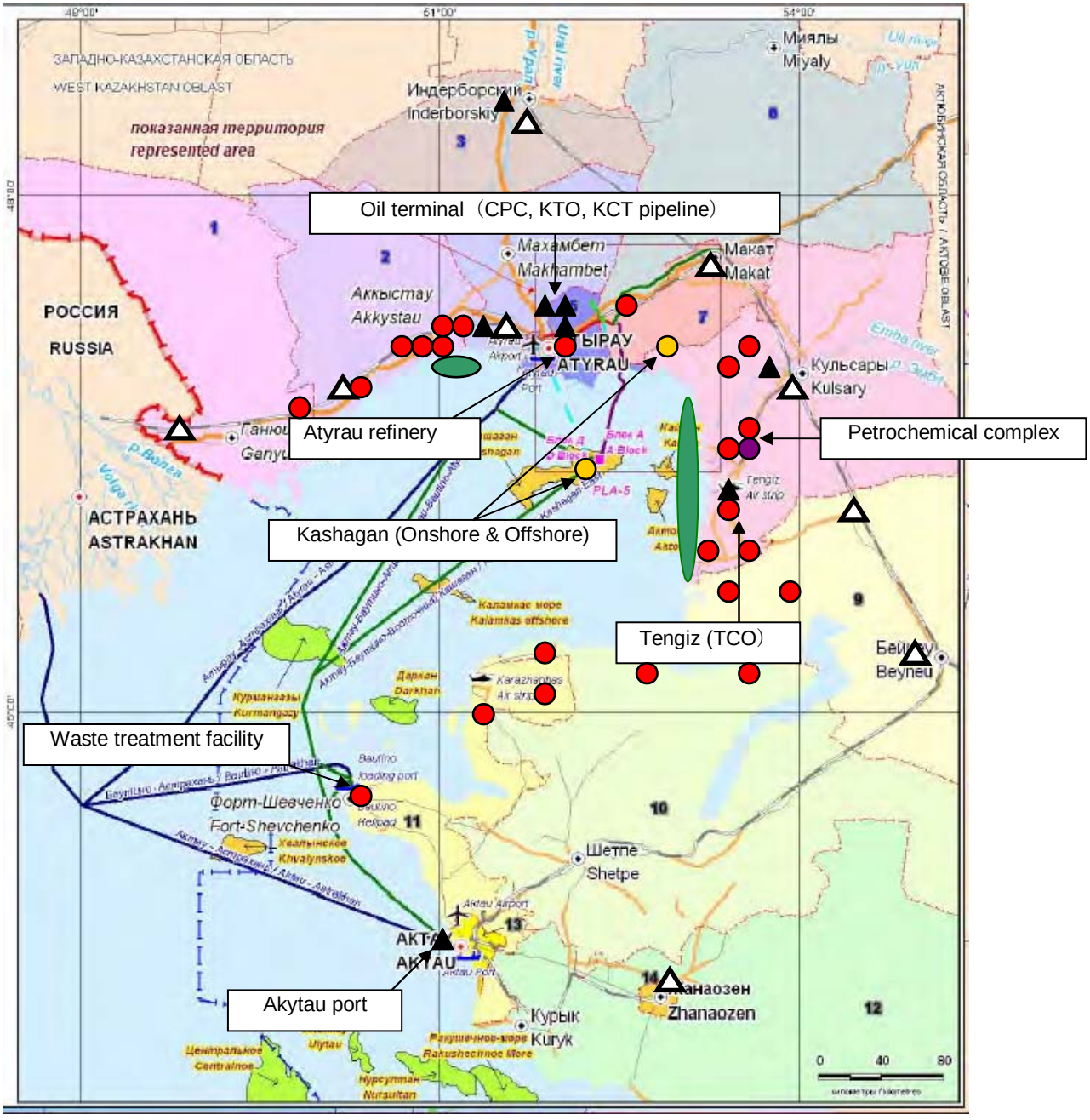
Items	Oil refinery	Gas refinery
Location	Atyrau city	TCO production base
Capacity	Crude oil : 110,000 bbl/day （5,000,000 tonne/year）	LPG production : 976x3 tonne/day Gas Sales : 3,700x3 tonne/day
Revamping	The new facilities for production of high ON gasoline and low sulphur diesel oil has been installed in June 2006	LPG and sale gas facilities for utilization of associated gas has been operating since 2004
Environmental protection	・ Sulphur recovery unit (recovery rate 98%) ・Wastewater treatment facility (activated sludge method)	Sweetening unit (H_2S and mercaptan removal)

Source：Information obtained during field survey and reply for questionnaire (Jun.2006)

Table 3.3.3 Oil and Gas Terminal

Oblast	Company name	Location	Type
Atyrau	**Kaztransoil**	Right side of Ural river	Crude oil transport terminal
	CPC	Right side of Ural river	Crude oil transport terminal
	Karachaganak	Right side of Ural river	Crude oil transport terminal
	Kaztransgas	6 Locations	Gas transport terminal
	-	Ural river bank	Oil supply base for ship
Mangistau	-	Akytau port	Tanker shipping terminal
	Kaztransgas	3 Location	Gas transport terminal

Source：Information during field survey and replies to questionnaire (Jun-Jul. 2006)



Source: Development map for North Caspian Sea, information during field survey (Jun-Jul. 2006)

Figure 3.3.1 Oil and Gas Facilities in North Caspian Sea Region

3.4 Oil and Gas Development Plan

According to the long-term plan, the oil production in the Caspian Sea region (offshore + onshore) is expected to increase rapidly with the increase in the number of artificial islands and platforms for oil production from 2 in 2005 to 56 with 1,100 wells in 2015.

Table 3.4.1 Estimated Oil Production

Production area	Oil production volume (million tonne)		
	2005 year	2010 year	2015 year
Caspian Sea area	0.5	40.0	100.0
TCO&KIO	21.8	45.1	51.9
Onshore except TCO&KIO	38.9	33.5	27.3
Kazakhstan Total	61.2	118.6	179.2

KIO: Karachaganak Integrated Organization

Source: Oil & gas sector development national project in Caspian sea region (The long -term development plan)

The oil production from the Kashagan field is estimated at about 60 % of the total production from the North Caspian Sea area (offshore).

Table 3.4.2 Estimated Oil Production from the North Caspian Sea Area in the Future

Production area	Oil production volume from Caspian Sea area (million tonne)		
	2005 year	2010 year	2015 year
North Caspian Sea (Kashagan)	0.5	22	60
Other offshore	0	18	40
Total	0.5	40	100

Source: Oil & gas sector development national project in Caspian sea region (The long -term development plan)

In order to execute this plan, the following action will be required in each stage:

- First stage (2003-2005) : Monitoring of the North Caspian Sea area, construction of a database, promotion of a national oil and gas company, tender of oil field and negotiation (Agip KCO won the right) and studies of a new export pipeline and oil transport methods
- Second stage (2006-2010) : Start of offshore development, increase in production volume and economic effect, establishment of operator capability by national oil & gas company, implementation of environment protection measures to international standards, development and implementation of additional measures for natural resources protection, and operation of the new export pipeline and further study of new pipeline routes
- Third stage (2010-2015) : Realization of offshore oil and gas development, attaining and maintaining a high level of offshore production, operation of additional oil & gas export facilities, study and development of facilities and systems for utilization of associated products such as petrochemical development.

3.5 Pipelines

Table 3.5.1 summarizes the operating and planned crude pipelines. It is envisaged that new export routes will be constructed in order to meet the increasing oil and gas export volumes. With respect to the crude oil export pipeline, the general plan is as follows:

- A new pipeline for oil export (first step) will be required when the crude oil production in Kazakhstan reaches 92 million tonnes/year (21 million tonnes/year in the Caspian Sea region), which is forecasted to be in 2010.
- The second oil export pipeline (second step) will be required when the crude oil production in Kazakhstan reaches 140 million tonnes/year (64 million tonnes/year in the Caspian Sea region), which is forecasted to be in 2012.

With respect to gas pipelines, the transport capacity of the Central Asia-Central Gas Pipeline will be increased from 40 billion m^3 in 2005 to 65 billion m^3 in 2010, and studies of three major gas pipelines are being carried out.

Table 3.5.1 Crude Oil Pipeline in Kazakhstan

Pipeline	Route	Distance (mile)	Transfer capacity (bbl/day)	
			2001/2002	2010/2015
Operating pipeline				
Atyrau-Samara	Atyrau, Kazakhstan to Samara, Russia	432	310,000	500,000
Baku-Novorossiisk	Baku, Azerbaijan, via Chechnya, to Novorossiisk, Russia/Black sea (Northern route)	868	100,000	300,000
Baku-Novorossiisk	Baku-Novorossiisk via Dagestan Russia	204	120,000	360,000
Baku-Supsa	Baku to Supsa, Georgia/Black sea	515	100,000	100,000
Caspian Pipeline Consortium(CPC)	Tengiz oil field, Kazakhstan to Novorossiisk,	980	560,000	1,340,000
Under construction and planned pipeline				
Baku-Ceyhan (BTC) (May,2006 completion)	Baku to Tbilisi, Georgia, to Ceyhan, Turkey/Mediterranean	1,040	1,000,000	1,000,000
Iran oil swap (under construction)	Neka(Iranian port) to Persian Gulf, oil will be swapped for equivalent amount	208	175,000	370,000
Kazakhstan-Turkmenistan -Iran (proposed)	Kazakhstan via Turkmenistan to Kharg Iisland, Iran on Persian Gulf	930	1,000,000	1,000,000
Kazakhstan-China (under construction)	Aktyubinsk, Kazakhstan to Xingjian, China	613	200,000	400,000

Source : CRS Report for Congress, updated Mar.2005

3.6 Petrochemical Industry

To utilize the huge volume of associated gas from oil production, construction and operation of petrochemical facilities (production of ethylene, propylene, ammonia, etc.) is envisioned as one of the third stage activities (operation after 2015), in order to satisfy demands for petrochemical products in Kazakhstan and to develop the domestic petrochemical industry. The planned location is near Tengiz field (Karaton).

3.7 Environmental Issues and Countermeasures

3.7.1 Countermeasures for Surplus Gas (Flare gas)

Surplus gas from oil and gas development has in the past been burnt-off in flare stacks as flare gas. The long-term national development plan estimates that the total amount of flare gas burnt in Kazakhstan till now is up to several hundred billion m^3. In order to reduce flaring and control emission of pollutants such as SO_2, NO_x, black smoke and global warming gas (CO_2), as well as for energy saving, the Oil Law 2004 mandated, in principle, the prohibition of flaring, and each enterprise submitted their flare gas reduction program by July 2006. According to the latest guideline, the enterprises have to start implementation of their programs from 2010, and they are testing re-injection and other ways to control flaring.

3.7.2 By-products

By-products from the oil and gas industry include: (i) sulphur (generated from the sulphur recovery units in oil and gas development and refining), and (ii) coke (generated from delayed coker in oil refining). There is no plan to increase the capacity of oil refining during 2007-2015. However, generation of by-product sulphur is expected to increase from currently about 3,000 tonnes/day to 10,000 tonnes/day with the increase in oil and gas production in the area. Now TCO stores about 9 million tonnes of sulphur as blocked sulphur. However, export of sulphur to China started in 2005, and the stored volume is gradually decreasing. According to a TCO brochure, the stored volume will be reduced to 5 million tonness by 2015 and 2 million tonnes by 2020.


Figure 3.7.1 Photographs of Stored Sulphur

3.7.3 Oil Contaminated Soils

The status of contaminated land remediation in Atyaru and Mangistau oblasts is shown in Table 3.7.1 and Table 3.7.2

Table 3.7.1 Contaminated Land in Atyrau Oblast

Company name	Contaminated land, ha (beginning of 2004)	Remediatded land, ha (2004-2005 actual (%))	Remaining land, ha (end of 2005)
Tengizchevroil	1,720.890	13.400 (1)	1,707.490
Embamunaigaz	1,961.456	108.31 (6)	1,853.146
KazMunayGas-Telf	4.07	4.07 (100)	0
Arnaoil	3.16	3.16 (100)	0
KazMunayGas-Burenie	155.0	130.0 (84)	25.0
Total	3,844.576	261.94 (7)	3,585.636

Source: Annual Environmental Report of Atyrau oblast (2004 & 2005)

Table 3.7.2 Contaminated Land in Mangistau Oblast (Year 2004－2005)

Company	Contaminated land (ha)	Remediatded land (ha)	Remaining land (ha)
Uzenmunaigaz	114.8	6.0 (5%)	108.8
Zhetybaimunaigaz	367.4	5.4 (2%)	362.0
Kalamkasmunaigaz	65.3	20.7 (33%)	44.6
Karazhanbasmunaigaz	552.7	0.9 (0%)	551.8
Total	1,100.2	33.0 (3%)	1,067.2

Note: waste oil pit area is not included
Data Source: Annual Environmental Report of Mangistau Oblast

3.7.4 Inundated Abandoned Wells

Surveys of 1383 abandoned wells including inundated abandoned wells have already been finished and their locations and status recorded, and the Committee of Geology has produced a GIS map of the wells. (The inundated abandoned wells were surveyed along the Atyrau oblast coast, but not on the Mangistau oblast coast)

3.7.5 Waste

The amount of waste generation by major oil industries in Atyrau oblast is as shown in Table 3.7.3. The amount of waste is decreasing with the improvement of waste management.

Table 3.7.3 Generation of Waste by Major Oil and Gas Companies in Atyrau Oblast

Company name	2004 year	2005 year
	Solid waste (tonne)	Solid waste (tonne)
Tengizchevroil	841,568	674,651
Embamunaigas	38,138	27,558
Kaztransoil (Atyrau pipeline branch)	362	245
Agip KCO	1,315	2,524
Total	881,382	704,978

Source: Annual Environmental Report of Atyrau oblast (2004 & 2005)

3.8 Review of National Oil Spill Response Plan (NOSRP 2000)

The draft NOSRP was reviewed based on an international guideline of IPIECA (International Petroleum Industry Environmental Conservation Association).

- Overall Comments

- The present strategy section does not elaborate actual actions in detail, so more detailed action plans should be specified.
- The NOSRP has to be amended as soon as possible because the effective date of the law has already expired in January 2005.

- Detailed Comments

Detailed comments for each section of the draft NOSRP are given in the Table 3.5.1 of the Main Report. Descriptions of response procedures, availability of response materials and equipment, and the telegram communication system are not adequate.

CHAPTER 4 ENVIRONMENTAL ADMINISTRATION

4.1 Environmental Laws

Kazakhstan inherited its environmental laws from the Soviet Union. Following independence in 1991, Kazakhstan enacted new environmental legislation to replace the Soviet laws. These include the Law on Environmental Protection (1997), the Water Code (1993), the Law on Ecological Expertise (1997), the Law on Specially Protected Natural Territories (1997), and the Air Pollution Law (2002). These new laws gradually superseded the Soviet-era legislation. However, at the start of the present study, the statutory situation remained confusing, and needed a complete revision of the basic law. That revision was undertaken, in consultation with stakeholders, during 2005/6. The resulting Environmental Code has been approved by Parliament, and came into force in early 2007. Some provisions of the Environmental Code came into force immediately. Forty-six other provisions will require secondary legislation, as specified in the decree that introduced the Code.

4.2 Environmental 'Expertise' and Environmental Impact Assessment (EIA)

The Soviet system for the environmental assessment and approval of new project proposals consisted of a process referred to as environmental 'expertise', otherwise known as a State Environmental Review (SER), which persists in Kazakhstan. SER is the responsibility of the oblast offices of MoEP, but large projects are reviewed by the MoEP Headquarters. The requirement for EIA as conceived in the OECD countries has been added to that for 'expertise' by government instructions issued in 1993 and 1996. In addition, Public Environmental Review (PER) has been introduced, which enables interested parties to officially submit recommendations on proposed projects. As such, the character of SER/EIA/PER in Kazakhstan is evolving toward a flexible tool for environmental consideration of proposed projects.

4.3 The Environmental Permitting System and Environmental Standards

There is a system of permits and licenses for access to, and use of, natural resources, which are administered by Forestry, Fishing and Hunting Committee of the Ministry of Agriculture (MoA) for forestry, fishing and hunting, Water Resources Committee of MoA for water uses, and the Geology Committee of the Ministry of Energy and Mineral Resources for oil/gas and minerals. For industrial discharges, the conditions of the permit (now referred to as an 'Emission Permit') are developed by the MoEP. The requirements for permitting, such as individual activities to be controlled and pollutants regulated under the permitting, are substantial, and these requirements made the Kazakhstan's permitting system very burdensome and expensive, and prevented it from achieving the high standards that it appeared to demand.

However, following the recent adoption of the new Environmental Code, it is expected that permit conditions will be simplified, and the number of regulated pollutants will also be reduced from several hundreds to the 40 most hazardous compounds. For these compounds, national limits will be set, and quotas for their discharge will be set by region. For some major enterprises such as those in the oil industry, an alternative system of standards and permits will be used. Technical Specific Emission Standards will be established for specific processes and segments of industries on the basis of their introduction of the best available technologies, and they will then serve as the basis for their integrated environmental permits, known as Complex Permits. Kazakhstan has therefore started to adopt some aspects of the Best Available Technique (BAT) concept that is applied to pollution control in the European Union (EU) and other countries of the Organisation for Economic Co-operation and Development (OECD).

Nevertheless, there is no doubt that the process of redeveloping the system, such as evaluating and selecting the best available technologies and choosing industrial facilities that are eligible for Complex Permits will be very time-consuming.

4.3.1 Economic Instruments and Environmental Funds

The main economic instrument for the control of pollution is the system of fees and fines that is directly associated with the permitting system described above. 'Fees' ('Normative Payments') are set for the MPEs / MPDs stated in the Nature Use Permit, and 'Fines' ('Extra-Normative Payments') are charged for any discharges / emissions / wastes that are made above those limits. The imposition of 'Fines' relies on the self-reporting of the enterprises, backed up by checking and monitoring by the akimat environmental authority (DUCER).

Like the permitting system, the associated system of environmental fees and fines has been roundly criticised by external observers and oil companies. The main criticisms have been as follows:

- The scale of the fees and fines has been insufficient to act as an incentive for companies to improve their environmental performance.
- The system seems to be designed to generate revenue rather than control pollution.
- Of the funds collected in fees and fines, relatively little is spent on environmental management / protection.
- The imposition of fees and fines is inequitable.
- Like the system of environmental permits and MPEs / MPDs, the associated fee-charging system is overly complex and has had to be revised every year, thus incurring a large amount of private and public time and expense in the calculation and negotiation of fees.

Some evolution is taking place, particularly in relation to the scale of fines, which is to be increased, and the 'earmarking' of fees for environmental purposes. However, the other criticisms still stand, particularly the complexity, opacity and inequitability of the system. Despite the introduction of BAT for major oil industries via the new Technical Specific Emission Standards and Complex Permits as specified in the Environmental Code, the system for calculating environmental fees and fines is expected to remain the same.

4.4 Organisations Involved in Environmental Management

4.4.1 Ministry of Environmental Protection

The main Kazakhstan institution working in the field of environmental management is the Ministry of Environmental Protection (MoEP). MoEP has 111 technical staff in its Astana headquarters, and 31 staff on the Committee for Environmental Protection and Control. In addition, MoEP has about 80 staff in each of its 16 'territorial' offices (14 oblasts plus Almaty and Astana). MoEP's strategy for environmental management is based on its 'Concept for the Ecological Safety of the Republic of Kazakhstan for 2004-2015' published at the end of 2003. This is a long-term strategy, the present initial phase of which is concentrating on reducing pollution and then stabilizing the situation at the reduced level. Three-year Action Plans are developed under the Concept, and the present Plan runs until 2007.

4.4.2 KAZHYDROMET

KAZHYDROMET is one of the state service organizations established in March 2, 1999 based on the Government Order No. 185. It is under the responsibility of MoEP, but financially independent of it. It has 2,443 staff involved in various hydro-meteorological monitoring and research activities, which include environmental monitoring at the state level.

It has a programme of regular monitoring of soil, air and water quality. KAZHYDROMET does not get involved in environmental sampling and analysis related to MoEP's inspection and enforcement duties. Monitoring of the ambient environment is kept completely separate from the monitoring of industrial emissions and discharges. However, KAZHYDROMET may sit with MoEP on regional and national commissions that are established to address particular environmental problems or issues.

4.4.3 Oblast Governments

The local structure of environmental management consists of oblast-level (and selected rayon-level) environmental agencies – the Akimat Departments of Use and Control of Environmental Resources (DUCERs). The total number of staff in the DUCERs is about 1,500, i.e. an average of 80 per oblast or oblast-level city, but staffing levels vary according to the local importance of industry. The DUCERs are administratively and financially part of the akimats, but they are subordinate to the MoEP for technical matters. The collection of pollution charges, the monitoring of industrial emissions and the administration of oblast environmental programmes are the main foci of DUCER environmental management. This puts the akimat in a considerable position of power, particularly in an oil-producing area of the country such as Atyrau, which contributes some 20% of the total state budget.

4.4.4 Ministry of Emergency Response

The part of the Ministry that is most relevant to the Caspian oil industry is the marine inspection service or 'State Inspection and Supervision of Safety for Offshore Oil Operations' based in Atyrau with a satellite office in Mangistau oblast. At present, the marine inspection service has no physical capability to respond to oil spills. (The major oil companies are well prepared for the prevention of oil spills. At its Bautino base, Agip KCO has a 1,000 m2 oil spill response facility. An additional oil response centre is to be constructed at Atyrau on the Ural River).

The marine inspection service is responsible for enforcement of two 1999 legal instruments: the Marine Safety Rules and the Technical Rules for Construction of Offshore Oil Facilities. The service may make inspections of offshore and coastal oil exploration and production facilities, pipelines, etc. at any time. It is responsible for technical integrity, fire, health & safety, and it issues licenses for the equipment and certificates of safety. If inspection reveals unsafe equipment or practices, the service has the authority to stop the operation concerned and may impose charges for any additional inspection that is consequently required.

4.4.5 Ministry of Energy

The Ministry of Energy (MoE) is responsible for issuing permits for oil and gas exploration and production operations. It is not known whether / what environmental requirements are attached to such permits. The MoE has taken the lead in organising an industry working group on the utilisation / disposal of sulphur. It also specifies the environmental conditionality within oil and gas Production Sharing Agreements (PSAs).

4.4.6 Ministry of Agriculture

The Ministry of Agriculture (MoA) is responsible for issuing permits for the use of natural resources, including water. It is believed that MoA is involved in the permitting of oil and gas exploration and production operations, for example in relation to the abstraction or reinjection of water, and the use of cooling water. However, it is not known whether / what environmental requirements may be attached to such permits.

4.5 Control of Pollution Sources

4.5.1 Introduction

The regulation of pollution sources is achieved using the complex system of permits, standards and fees/fines. The enforcement of this system is then carried out by 'State Environmental Control' (= compliance enforcement) by authorised government bodies, which include official environmental audits and inspections, and by 'Production Environmental Control' (= self-reporting of environmental performance by the companies concerned). In Atyrau, the inspectorate service of Atyrau MoEP is the executing body for the environmental auditing and inspection of 140 companies, including 37 companies related to the oil and gas industry.

4.5.2 System of Monitoring, Inspection and Auditing

(1) Production Environmental Control

1) Submission of Annual Program and Monitoring Plan by Industries

Companies are required to submit annual programs to Atyrau MoEP in formats designed for each industrial field. An annual program is a comprehensive environmental management document, which generally includes anticipated pollution loads to atmosphere, water, or as waste. Atyrau MoEP checks these programs, and if necessary, requests revisions, and approves the environmental operation licenses. According to the approved annual program, the companies develop their own monitoring plans and submit them to Atyrau MoEP for approval. The monitoring plans are developed independently in accordance with the official rules of MoEP.

2) Environmental Monitoring by Industries

Each company conducts environmental monitoring based on its own approved monitoring program, which prescribes monitoring parameters, locations, frequencies, methods and equipment (see Chapter 5 of this report for the typical monitoring items). The results of self-monitoring by a company are reported to MoEP once/month to once/year depending upon the size of the company. The monitoring results for the year are summarized by a licensed consultant as an annual monitoring report, and submitted to MoEP. According to the new Environmental Code, there is now public access to the annual plans and monitoring results of companies.

(2) State Environmental Control

In order to ensure environmental compliance, MoEP carries out environmental inspection, in which a company's various permits, documents, and monitoring records are reviewed, and inspected on site. Atyrau MoEP executes comprehensive inspections including field inspections once per year under the authority of the central MoEP. The results of MoEP inspections are published in an annual report, which is not confidential. According to the Article 119 of the Environmental Code, five types of inspection (planned inspections, unplanned inspections, cross inspections, patrol inspections, and integrated inspections) may now be conducted.

(3) Control of Violators

MoEP compares the licensed amount and the actual amount of emission/discharge from the monitoring report, and determines the fine to be paid if the actual amount exceeds the licensed amount. If an inspection (or self report) exposes any violations of environmental law, administrative or punitive measures may be taken by the inspector. In a case where

environmental damage has occurred, the company will be presented with a 'claim' for financial reparation. The company can either accept the claim and pay the stated penalty, or may contest the claim in court. The court will review the claim in detail, so inspectors must provide documentary evidence of the violation to prove the case. In cases of continuing pollution, State Environmental Inspectors may issue an order to stop the operation of the unit or plant concerned by presenting the court with proof of the need for closure.

(4) Environmental Audits

The new Environmental Code defines two types of audit. Obligatory audits will be required when environmental damage has occurred, at the re-organization of a company that conducts hazardous activities, or in the case of bankruptcy. Voluntary audits may be initiated by the companies themselves or by insurers, investors, etc. that have an interest in the company.

4.5.3 Problems of Implementation of the Enforcement System

There is no doubt that great efforts are being made, by both the regulators and the regulated, to rigorously enforce pollution control. This is evident from the following:

- Detailed emission/discharge data for various sources are available and reported.
- Pollution charges are collected, based on the monitoring/inspection data. In 2005, the total environmental fine against violation of environmental regulation (extra-normative payment) in Atyrau was KZT 1.1 billion, and the total fees (normative payment) based on nature use permits were KZT 3.7 billion.
- Atyrau MoEP is aware of details of pollution control measures carried out by companies, which are reported in the Annual Report of Atyrau MoEP, as these measures are included in the three-year oblast Environmental Program funded both by the oblast and the companies (see Chapter 4).

On the other hand, it is also the case that the current enforcement system is putting a heavy burden on both the inspectors and the companies. For example, the inspection service of Atyrau MoEP is under significant pressure because:

- The amount of information the inspectors have to deal with, such as the companies' environmental plans and monitoring reports, is overwhelming.
- There is a shortage of skilled specialists to review the pollution control measures of companies.
- There is no MoEP laboratory, and it is difficult to support the results of inspection with scientific data.
- The inspectors have to travel long distances.
- The rapid growth of the economy is resulting in an increased number of premises to be inspected.

Likewise, the companies are also under pressure to cope with growing demands to meet the environmental regulations. The criticisms of the current enforcement system include the complexity, opacity and inequitability of the system, as already discussed above.

CHAPTER 5 ENVIRONMENTAL MONITORING

5.1 Basic Framework of Environmental Monitoring in Kazakhstan

Under the Kazak legislation system, environmental monitoring activities are implemented for not only environmental protection but also wise-use of natural resources with dissemination of monitoring results to the public. The new Environmental Code promulgated in early 2007 has adopted the same general monitoring framework, and MoEP is gearing towards formally establishing the Unified State Monitoring System for Environment and Natural Resources (USMS ENR), and sharing of environmental information is being pursued under the leadership of MoEP's Department of Environmental Monitoring, which is supported by MoEP's Information-Analytical Centre and KAZHYDROMET.

5.2 Environmental Monitoring in the Northern Caspian Sea Region

5.2.1 Overview

There is a clear demarcation for monitoring activities between MoEP and KAZHYDROMET. MoEP has the responsibility to monitor emission sources, while KAZHYDROMET is in charge of monitoring of the ambient environment. Periodic monitoring activity in the Caspian Sea is implemented by KAZHYDROMET. In addition, several national and local organizations, such as the Ministry of Agriculture, Ministry of Health, and the akimat office, implement monitoring on land and sea area. Currently, KAZHYDROMET is upgrading the environmental laboratory of the Atyrau KAZHYDROMET as "the Regional Environmental Monitoring Centre" in order to manage regional environmental monitoring activities in the entire northern Caspian region.

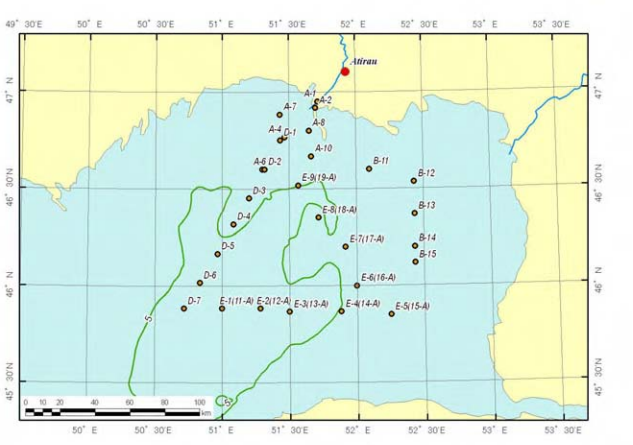
5.2.2 Sampling Points

(1) Air Quality Sampling Points

According to Atyrau HYDROMET Center under KAZHYDROMET, there are two sampling stations for air sampling in Atyrau city. The number of air sampling points should be increased to monitor overall air quality in the region, and to evaluate air quality around oil refineries, oil fields, sulphur storage sites, and other pollution sources.

(2) Water Sampling Points

KAZHYDROMET's water sampling points in the Caspian region are located as shown in Figure 5.2.1. However, recent sampling is limited to the downstream of Ural River and some coastal points because there is a problem with the sampling boat. Also, there is a need to optimize locations of sampling points based on the needs for environmental information by MoEP, akimat, and other stakeholders, as there are locations that are of special interest to environmental management activities of these stakeholders.



Source : Atyrau HYDROMET Centre

Figure 5.2.1 Sampling Points Downstream of Ural River and the Caspian Sea

5.2.3 Sampling Frequency and Analyzed Parameters

The frequencies of air quality monitoring and water quality monitoring stipulated in the yearly environmental monitoring plan: (i) air quality – four times per every day, (ii) water quality – four times per year, and (iii) sediment quality – once per year.

Table 5.2.1 summarizes the monitoring parameters analyzed by Atyrau KAZHYDROMET. However, apparently not all parameters are analyzed regularly. Analytical methods and quality control system follow systems from the Soviet era such as SNIP and GOST, which are consistent with the national regulations.

Table 5.2.1 Analyzed Parameters

Category	Parameters
Air Quality	(1) SO_2 (2) CO (3) NO_2 (4) H_2S (5) NH_4 (6) Particle matter
Water Quality	(1) pH (2) DO (3) BOD_5 (4) NH_4-N (5) NO_3-N (6) PO_3-P (7) K (8) Mg (9) Si (10) Fe (Fe (II), Fe (III)) (11) Cu (12) Zn (13) Ni (14) Cr (Cr (VI), Cr (III)) (15) Cd (16) Pb (17) Ag (18) Hs (19) Hg (20) Co (21) Mo (22) Sn (23) Mn (24) V (26) H_2S (27) F (28) SO_4 (29) F (30) B (31) CN (32) SCN (33) Phenol (34) Oil Products

Source : Atyrau HYDROMET Centre

5.2.4 Data Analysis, Reporting and Feedback of Environmental Monitoring Information

To store air quality monitoring data, the Atyrau HYDROMET Centre has a database application, which was provided by KAZHYDROMET under the concept of Unified State Monitoring System of Environment and Natural Resources (USMS ENR). However, water quality monitoring data are usually sent to the head office of KAZHYDROMET in Almaty, and managed at the head office. Atyrau HYDROMET Centre has a part of the data in an Excel file, but does not have the complete data set for the region.

KAZHYDROMET compiles analytical results and prepares a quarterly newsletter, "Environmental Status of the Caspian Sea in the Kazakhstan Area", and an annual report, "Monitoring Results of Environmental Status of the Caspian Sea in the Kazakhstan Area". The newsletter and report are distributed to MoEP, Atyrau Akimat, Mangistau Akimat, and Atyrau HYDROMET Centre. Under the existing system, the information is provided to other organizations upon request of the other organizations.

5.3 Environmental Monitoring Activities by Other Organizations

5.3.1 MoEP

MoEP has a responsibility to monitor discharge of pollutants from the enterprises. Under the regulations based on the Law on Environmental Protection, the enterprises themselves have a duty to monitor the pollutants they discharge, so the regular work of Atyrau MoEP for pollution source monitoring is to check the monitoring reports submitted by each enterprise. The enterprises should prepare an annual monitoring plan on pollutants discharged, and regularly submit the environmental monitoring report to MoEP. Atyrau MoEP checks their monitoring data, and charges fines if they find pollution loads above the MPDs. (see Chapter 4 for the details of pollution control activities). At the moment, Atyrau MoEP does not have any environmental laboratory. However, it has a plan to establish their own laboratory (Atyrau MoEP laboratory) to analyze emission gas and wastewater for crosschecking of monitoring data by the enterprises.

5.3.2 Environmental Monitoring Activities by Other Governmental Organizations

Atyrau akimat implements air and water quality monitoring in and around Atyrau city. They have authority to monitor discharge of pollutants from enterprises, and implement inspection at the local level and report violations to the responsible bodies. The Ministry of Agriculture monitors water quality related to agricultural activities. The main targets of their monitoring are drainage channels. The Ministry of Health has a responsibility for assessing the health impact of pollutants discharged.

5.3.3 Environmental Monitoring by the Oil Industries

Private oil industries implement self-monitoring based on the monitoring plan submitted and approved by MoEP. Examples of monitoring items are shown in Table 5.3.1. As mentioned in Section 5.4, remote sensing techniques are also being adopted for the monitoring activities.

Table 5.3.1 Examples of Monitoring Items of Private Oil Enterprises

Project	Kashagan		Tengiz
Company	Agip KCO		TCO
Location	Offshore	Onshore	Onshore
Ambient air	CO, SO_2, NO_2, H_2S, HC, PM, mercaptans	CO, SO_2, NO_2,HC, H_2S, mercaptans	CO, SO_2, NO, NO_2,HC, H_2S, mercaptans
Water	Temp, pH, Salinity, DO, THC, Turb, T-N, T-P, Heavy metal etc	Groundwater Level, pH, Oil etc	Groundwater Level, pH, Oil etc
Sediment	HC, TOC, Phenol Heavy metal etc.	(On land soil) Oil, Heavy metal	(On land soil) Oil, Heavy metal
Flora and Fauna	Benthos, bird, Caspian seal	Territorial flora, bird	Territorial flora, bird
Sea conditions	Wave, current, temp.	-	-
Air	Fuel & Flare flow, NO_x SO_2, , RSH, PM etc	Fuel & Flare flow SO_2/H_2S NO_x, CO	Fuel & Flare flow, Temp, SO_2, NO_x, CO
CO_2 (Calc.)	Yes	Yes	Yes
Water	Flow, Temp, TSS, pH, Oil, COD, T-N, T-P etc,	Flow, Temp, TSS, pH, Oil, BOD_5	Flow, Temp, TSS, pH, Oil, BOD_5, Heavy metal
Chemical	Input & output Drilling mud	Input & output	Input & output
Waste	Volume & disposal	Volume & disposal	Volume & disposal
Radiation (NORMs)	Yes	No	Yes

Source : Kashagan EIA report, TCO Annual monitoring report

5.4 Environmental Monitoring Using Remote Sensing and GIS

5.4.1 KAZHYDROMET

Since 2002, KAZHYDROMET has been forecasting oceanographic-phenomena and freezing of the Caspian sea using common image-processing software, to view imagery of the meteorological satellite NOAA. However, they were not processing satellite imagery. As of July 2006, there was no engineer in KAZHYDROMET who could use satellite image processing software, and this study provided training on satellite image analysis (see Pilot Project).

The GIS database for the environmental monitoring of the whole of Kazakhstan has been developed by KAZHYDROMET from the 2004 fiscal year. The map information on 1/1 million scale is used as the base map. The environmental monitoring data in each oblast, such

as air, river, and water quality, are contained in this system. KAZHYDROMET has already started building a WebGIS server on an exploratory basis. Using this system, it will become possible to check monitoring results or to input monitoring data into the system, from the local monitoring centres in the country, by using the Internet. The tasks of local monitoring centres are data collection, and they are not involved in satellite image analysis and GIS database development.

5.4.2 MoEP

A natural resources database (forest, specially nature preserve, animals-and-plants, fishery facilities) has been created at the Information-Analytical Centre of MoEP. The scales used in the database are 1/1 million at the national scale and 1/200,000 for the oblast unit and the Caspian Sea area. At Atyrau MoEP, there is no section that can perform image processing, and there is no record of the latest satellite images being used. Atyrau MoEP's main interest in the use of satellite image analysis is the application for surveillance and/or identification of pollution sources. There is a wish to manage information on enterprises and their environmental data using GIS. However, time pressures and the limited budget prevent them from developing such a GIS system.

5.4.3 KazMunayGas

KazMunayGas has been carrying out environmental monitoring by satellite image data and construction of GIS databases from 2005. KazMunayGas's environmental monitoring covers their facilities in the northern part of Caspian Sea. The contents of environmental monitoring are 1) Air Pollution (flare), 2) Sea Pollution (oil slick), 3) Soil Pollution, 4) Drift Ice and 5) Environment in the facilities. Kazgeocosmos under KazMunayGas performs the KazMunayGas's satellite image analysis, and construction of the GIS-based environmental database. Kazgeocosmos tackles the upgrading of not only hardware but also software for the environmental monitoring. Kazgeocosmos is equipped with a ground receiving station for satellite data and aircraft equipped with sensors. In addition, Kazgeocosmos developed a progressive GIS database system, which consists of a WebGIS server by ArcIMS. KazMunayGas, KazTransOil, and other companies as the clients, can browse the GIS database via the WebGIS server and Internet.

5.5 Examination of Current Capacity for Environmental Monitoring

The issues related to monitoring activities discussed above can be summarized as shown in Table 5.5.1.

Table 5.5.1 Existing Issues for Monitoring Activities on Petroleum Industry Pollution Control

Activities	Issues		
	Institutional Aspects	Organizational Aspects	Technical Aspects
1) Collect data to assess current situation and trends in environmental conditions of the northern Caspian Sea by ambient environmental monitoring in the Caspian Sea and its adjacent terrestrial area.	a Clarification of responsibilities for monitoring of the Caspian Sea among relevant organizations b Examination of possible additions to monitoring parameters related to oil development	a Revision of the monitoring plan considering the development of oil fields in off-shore areas and construction of on-shore facilities b Setting of representative sampling points in the northern Caspian Sea c Fixing of sediment sampling points d Setting of air quality monitoring points outside Atyrau city e Development of a database for management and utilization of monitoring data f Input of human resources for the Regional Environmental Monitoring Centre	a Adoption of technical tools to collect regional environmental information including the areas where access is difficult b Improvement of technical capacity to analyze pollutants related to oil development c Securing reliability of analytical laboratories
2) Collect data to identify environmental impact by the petroleum industry by pollution source monitoring of relevant facilities.	-	a Formulation of pollution source monitoring plans depending on the condition of oil development facilities b Setting priority monitoring parameters for pollution source monitoring	a Improvement of technical capacity to analyze pollutants related to oil development b Development of technical capacity to analyze constituents of petroleum products and interpretation of analytical results c Improvement of technical capacity for compliance inspection
3) Confirm the scale of impact and progression of oil spills by spilled oil monitoring after occurrences of oil spill cases.	a Clarifying responsibilities of relevant organizations for spilled oil monitoring	-	a Introduction of measures to implement swift and continuous post-accident monitoring of oil spills
4) Provide the collected monitoring information to various stakeholders such as central and local governments, private sectors including the petroleum industry, and other countries related to the Caspian Sea.	a Clarifying responsibility of the Regional Environmental Monitoring Centre to participate in the international monitoring program	a Securing means to disseminate monitoring information from the Regional Environmental Monitoring Centre and other organizations	a Development of a GIS database to combine the various monitoring information. b Training of the staff of Atyrau Hydromet Centre and Atyrau MoEP about environmental databases.

Source : JICA Study Team

CHAPTER 6 ENVIRONMENTAL CO-OPERATION BY DONORS

Since its independence in 1991, Kazakhstan has received a considerable amount of environmental assistance from the donor community. Selected environmental projects supported by donors are listed in Table 6.1.1.

Table 6.1.1(1) List of Kazakhstan Environmental Projects Funded by Donors Since 1995

1995 – on-going	CIDA	Canada Fund (1); Climate Change Initiative Support (2); Local Initiative Programme Fund (3)
1996 - 2002	FRG / GTZ	Environmental Protection in the View of Water Resources Protection in Almaty
1997 – on-going	UNDP	GEF Small Grants Programme. Jointly with GEF.
1997 - 2005	UNDP	Assistance to the GoK in the Development of a Strategy to Implement the Convention on Biodiversity
1998 - 2003	UNDP	The Aral Sea Region Development and Humanitarian Assistance Programme
1998 - 2002	UNDP	Support to the National Programme (NAP) Process in Context to Combat Desertification in Kazakhstan
1998 - 2005	UNDP	In-situ Conservation of Kazakhstan's Mountain Agrobiodiversity
1998 - 2003	UNDP	Integrated Conservation of Priority Globally Significant Migratory Bird Wetland Habitat
1999 - 2002	WB	Nura river cleanup
2000 - 2004	UNDP	Institutional Strengthening for Sustainable Development
2000 - 2004	EU-TACIS	Establishment of Facilities for Mass/Volume, Containment/ Surveillance and Training at the Ulba Fuel Fabrication Plant in Kazakhstan
2000 - 2004	EU-TACIS	On-Site Assistance to the BN 350 Aktau Nuclear Power Plant
2000 - 2003	EU-TACIS	Joint Environmental Programme, phase I
2000 - 2001	FRG / GTZ	Rehabilitation of Old Neglected Deposits in Ust-Kamenogorsk
2000 - 2003	JICA	"Enhancement of Water Quality Monitoring"
2000 - 2003	WB	Drylands Management
2001 - 2002	UNDP	Capacity Building for Disaster Preparedness in Kazakhstan
2001 - 2004	UNDP	Country Programme for Phasing Out of Ozone Depleting Substances
2001 - 2002	EBRD	Almaty Solid Waste Management Project - Institutional Support (ear-marked portion)
2001 - 2005	USAID	Energy and Water Management
2001 - 2003	EU-TACIS	Support to the Ministry of Ecology - air pollution mitigation in Almaty
2001 - 2003	EU-TACIS	Western Tian-Shan Biodiversity Conservation Project
2001 - 2002	EU-TACIS	Atmospheric pathways and monitoring systems for Ukrainian and Kazakh sites
2001 - 2003	EU-TACIS	Support to implementation of environmental policies and NEAPs (National Environmental Action Plans) in NIS
2001 - 2003	EU-TACIS	Support to RECs (Regional Environmental Centres) in NIS, phase III
2002 - 2003	UNDP	Aid Co-ordination Report in the Aral Sea Basin - Removing Barriers to Improve Projects' Performance in the Aral Sea
2002 - 2005	UNDP	Initial Assistance to the Republic of Kazakhstan to Meet its Obligations Under the Stockholm Convention on Persistent Organic Pollutants (POPs)
2002 - 2004	UNDP	Environmental Impact on National Development. A Review.
2002 - 2003	FRG / GTZ	Consolidation of results of the water resources project in Almaty
2002 - 2003	UK / DFID	Young Guards of Nature
2002 - 2003	UK / DFID	Environmental group "Assa"

Table 6.1.1(2) List of Kazakhstan Environmental Projects Funded by Donors Since 1995

2002 - 2002	OSCE	Regional Workshop "Raising Awareness on the Aarhus Convention in the East Kazakhstan region"
2002 - 2002	OSCE	Preparatory Seminar "Rio+ 10: Central Asia"
2002 - 2002	OSCE	Clean-up action in the Charyn Canyon
2002 - 2002	OSCE	Conference "Import and Storage of Radioactive Waste in Kazakhstan"
2002 - 2003	OSCE	Elaboration of the Monitoring Indicators for the Implementation of the Aarhus Convention in Kazakhstan
2002 - 2004	UK / Other	Energy Efficiency Project in Karaganda (was cancelled).
2003 - 2004	EU-TACIS	Support to RECs (Regional Environmental Centres) in NIS, phase IV
2003 - 2006	EU-TACIS	Joint Environmental Programme, phase II
2003 - 2005	EU-TACIS	WARMAP - III (Water resources management in the Aral Sea basin)
2003 - 2005	EU-TACIS	Cleaner production in selected countries of the NIS Moldova, Georgia and Kazakhstan
2003 - 2005	EU-TACIS	Caspian Environment Programme
2003 - 2003	Mashav	Training programmes; Demonstration projects
2003 - 2004	UNDP	Strengthening Environmental Management for Sustainable Development
2003 - 2010	UNDP	Integrated Conservation of Priority Globally Significant Migratory Bird Wetland Habitat: A Demonstration on Three Sites.
2003 - 2004	UNDP	National Capacity Self-Assessment for Global Environmental Management (NCSA)
2003 - 2004	EU-TACIS	Strengthening the Capacity of Basin Water Organisations (BWOs) for Improved Resource Planning
2003 - 2004	UK / Other	Saiga Antelope Project
2003 - 2003	UK / Other	GHG Inventory Workshop
2006-ongoing	JICA	Mercury Monitoring in Nura River Basin
2004 - 2005	EU-TACIS	Environmentally Friendly Development in Kyzylorda Region
2004 - 2006	EU-TACIS	The Initial Ignition of Sustainability - Creation of Central Kazakhstan Education Bio Gas Centre "Azure Flame"
2004 - 2004	UK / Other	Education for Sustainability
2001-ongoing	JBIC	Atyrau Refinery Reconstruction Project
2006-ongoing	JICA	Study on Capacity Development for Pollution Prevention and Control in the Petroleum Industry of the Caspian Sea and its Coastal Areas in the RK
ongoing	EC	Development of National Environmental Strategies for Sustainable Development (Kazakhstan, Kyrgyzstan and Tajikistan)

Source: UNDP Almaty Office, May 2006, modified by JICA Study Team

CHAPTER 7 OBJECTIVES OF PILOT PROJECT

7.1 Objectives of Pilot Project

The pilot project of this study has two components: (i) examination of the environmental monitoring plan, trial sampling and analysis, and (ii) remote sensing and GIS technologies in environmental management. The objectives of the pilot project are:

- To implement activities contributing to future development of monitoring activities by Atyrau MoEP and the Atyrau HYDROMET Centre, which is the parent body of the Regional Environmental Monitoring Centre, and
- To support the introduction of remote sensing and GIS technologies for environmental monitoring in the northern Caspian Sea.

7.2 Main Joint-work during the Pilot Project

In order to effectively use this opportunity to develop local capacity and transfer technologies, all activities were carried out jointly by local experts and JICA Study Team members. The main joint-works implemented through the pilot project are summarized below:

Table 7.2.1 Main Joint-work Implemented through the Pilot Project

Component	Work Item	Period	Participants for Joint-work	Measures
1.Environmental Monitoring Activity	(1) Water and sediment quality monitoring	Oct. to Nov. 2006 Sampling : 14th, 16th, and 20th to 21st Oct.	Atyrau MoEP Atyrau HYDROMET	Planning and sampling: Joint-work Analysis: Sub-contract work named "Environmental Monitoring (off-shore) Survey"
	(2) Air quality monitoring	Oct. to Nov. 2006 Sampling : 26th to 27th Oct.	Atyrau MoEP Atyrau HYDROMET	Planning and sampling: Joint-work Analysis: Sub-contract work named "Environmental Monitoring (on-shore) Survey"
	(3) Soil quality monitoring	Oct. to Nov. 2006 Sampling : 19th to 29th Oct.	Atyrau MoEP	Planning and sampling: Joint-work Analysis: Sub-contract work named "Environmental Monitoring (on-shore) Survey"
	(4) Lecture on petroleum derived pollutants analysis	24th Oct. 2006	Atyrau HYDROMET	Lecture
	(5) Mini-workshop for discussion on needs of Regional Monitoring Centre	27 Oct. 2006	Atyrau MoEP KAZGIDROMET Atyrau HYDROMET Atyrau AKIMAT Fishery Department Emergency Response Department	Presentation and discussion in mini-workshop
	(6) Analytical training with certified reference material	1st to 3rd Nov.2006	Atyrau MoEP Atyrau HYDROMET	Lecture and practical training in laboratory
2. Remote sensing and GIS technologies in environmental management	(1) Technical transfer training on satellite image analysis	18th Oct. to 17th Nov.2006	Atyrau HYDROMET	Lecture and practical training with ArcGIS 9
	(2) GIS database formulation	Oct. to Nov. 2006	MoEP (provision of information for GIS database)	Sub-contract work named "GIS Database Formulation"
	(3) Mini-workshop for introduction of remote sensing and GIS technologies in environmental management	8th and 9th Nov. 2006	Atyrau MoEP Atyrau HYDROMET Private petroleum industries	Presentation and discussion in mini-workshop

Source : JICA Study Team

CHAPTER 8 EXAMINATION OF ENVIRONMENTAL MONITORING PLAN AND TRIAL SAMPLING AND ANALYSIS

8.1 Introduction

In order to develop capacity for environmental sampling and analysis, the following activities were planned and implemented from September to November 2006:

- Examination of the environmental and pollution source monitoring plan for the Regional Environmental Monitoring Centre and Atyrau MoEP
- Water and sediment quality monitoring
- Air quality monitoring
- Soil pollution monitoring
- Lecture about analysis of petroleum derived pollutants and constituents of petroleum
- Heavy metal analysis with certified materials

8.2 Examination of the Environmental and Pollution Source Monitoring Plan for the Regional Environmental Monitoring Centre and Atyrau MoEP

A mini-workshop to discuss the scope for environmental monitoring by the newly established Regional Environmental Monitoring Centre was held with 17 participants from the Atyrau HYDROMET Centre, Atyrau MoEP, the Department of Use ad Control of Environment and Natural Resources (DUCER) of Atyrau Oblast, Fishery Department and Department of Safety Control on Off-shore Oil Field Development. The participants hoped that the Regional Environmental Monitoring Centre could implement not only ambient environmental monitoring but also monitoring of pollution sources on air, water and soil so that the impact of discharged pollutants can be characterized.

8.3 Trial Sampling and Analysis

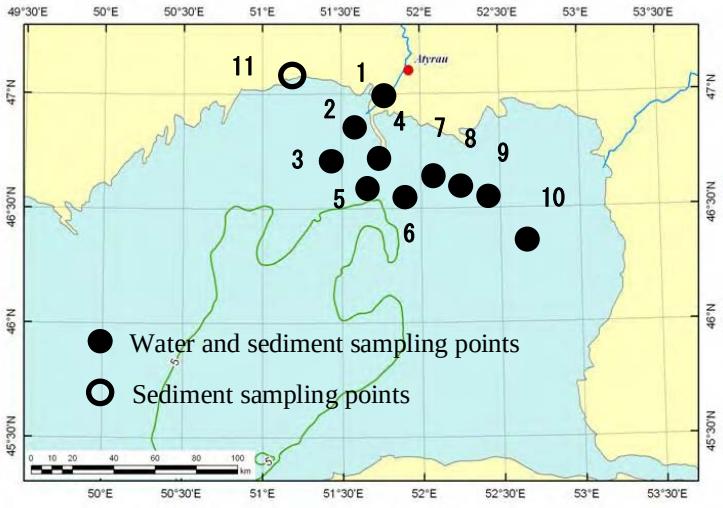
8.3.1 Water Quality/Sediment Quality Monitoring in Northern Caspian Sea

Water and sediment quality monitoring was implemented with one expert from the Atyrau HYDROMENT Centre and another expert from Atyrau MoEP. The outline of activities is as follows:

Table 8.3.1 Outline of Water/Sediment Quality Monitoring

Item	Contents
Survey Period	14, 16 and 20 to 21 October 2006
Monitoring points	10 sampling points around the estuary of Ural River and Kashagan oil field (The water samples were taken from surface and bottom layers. Sediment samples were taken from the surface of sediments.) Additionally one sediment sample was taken at a coastal area.
Analysed parameter	Water quality: water temperature, pH, EC, salinity, DO, BOD_5, COD, SS, turbidity, nitrogen (NH_4, NO_2, NO_3), phosphorous (T-P), oil products, heavy metals (Cu, Zn, Cr(VI), Pb, Hg) Sediment quality: oil products, phosphorous, heavy metals（Cu, Zn, Cr(VI), Pb, Hg）

Source: JICA Study Team



Field Measurement

Source: JICA Study Team

Figure 8.3.1 Water and Sediment Monitoring Points

(1) Heavy Metals

The analytical results for heavy metals in seawater are shown in Table 8.3.2. In comparison with Japanese water quality standards, no significant pollution was found.

Table 8.3.2 Analytical Results for Heavy Metals in Water

Unit:mg/L

Monitoring Points	Coordination	Chromium	Copper	Zinc	Lead	Cadmium	Mercury
	Minimum	0.0007	0.0026	-	-	0.0002	0.00008
	Average	0.0049	0.0107	-	-	0.0007	0.0003
	Maximum	0.0122	0.0441	-	-	0.0011	0.0005
Japanese standard		0.05	—	—	0.01	0.01	0.0005
Kazakh standard (sea water)		0.001	0.005	0.05	0.01	0.01	less than detective limit
US EPA ecological toxic threshold		0.05	0.0024	0.081	0.0081	0.0093	0.0011
Canadian guideline (aquatic life)		0.0015	—	—	—	0.00012	—
Detective limit		0.0005	0.0005	0.05	0.0005	0.0001	0.00005

Source: JICA Study Team

Analytical results for heavy metals in the sediment are shown in Table 8.3.3. There was no significant heavy metal pollution observed when compared with international standards. Among the sampling points, the concentrations of heavy metals were higher at the estuary of the Ural River (No.1 and No.3 of monitoring points) and at the north coast (No.11 of sampling point).

Table 8.3.3 Analytical Results for Heavy Metals in Sediment

Unit: mg/kg

Monitoring Points	Coordination	Chromium	Copper	Zinc	Lead	Cadmium	Mercury
Maximum		16.4	2.72	4.9	7.37	0.08	0.076
Average		24.3	11.2	18.2	14.5	0.37	0.011
Minimum		38.5	33.4	44.4	26.2	0.96	0.133
Probable Effect Level in sediment (Note 1)		160	108	271	112	4.2	0.696
Analytical results under CEP in 2001 at adjacent area of monitoring points in this study		3.8-103	1.7-19.2	-	1.4-14.6	-	0.001-0.04

Note 1 : Source "Screening Quick Reference Table" (Office of Response and Restoration, NOAA)
Note 2 : At No.5 of the sampling points, the sample taken comprised of pieces of shells, so analysis was not carried out.
Source: JICA Study Team

(2) Oil Products

The analytical results for oil products in water are shown in Table 8.3.4. All the analytical values of oil products in water were less than the Kazakh standard values. There is no significant difference between their concentration in the surface layer and those in the bottom layer. The analytical results of oil products in the sediment are shown in Table 8.3.5. The concentrations of total petroleum hydrocarbons, or TPH, were determined in Japan. Compared with heavily polluted bays in the world, such as Havana Bay, the sediment in the northern Caspian Sea has not been significantly affected by pollutants. The concentrations of 16 priority poly-nuclear aromatic hydrocarbons (PAHs) measured in Japan were all below the detection limits.

Table 8.3.4 Analytical Results of Oil Products in Water

Unit: mg/L

Monitoring Points		No.1	No.2	No.3	No.4	No.5	No.6	No.7	No.8	No.9	No.10	MPC
Oil Products	Surface layer	0.031	0.015	0.014	0.027	0.012	0.016	0.029	0.02	0.017	0.023	0.05
	Bottom layer	0.028	0.011	0.017	0.022	0.015	0.018	0.024	0.018	0.015	0.027	

Note 2 : MPC means Maximum Permissible Concentration.
Source: JICA Study Team

Table 8.3.5 Analytical Results of Oil Products in Sediment

Unit: mg/kg

Monitoring Point	No.1	No.2	No.3	No.4	No.6	No.7	No.8	No.9	No.10	No.11
Oil Products	3.82	2.73	2.59	4.89	3.41	3.32	2.39	3.95	2.11	1.32
TPH	100	74	78	58	62	75	57	59	55	61

Note 1 : At No.5 of the sampling points, the sample taken comprised of pieces of shells, so analysis was not carried out.
Source: JICA Study Team

8.3.2 Air Quality Monitoring

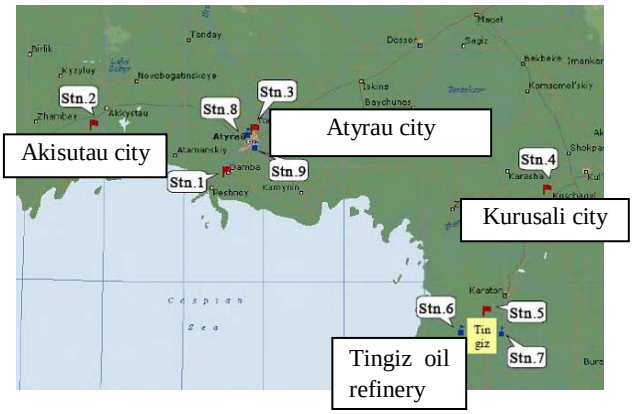
Although the Atyrau HYDROMET Centre's current air quality monitoring program is limited to Atyrau city, there are a number of important pollution sources outside of the city (e.g., oil fields), and the centre has a plan to expand its monitoring to a regional-scale in the future. In order to gain practical experiences and information to design the regional air quality monitoring program, a trial air quality monitoring was implemented at the locations in Figure

8.3.2 with participation of one expert from the Atyrau HYDROMET Centre and another expert from Atyrau MoEP.

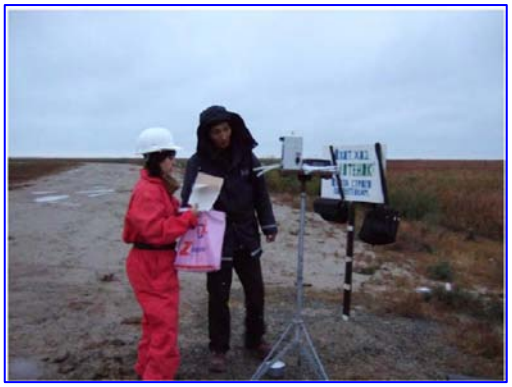
Table 8.3.6 Outline of Air Quality Monitoring

Item	Contents
Survey period	19 to 29 Oct 2006
Survey points	Three points in Atyrau city and two points around Tengiz gas refinery (Note: Additionally, NMHC was measured at four points.)
Analytical parameters	SO_2 , NO_2 , CO, PM , meteorological parameter (wind direction, winds peed, temperature) (Note: NMHC was analyzed at some of the sampling points)
Frequency	Three times per day of sampling during three days

Source: JICA Study Team



Source: JICA Study Team



Air quality sampling

Figure 8.3.2 Air Quality Monitoring Points

The air quality monitoring results are shown in Table 8.3.7. Although the information is not sufficient to judge overall air quality condition because the survey period was limited to three days, no significant air pollution was detected in this survey. The analytical results of sulphur dioxide and carbon monoxide were not so different between sampling points in the city areas (Atyrau city and Akistau city) and those in local areas (a southern suburb of Atyrau city and adjacent area of Akistau city). On the other hand, the analytical results of nitrogen dioxide in the city area, at 0.031-0.045 mg/m^3, were higher than those in the local areas, at 0.015-0.034mg/m^3. Apparently this is due to mobile sources (vehicles), which are the main air pollution sources in the city area under existing conditions. The concentrations of non-methane hydrocarbons were in the order of 3-5 mg/m^3, and they were slightly higher around the Tengiz gas refinery than in Atyrau city.

Table 8.3.7 Air Quality Monitoring Results

Sampling Points	Survey Period	Sulphur dioxide	Nitrogen dioxide	Carbon monoxide
		mg/m^3	mg/m^3	mg/m^3
1.Southern suburb of Atyrau city	10/19-10/21	0.009 - 0.021	0.015 - 0.034	0.3 - 0.5
2. Adjacent area of Akistau city	10/22-10/24	0.008 - 0.016	0.017 - 0.034	0.2 - 0.9
3. Atyrau city	10/25-10/27	0.009 - 0.017	0.038 - 0.045	0.9 – 1.5
4. Kurusari city	10/20-10/22	0.007 - 0.012	0.031 - 0.045	0.1 – 0.9
5. Tengiz gas refinery	10/23-10/25	0.006 - 0.015	0.018 - 0.038	0.1 – 0.2
Kazakh standard (mg/m^3)	-	0.5	0.085	5.0
WB guideline figure (mg/m^3) (note)	-	0.125	0.15	-

Note : Pollution Prevention and Abatement Handbook
Source: JICA Study Team

8.3.3 Soil Pollution Monitoring

The oil fields belonging to Embamonaigaz Company and the adjacent area on the coast of the northern Caspian Sea were selected as soil pollution monitoring sites. On 26 and 27 September 2006, soil sampling was carried out with one expert from Atyrau MoEP. The analytical results are shown below. Compared with international guideline values, the concentrations of heavy metals in the samples were not particularly high, though the concentrations of oil products exceeded the guideline values. Further investigation is recommended.

Table 8.3.8 Soil Pollution Monitoring Results

Sampling Point	Cadmium	Copper	Lead	Chromium	pH	Oil products
	mg/kg	mg/kg	mg/kg	mg/kg	-	g/kg
Embamonaigaz oil field	0.080	3.75	2.15	1.89	7.4000	2.080
Embamonaigaz oil field	0.075	3.25	1.80	2.38	7.5000	0.310
Botanahan oil field	0.071	6.07	5.10	2.54	7.4000	3.210
Kazakh standard (mg/kg)	0.5	3.0	6.0	6.0	-	0.1
Dutch standard (mg/kg)	0.8	36	85	100	-	-
EU directive 86/278(mg/kg)	0.5	45	55	55	-	-
Reference figure of total amount in soil in Japan (mg/kg)	9	-	600	-	-	-
TPH cleanup standard in Oklahoma (g/kg)						Residential area 0.05; Industrial area 0.5

Source: JICA Study Team

8.4 Lecture on Analysis of Constituents of Petroleum

A lecture about analysis of constituents of petroleum and related pollutants was provided at the Atyrau HYDROMET Centre. Atyrau HYDROMET Centre recently procured a gas chromatograph with a flame ionization detector and capillary column, and a FT-IR. Therefore, once these machines are properly installed, it will become possible to implement environmental monitoring of individual pollutants.

8.5 Analytical Training with Certified Reference Materials

Training on heavy metal analysis was carried out using certified environmental materials brought from Japan. Two analytical experts from the Atyrau HYDROMET Centre and one expert from Atrau MoEP joined the training. After the training, the three trainees answered that their knowledge on theory and the operational procedure of AAS was improved. Further training for operation of analytical equipment including AAS is recommended.

CHAPTER 9 SATELLITE IMAGE ANALYSIS AND GIS DATABASE CONSTRUCTION

9.1 Introduction

(1) Technical Transfer regarding Application of Satellite Image Analysis for Environmental Management

This component of the pilot project was implemented to transfer techniques on the use of satellite image analysis for environmental management. The target group of the technical transfer was the staff of the Information Technology Department of KAZHYDROMET's headquarters in Almaty. The satellite image processing and analysis system was installed at the Information Technology Department, and training was carried out using this system. The outline of the technical transfer is shown in Table 9.1.1.

Table 9.1.1 Technical Transfer regarding Application of Satellite Image Analysis for Environmental Management

Item	Contents
Utilized Satellite Image	- TERRA/ASTER data: 20 scenes - ENVISAT/ASAR data: 3 scenes
Training Period	- Middle of October to middle of November 2006 (three weeks) - Early of May 2007 (one week)
Contents of Technical Transfer	- Installation of satellite image processing and analysis system - Lecture on fundamentals of satellite image processing and analysis - Introduction of case examples in the field of environmental management - Lecture about searching methods and purchasing satellite image data - Exercises on software operation - Lecture on case study for the extraction of oil pollution and environmental information

Source: JICA Study Team

(2) Technical Transfer Regarding GIS Database Formulation and Its Utilization

This component was implemented to improve the capacity of Kazakh experts in the use of GIS for environmental data management. The target group was the staff of the Information Technology Department of KAZHYDROMET's headquarters. However, considering the sharing of GIS database between Almaty and Atyrau, brief training for the staff of Atyrau HYDROMET Centre and Atyrau MoEP was also carried out. The outline of the technical transfer is shown in Table 9.1.2.

Table 9.1.2 Technical Transfer regarding GIS Database Formulation and its Utilization

Item	Contents
Training Period	- Early of May 2007 (one week)
Installed GIS System	- Personal computer and ArcGIS 9.1 of ESRI as GIS software for Information Technology Department of KAZHYDROMET - ArcExplorer 2.0 of ESRI, a free GIS database viewer, for Atyrau HYDROMET Centre and Atyrau MoEP
Contents of Technical Transfer	- Installation of GIS system - Construction of GIS database - Exercises on software operation - Lecture on fundamentals of GIS and its utilization

Source: JICA Study Team

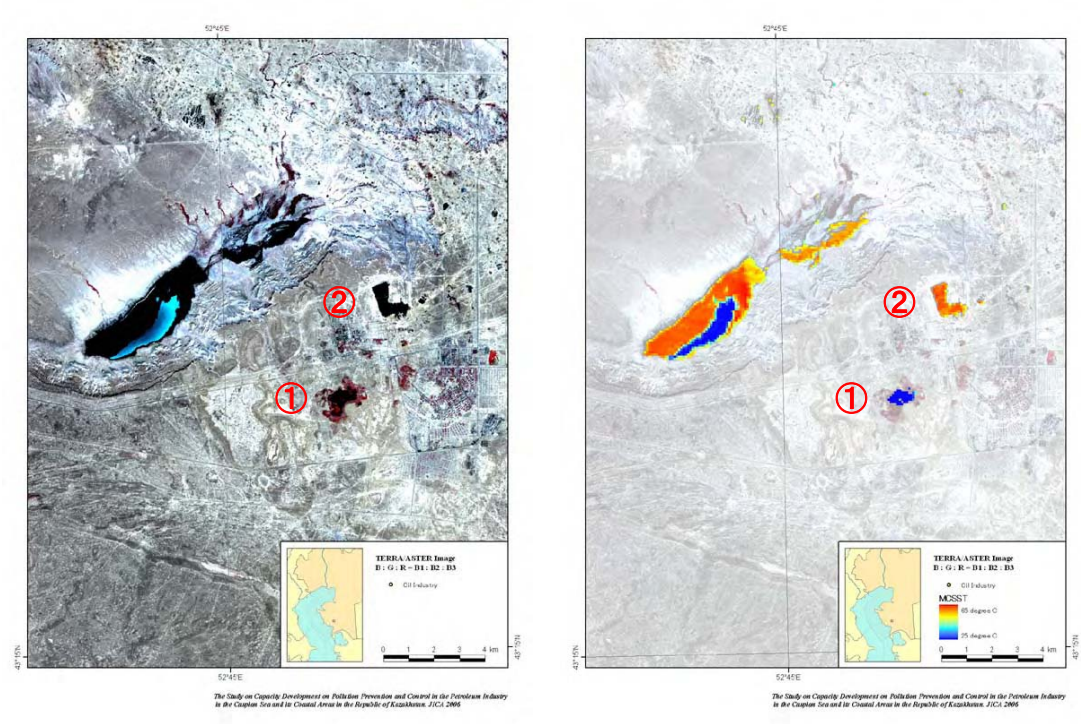
(3) Mini-workshop Regarding Satellite Image Analysis and GIS Technique in Atyrau

In order to deepen the understanding regarding environmental monitoring by satellite image analysis and use of a GIS database, a series of mini-workshop was held in Atyrau for the staff of Atyrau HYDROMET Centre, Atyrau MoEP, and relevant stakeholders.

9.2 Satellite Image Analysis

9.2.1 Multi Channel Sea Surface Temperature

The multi channel sea surface temperature (hereafter MCSST) analysis is a method to estimate sea temperature using thermal infrared data. This technique was selected for its ability to detect oil pollution using satellite images. The MCSST of water bodies in the Uzen oil field (evaporation ponds) is shown in Figure 9.2.1. The difference in temperature cannot be detected from the false color image. However, MCSST enables distinction of high temperature pond 2 from low temperature pond 1 (the image was color-coded with high temperature shown in red to yellow and low temperature shown in blue). It became evident that P1 consists of clear water and P2 is covered by a layer of oil.



False Color Image MCSST Image

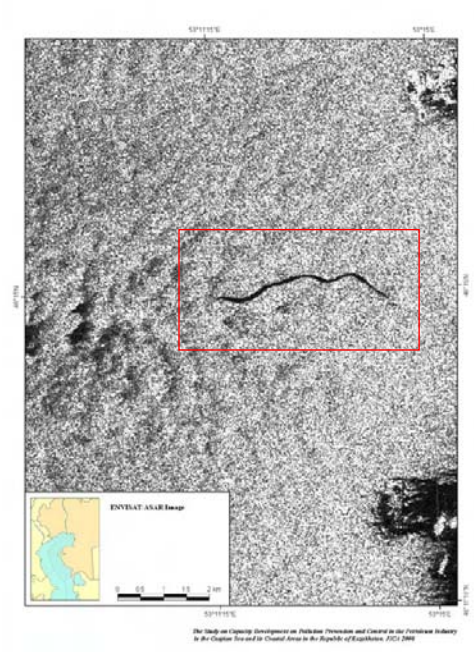
Source: JICA Study Team

Figure 9.2.1 MCSST Image of Uzen Oil Field

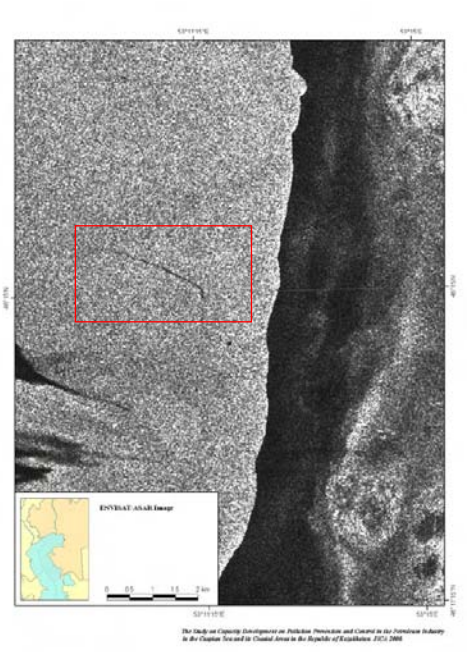
9.2.2 Oil leak Monitoring in Submerged Oil Fields

This is a technique to detect an oil slick on a water body using backscattering of microwaves emitted from a satellite. A trial oil leak detection was performed in the submerged oil field of Pribrezhnoye where an oil leak accident occurred in May, 2006. The ENVISAT/ASAR images used for the analysis are shown in Figure 9.2.2. Dark pixels, which spread in an east-west

direction, can be observed in the centre of 17th May and 30th August images, but it can not be observed in 6th October image (not shown). Comparison of these dark pixels with the location of the submerged oil field revealed that these dark pixels in the ENVISAT/ASAR images originate from the submerged oil fields detected from the TERRA/ASTER image. There is a high possibility that the dark pixels indicate the oil slick of the oil leak accident that occurred on May, 2006.



ENVISAT/ASAR Image（17/MAY/2006）



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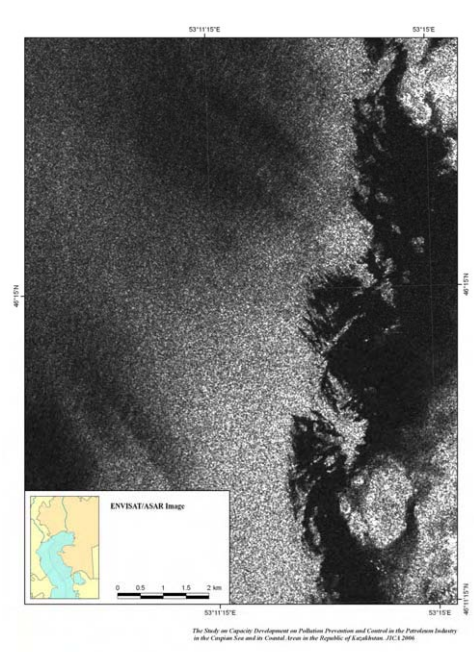
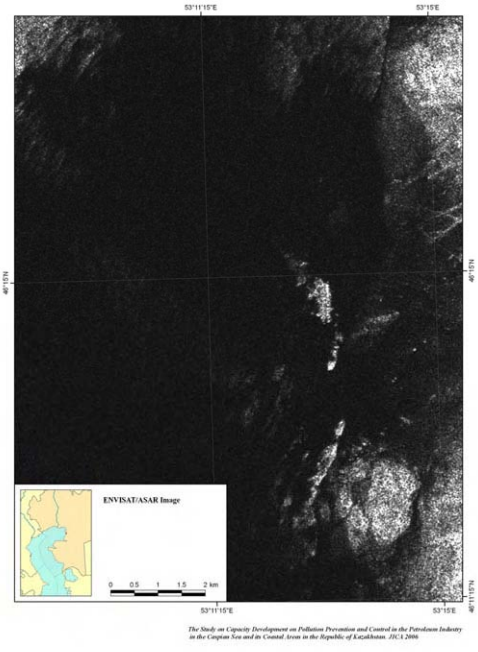


ENVISAT/ASAR Image（06/OCT/2006）



ENVISAT/ASAR Image（08/NOV/2006）

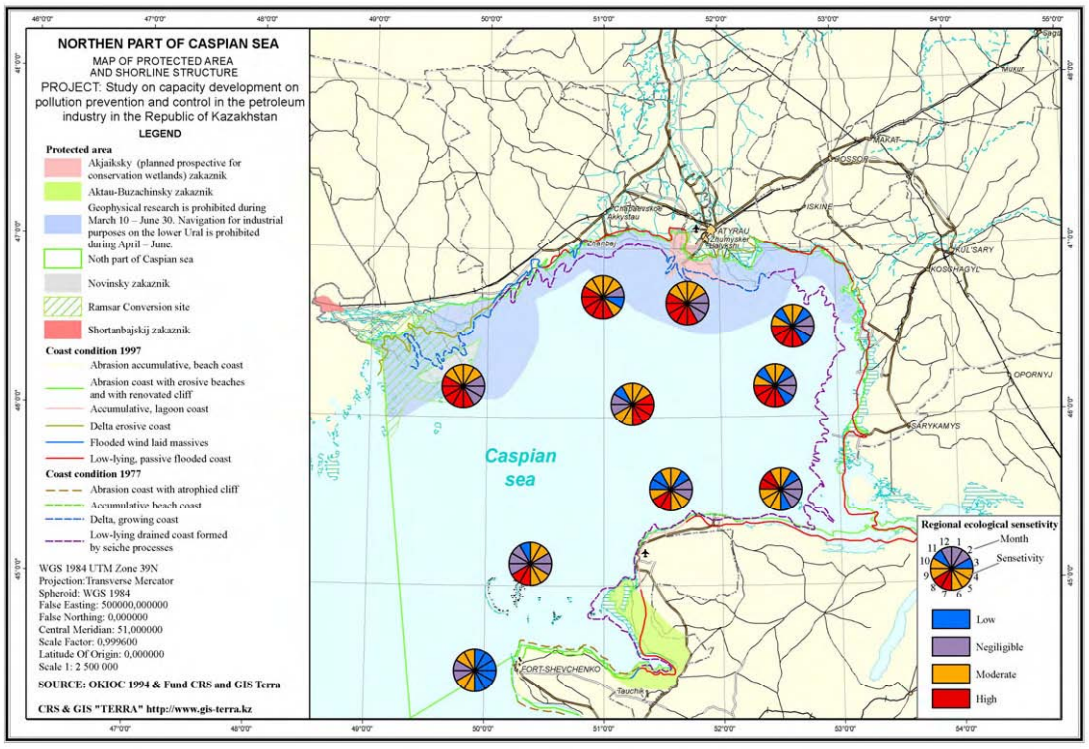
Source: JICA Study Team

Figure 9.2.2 ENVISAT/ASAR Image of the Submerged Oil Field in Pribrezhnoye

9.3 GIS Database Construction

Because environmental information in Kazakhstan is scattered among different organizations, this component of the pilot project collected relevant environmental information and developed a GIS database. The database consists of four sub-databases; base map, environmental monitoring, environmental resources, and pollution sources. The base map consists of the map information of KAZHYDROMET on a scale of 1:1,000,000 and information of the city, river, shoreline, and depth of water. The environmental monitoring sub-database is made up of the results of environmental monitoring by KAZHYDROMET and the pilot project. The pollution source sub-database consists of information on oil and gas fields, submerged oil and gas fields, and related facilities. The environmental resource sub-database is made up of information on the distribution of the flora and fauna, conservation area, and environmental sensitivity.

The subject maps were created by overlaying necessary information by using the display and layout functions of ArcGIS. An example of subject maps is shown in Figure 9.3.1. The database was distributed to the central MoEP, KAZHYDROMET, the Information Analytical Centre of MoEP, Atyrau MoEP and the Atyrau Hydromet Centre.



Source: JICA Study Team

Figure 9.3.1 An Example of Subject Map by ArcGIS

CHAPTER 10 FRAMEWORK FOR POLLUTION CONTROL MASTER PLAN

10.1 Conditions and Requirements associated with Master Plan Development

10.1.1 Present and Anticipated Pollution

Table 10.1.1 summarizes anticipated emissions/discharges of pollutants in 2010 and 2015, which were estimated based on the long-term oil production plan (see Table 3.4.1 of this report).

Table 10.1.1 Anticipated Emissions and Discharges of Pollutants by 2015

Unit: tonne/year

Pollutants	2005	2010 (tonne/year)	2015 (tonne/year)
Air emission total	87,731	163,943-195,527	266,420
SO_2	23,452	46,995-57,303	80,915
NO_x	9,052	26,531-37,389	53,664
Hydrocarbons	29,719	43,209-45,304	56,403
CO	25,327	45,683-52,995	71,524
H_2S	47	150-180	356
Others	134	303-558	752
Flare gas	Unknown	In principle 0	In principle 0
Waste generation	173,000	275,000-302,000	418,000
Contaminated soil (ha)	4,652 +α	4,652.8－α	Complete Restoration
Dangerous underwater abandoned well	90	Complete shut off	Complete shut off

Note: Including emission & discharge arising from drilling and transportation activity, but not including those from power stations and gas companies. The values for Mangistau oblast show calculated values using the unit pollutant emissions/discharges of Embumnaigaz. “a number +α” implies the total is somewhat larger than the number. “a number -α” implies the total is somewhat smaller than the number.

Source: Forecasted from the data of annual environmental report of Atyrau oblast ＆Mangistau oblast. EIA report of Kashagan (Agip KCO) project and oil & gas sector long-term development plan

If flare gas reduction is not considered, the total emission to air in 2015 will increase 3.0 times, from 87,731 tonnes in 2005 to 266,420 tonnes in 2015. The increase in NO_x will be 5.9 times, and that of H_2S will be 7.6 times. The total volume of wastewater to evaporation ponds is not listed here as the values for Mangistau were difficult to estimate. The amount in the onshore area in Atyrau oblast will decrease to 2,343,000 tonnes in 2015 from 3,033,000 tonnes in 2005 by reusing treated water at the Atyrau refinery and the Agip KCO OPF. However, the amount of pollutants in wastewater will increase to 7,850 tonnes in 2015 from 4,470 tonnes in 2005, or about 1.8 times, due to the increase in production by TCO. Waste generation will increase to 418,000 tonnes from 173,000 tonnes, or 2.4 times, if the stored sulphur volume is not counted toward waste generation.

It should be noted that these are the overall changes. Environmental impacts may be highly localized, and there may be areas where the environmental conditions deteriorate significantly. In particular, the area near the Tengiz field is a potential hot spot due to the cumulative effect of the oil field and pollution from the planned petroleum complex. The pollution status in Atyrau city is not expected to change drastically, though increase in air pollution due to mobile source (automobiles) is anticipated. This problem may be compounded by the emission

of hydrocarbons from the oil terminal in the north of the city. Because, in principle, the discharge of wastewater to the Caspian Sea is prohibited, the impact on water quality arising from oil industry's activity in the Caspian Sea area is considered small as long as the oil and gas sector observe the environmental requirements in the area, and environmental accidents are effectively prevented. Due to the increase in maritime shipping of crude oil from around 2011, the risk of oil spill accidents will increase.

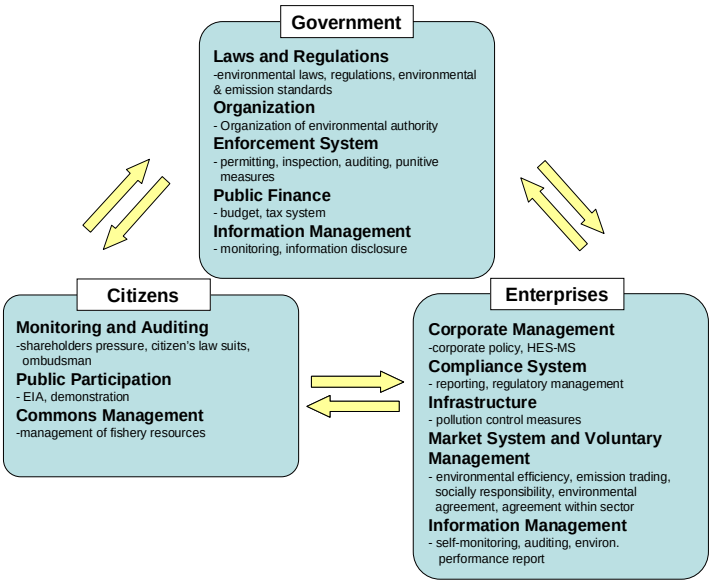
10.1.2 Other Conditions and Requirements

The new Environmental Code was enacted early in 2007. It is highly ambitious and various new ideas were incorporated, such as simplification of emission regulations, introduction of a new environmental permit system based on Best Available Technique (BAT), a quota system for emission trading, etc. The Master Plan has to be developed considering these new requirements. Other considerations include the limited number of staff at MoEP and other environmental authorities, possible restructuring of the government, impacts of decentralization and change in fiscal policy.

10.2 Framework of the Master Plan

10.2.1 Social Capacity for Environmental Management

The overall capacity of society to deal with environmental issues is known as the social capacity for environmental management (SCEM). SCEM is determined by (i) capacity of government to develop, manage, finance and enforce environmental laws and regulations, (ii) capacity of enterprises to comply with regulations and pursue even higher environmental performance, and (iii) capacity of citizens to monitor and participate in environmental management, as well as the interactions among these parties, as explained in Figure 10.2.1.



Source: based on Matsuoka 2002, modified by the JICA Study Team

Figure 10.2.1 Components of Social Environmental Management Capacity

SCEM evolves with the development of economy, human capital, technology, and maturation of government-corporate-citizens' relation. It is believed that SCEM evolves in the following three stages:

- System-making stage: basic environmental laws and regulations are developed and regulatory environmental management is initiated.
- System-enforcing stage: enforcement of the law becomes regular practice, and pollution problems starts to improve
- Self-regulating stage: trust between government, enterprises and citizens is increased, and proactive attitudes of enterprises and citizens drives environmental management toward self-regulation.

10.2.2 SCEM of Kazakhstan

The analysis of current practices (see Chapter 2-6) revealed that Kazakhstan already has substantial SCEM, and is believed to be at the system-enforcing stage. Furthermore, some foreign oil companies brought international practices, and the domestic companies are also improving their environmental management. As the results, the oil and gas sector is already moving toward self-regulation. On the other hand, there are still various priority issues that have to be addressed as summarized in Table 10.2.1.

Table 10.2.1 Major Achievements and Priority Issues in SCEM Development in Kazakhstan

Major achievements in SCEM development	Priority issues in SCEM development
Government • Revisions of environmental laws and regulations inherited from the Soviet era and their enforcement. • Enactment of the new Environmental Code, which entails various new environmental management provisions in order to further modernize the legal systems. • Enforcement of environmental control of oil and gas development activities in the Caspian region, including the general ban on discharging wastewater into the Caspian Sea, development of regulations to control flaring, etc. • Enforcement through environmental inspection, collection of environmental charges and fines, and prosecution of violators. • Environmental monitoring in the Caspian Sea and its coastal area. • Development of National Oil Spill Prevention Plan	Government • Overall, the current environmental management system, such as emission standards, permitting and environmental charge, are unrealistically strict and extensive, and not "implementable" and "enforceable". • The new Environmental Code introduced a number of modern environmental management ideas, which cannot be implemented because the secondary laws and regulations are yet to be developed. • Environmental information is generally scarce. As a result, it is difficult to know what environmental consequences mismanagement of the oil and gas development activities will bring. • Reluctance to share information further prevents "informed" decision-making by government agencies as well as the enterprises.
Enterprises • Wide adoption of underground injection of produced water instead of discharging it to poorly managed evaporation ponds • Construction of environmentally-sound waste disposal facilities • Investigation on flare reduction measures • Preparation of equipment against oil pollution accidents • Study on disposal of sulphur • Establishment of modern HSE management systems by most major enterprises	Enterprises • The oil and gas sector in Kazakhstan is very diverse, and represented by various enterprises of different scales from different countries. Some enterprises are already operating at the international-level while others are lagging behind. • There are some unresolved technical issues, such as disposal of sulphur and control of flare gas in large oil fields.
Citizens • Coverage of environmental issues by media and NGOs	Citizens • Overall, participation of citizens in environmental management is still limited, partly because publicly available information is often not very reliable.

10.3 Overall Goal and Target Year

10.3.1 Overall Goal of the Master Plan

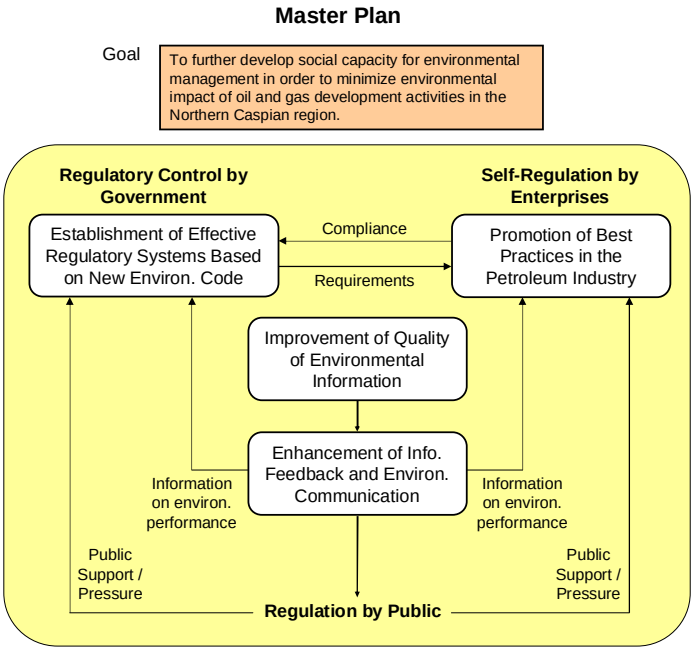
Considering the evolution of SCEM in Kazakhstan, the overall goal of the Pollution Control Master Plan is "to build further social capacity in order to minimize environmental impact of oil and gas development activities in the Northern Caspian region".

10.3.2 Target Year

The target year of the Master Plan is set as Year 2015.

10.3.3 Approaches

Considering the priority issues described above, the team adopted the following approaches in the Master Plan (see Figure 10.3.1).



Source: JICA Study Team

Figure 10.3.1 Goal and Approaches of the Master Plan

(1) Establishment of Effective Regulatory Systems based on the new Environmental Code

There is an urgent need to develop secondary laws and regulations in accordance with the newly introduced Environmental Code, and establish enforceable regulatory systems.

(2) Promotion of Best Practice in the Petroleum Industry

The oil and gas sector needs to adopt international best practice as the sector-wise standard of operation. With the introduction of technical specific emission standards and production environmental control prescribed in the new Environmental Code, adoption of best practice becomes the regulatory requirement. Moreover, this direction will also improve the long-term efficiency of the oil and gas operations.

(3) Improvement of Quality of Environmental Information

It is expected that the new system of inspection, auditing, environmental litigation, etc., will demand more reliable, defendable information. Therefore, the quality of environmental information, especially environmental monitoring information, has to be improved.

(4) Enhancing Information Feedback and Environmental Communications

The Master Plan emphasizes the need for feedback of information and environmental communication in order to induce environmentally conscious and accountable behaviour of environmental authorities and enterprises.

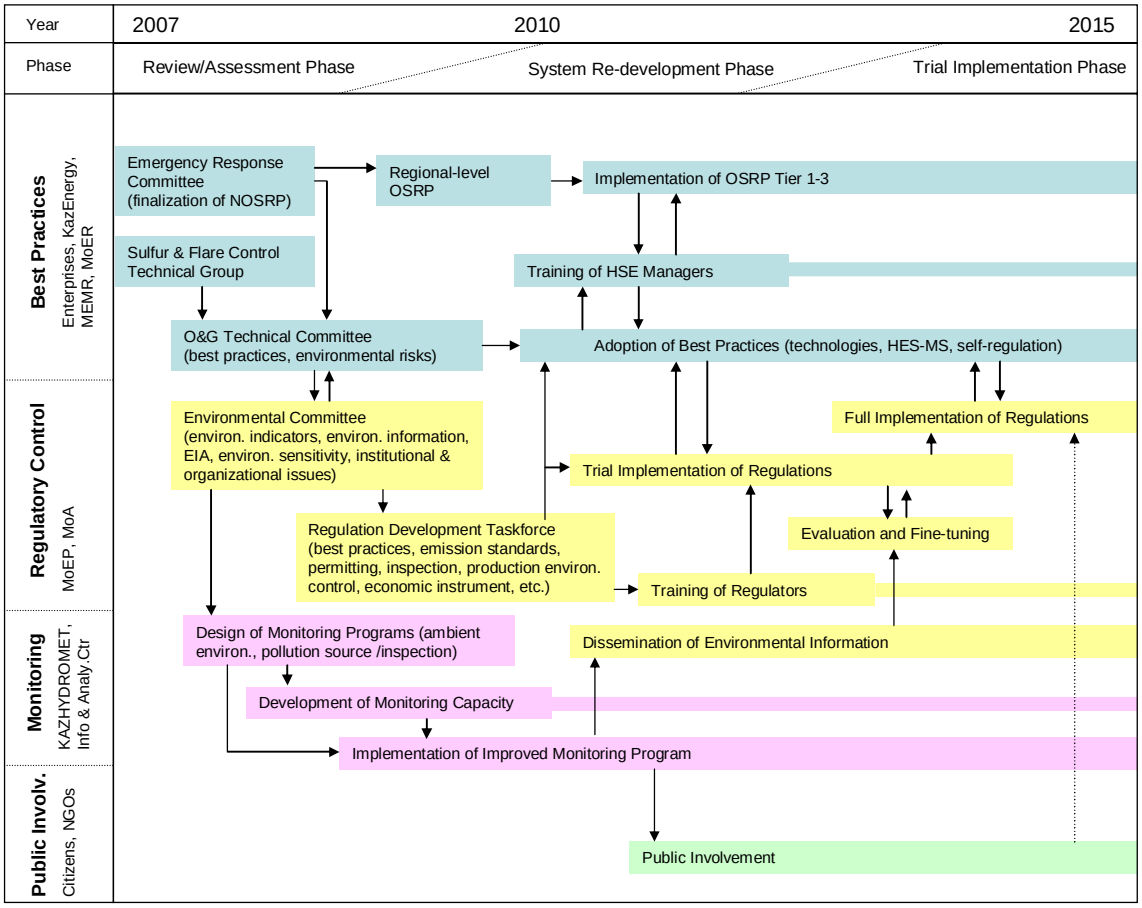
10.3.4 Overall Schedule for Master Plan Implementation

The Master Plan is to be implemented in three phases:

- Review/assessment phase (2007-2010)

- System Re-development Phase (2007-2013)
- Trial implementation phase (2010-2015)

In order to establish effective pollution control systems, tasks of four core areas, namely, the regulatory system development (Chapter 11), promotion of best practice in the petroleum industry (Chapter 12), environmental monitoring (Chapter 13), and information feedback and environmental communication (Chapter 14).



Source: JICA Study Team

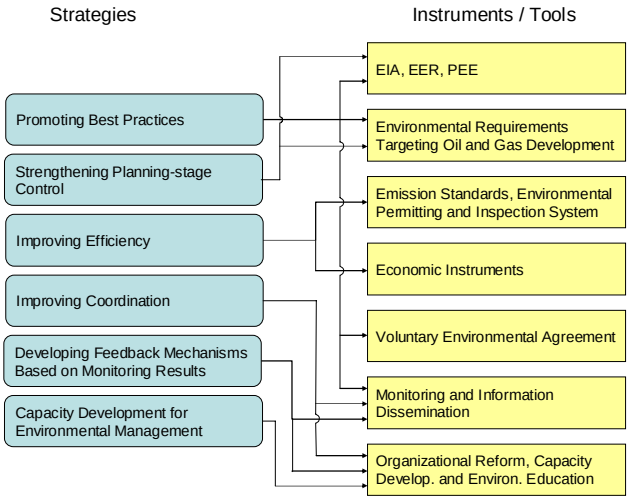
Figure 10.3.2 Suggested Flows for Implementation of the Master Plan

CHAPTER 11 REGULATORY SYSTEMS

11.1 Strategies for Development of Regulatory Systems

There are arrays of pollution control instruments and tools, such as EIA, emission standards, permitting and inspection, punitive system, economic instruments, environmental monitoring, information disclosure, etc., which are widely used in the world in an attempt to achieve efficient pollution control. In order to guide the selection of such instruments in accordance with the philosophy of the new Environmental Code, this Master Plan adopted the following strategies.

- Promoting best practice
- Strengthening planning-stage control
- Improving efficiency
- Improving coordination of environmental management
- Developing feedback mechanisms based on monitoring results
- Capacity development for environmental management



Source : JICA Study Team

Figure 11.1.1 Strategies and Instruments/Tools for Regulatory System Development

11.2 Promotion of Best Available Techniques and Self-Regulation

The promotion and facilitation of self-management, monitoring, reporting and control by the oil/gas companies themselves, will make for lighter, cheaper and more effective environmental regulation, to the benefit of the regulators and the regulated.

The self-regulation approach will be introduced by a linked series of mutually supporting measures that will enable considerable evolution of the existing system. Under the new Environmental Code, major oil/gas production facilities will benefit from:

- The adoption of 'Technical Specific Emission Standards' representing Best Available Techniques (BAT).
- The issue of complex permits, which will incorporate the above BAT approach rather than a large number of individual emission standards.
- The expansion of self-monitoring and self-reporting as part of 'Production Environmental Control', which is now very similar to a company Environmental Management System (EMS).
- Financial incentives to have EMSs certified to ISO 14001 (along with certification of the Quality Management System to ISO 9000).
- Reduced frequency of inspection as a reward for specified good environmental performance.

The Master Plan proposes the further promotion and enhancement of the above 'package' by the following measures:

- Promotion of BAT concepts within the EIA and SER process for new enterprises.

- Conduct of EIA follow-up studies, in order to apply lessons learned to new and existing oil and gas facilities through the BAT approach.
- Promotion of ISO 14001 certified EMSs or HES-MS as one of the measures of good environmental performance that can be rewarded by reduced inspection frequency.
- The presentation of annual awards for good environmental performance.
- Promotion of the wider use of corporate environmental performance reports to publicise environmental performance and disseminate self-monitoring results.
- Promotion of voluntary environmental agreements, both through the adoption of EMSs and through mutual support agreements, either between oil companies or between the companies and government / local government bodies.

11.3 Economic Instruments

The pollution charging system of permit fees and fines has been criticised diversely for being an inadequate incentive (for companies or the government) to reduce pollution, and as a generator of government revenue rather than a resource for environmental improvement. Some moves have been made for improvement of the situation, and the reduction in fees for companies certified to both ISO 14001 and ISO 9000 is now a very attractive economic instrument that deserves further promotion. The new Environmental Code also provides for State guarantees of non-state loans for environmental protection measures, and market mechanisms for pollution control (emission-trading).

The Master Plan recommends that it would be preferable to have a separation between the objectives of revenue generation and pollution control incentives. It suggests that revenue could be generated with much less administrative time and cost if the fee system were replaced by a single pollution tax, the level of which would be determined by the nature of the industry, and the amount of which would be determined by the production volume. In the case of oil / gas companies this could be done very simply by adjusting the government 'take' in the Production Sharing Agreement.

11.4 Capacity Building

The study has noted a shortage of technical capacity for pollution control in a number of areas. The main organisation addressed is the Environmental Inspectorate of MoEP, for which the following capacity building measures have been proposed:

- Training of environmental administrators / inspectors in oil industry operations.
- Recruitment of specialists from within the oil / gas industry for inspection duties.
- Secondment of MoEP staff into oil companies for a fixed term of, say, one year.
- Vice versa secondment of oil industry staff into MoEP.
- More joint 'integrated inspections' by relevant ministries.

Career development for oil industry environmental managers has also been recommended, to ensure that they keep up with changes in environmental legislation, such as those of the Environmental Code, and new developments in their own HSE fields.

The recommendations above address the short-term capacity problem. Looking to the longer-term future of the industry within the Master Plan period, improvements in environmental education at undergraduate and post-graduate levels are proposed for those expecting to enter the oil/gas industry as environmental regulators or managers. For the medium term, in-service training courses for inspectorate staff have also been recommended.

11.5 Improved Co-ordination

It has been recommended that co-ordination in pollution control should be improved at several levels. At the local level better co-ordination could be achieved if environmental regulation activities were the responsibility of a single organisation. At the provincial level the establishment of regular co-ordination meetings of all relevant bodies has been recommended. At the national level two co-ordinating bodies have been proposed, a Technical Committee on Oil and Gas Development and an Environmental Committee on the Caspian Sea. A co-ordinating mechanism for emergency situations will also be needed, and that is under development as part of the National Oil Spill Response Plan.

Further co-ordination among the oil companies is also proposed, particularly in relation to developments in the HSE field, probably through expansion of the KazEnergy representative body for the industry.

A most important field requiring improved co-ordination is the dissemination and use of monitoring data on ambient environmental quality. The effectiveness of pollution control activities should be evaluated according to whether they achieve their targets for the improvement of environmental quality. This requires more co-ordination between MoEP and KAZHYDROMET in the collection and dissemination of monitoring results. (Apparently, the first steps in this direction have been taken by the two organisations meeting to discuss a protocol on the necessary exchange and integration of monitoring information.) There is also the need for the regular monitoring of pollution sources, in order to support enforcement activities with scientific data, perhaps by the use of automatic remote monitoring equipment.

11.6 Protection of the Northern Caspian Sea

The Environmental Code has introduced a raft of controls on oil/gas industry activities in the coastal land and sea areas of the northern Caspian Sea. These include special protection measures within a planned National Nature Reserve (NNR). Whilst the areas of application of most of the controls have been specified, the boundaries of the NNR have not been defined. Definition of those boundaries is now an urgent requirement for the integrated environmental management of the oil / gas industry, in which nature conservation is as important as pollution control.

CHAPTER 12 PROMOTION OF BEST PRACTICES IN THE OIL INDUSTRY

12.1 Reduction of Flare Gas

According to the oil law and instruction of MoEP in 2004, flare gas emission is in principle prohibited except for the first 3 years from initial start-up period of oil production. Therefore oil companies have developed and submitted plans, for flare gas reduction, to MoEP in July 2006. Although the actual measures vary depending on the conditions of each enterprise, the anticipated general measures for flare gas reduction are as follows:

- Installing pipelines to facilitate the sale of gas
- Underground re-injection by using compressors for enhancement of oil recovery
- Gas usage as a fuel for internal use such as power generation
- Gas supply as raw material for the petrochemical and gas industry (oil /gas sector long term development plan (2015))

External consumers are a prerequisite for the sale and supply of gas to the petrochemical and gas industry. Underground re-injection and internal fuel usage are not affected by external conditions. These measures have to be selected considering the efficient use of energy resources and environmental impact in accordance with governmental instructions.

12.2 Promotion of Gas Utilization Business

Gas utilization has double-benefits. First, the gas is used effectively as a fuel and as a raw material of chemical industries. Second, it will contribute to reducing flaring and venting of associated gas from oil production. Thus, the gas utilization business should be expanded in order to effectively use sweet gas as clean energy, and to eliminate flaring by the oil development companies, which is required by 2009. The technologies that utilize associated gas are summarized in Figure 12.2.1. The use of gas has to be optimized considering the control required of the reservoir for effective recovery of oil, while at the same time allowing re-injection of surplus gas including unwanted H_2S, CO_2 and other harmful gases. Hence, the best combination of re-injection and gas utilization should be pursued based on simulations of a deep-oil reservoir.

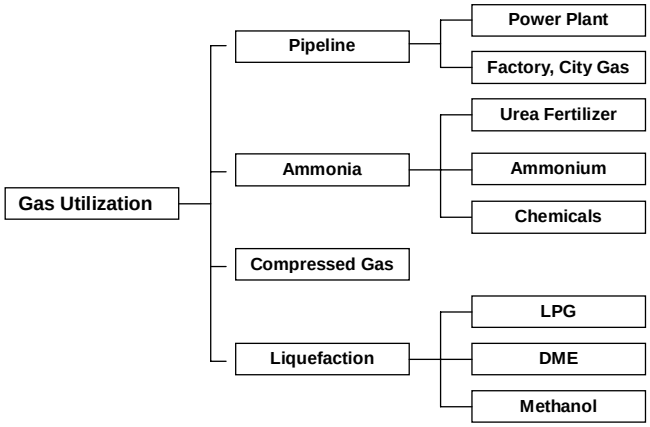


Figure 12.2.1 Technologies of Gas Utilization

12.3 Control of H_2S and Mercaptan Odour

The capability of humans to perceive odour is surprisingly acute, and odour is often the most common environmental problem along with noise problems. H_2S and mercaptan are the primary odour-causing pollutants associated with oil and gas development.

Drilling into deep oil reservoirs results in generation of cuttings and used muds. These cuttings and used muds are usually recovered, transferred by sealed container, and treated (de-oiling of cuttings and regeneration of used mud), but odour is generated during these processes, especially if the reservoir contains high-levels of H_2S and mercaptan. TCO stores the cuttings and used muds using containers inside the SPZ, and Agip KCO treats the cuttings (de-oiling)

and used mud (regeneration) at the Bautino base. However, the Bautino base is located near a residential area, and Agip KCO is now constructing a new cuttings de-oiling plant at a location where there is no residential area within 10 km.

Crude oil and associated gas also contains odour-causing H_2S and mercaptan. These materials in associated gas can be removed by an amine unit, and are recovered as sulphur. Mercaptan in crude oil is oxidized to disulfide (non odour-causing material) and returned to crude oil. H_2S in liquid sulphur is removed by a degassing unit in order to prevent odour generation at the stage of solidification. Odour associated with crude tanks can be minimized by selecting a containment-type tank such as a Floating Roof Tank (FRT) or sealed tank. KazuMunayGas has a plan to adopt FRT for new installations.

12.4 Control of Emission of Hydrocarbon Gases

Emissions of hydrocarbons from crude tanks can be prevented by adopting FRT and sealed tanks rather than open-type tanks. It is desirable to monitor the ambient air concentrations of hydrocarbons and oxidants (oxidants are generated by the reaction of hydrocarbons and NO_2), and if necessary to consider selection of tank types with less fugitive emission.

Construction of a petrochemical complex near Karaton in the Tengiz area is planned around 2015. Because large volumes of hydrocarbons and NO_x will be emitted from the complex in addition to the emissions from the Tengiz field, generation of photochemical smog (oxidant) is a concern. It is desirable to set a fair rule of controlling the cumulative impact and to minimize emissions of NO_x and hydrocarbons from these sources.

12.5 Reduction of Sulphur as Waste

Sulphur is a by-product of oil production, and because the crude oil from the chasm area from Astrahan in Russia to Tengiz including the Kashagan field has high (10-20%) H_2S content, a large amount of sulphur is generated. Unfortunately the present sulphur market has a supply surplus, and it is difficult to sell sulphur. This forces the oil enterprises to store sulphur. With the increase in crude oil production from the chasm area, the amount of recovered sulphur is expected to increase rapidly, and sale of sulphur alone cannot solve this problem. Both oil companies as well as relevant authorities have raised this issue and established a working group on sulphur in order to study disposal methods. The sulphur issue is not avoidable as long as high H_2S oil fields are developed, and there is no simple solution. The establishment of the working group is thus appropriate and timely.

12.6 Control of Oil Sludge at Crude Shipping Terminals

According to the national oil production plan, crude oil production is expected to increase rapidly from 2011, and many new large-capacity crude storage tanks will be constructed in the crude shipping storage terminals for marine tanker transportation and expansion of onshore pipelines. This will result in an increase in oil sludge in tanks at the terminals. The oil sludge has to be periodically cleaned out to protect the bottom plates of the tanks from corrosion. Thus, controlled disposal of sludge becomes necessary to prevent environment problems like soil pollution by oil. In Japan, an automated tank cleaning system is employed for the purposes of recovering the valuable components in the sludge and the reduction of waste discharge. This method not only saves on labour cost but also is a highly efficient means of cleaning.

12.7 Waste Management and Control System

Waste management is one of the most important aspects of environmental management in the oil and gas sector. As waste problems are very common, an integrated approach to waste management is essential. Hence adoption of a proper waste management system, as practiced

in most industrialized countries like Japan, Europe and the US, is suggested. Waste management should be carried out in accordance with a waste management plan that controls generation, treatment and final disposal of the waste. A manifest system is useful in order to keep track of the movement of waste. Although waste management is the responsibility of enterprises, it is necessary for such an integrated approach, that the government establishes clear regulations for waste management.

12.8 Countermeasures for Pollution from Past Oil Industry Activity

The pollution problems arising from past oil and gas industrial activity are the presence of oil-contaminated soil and oil spills from improper shut off works of underwater abandoned wells.

As of 2005, there remains 4,650 ha of contaminated land in Atyrau and Mangistau oblasts. The restoration works is progressing each year, but the progress of the works is different from one company to another, therefore it is desirable to clearly set the date for finishing restoration by discussing with MoEP and to setup a working group for studying the appropriate cleanup technology, final disposal methods and disposal facilities.

The action plan of the geological committee for unowned abandoned wells is discussed in Chapter 3. The owner has the responsibility for shut off work of his abandoned well, which will be individually implemented. Therefore it is desirable that the geological committee manage the shut off work schedule.

Contaminated soil in oil field

Shut off works of abandoned underwater well

Figure 12.8.1 Photographs of Abandoned Well

12.9 Oil Spill Response System

Crude oil production is expected to increase rapidly from 2011, and in order to ship crude oil to the international market, the maritime transportation of crude oil by tankers will also increase (KCTS project). This will increase the risk of large oil spill accidents. Therefore, the National Oil Spill Response Plan (NOSRP) is very important to minimize damage. NOSRP is currently under revision by the Emergency Response Agency (ERA) with specialist advice from MEMR, MOEP and Ministry of Transport (MoT), and will be finished in the middle of 2007. The comparison of the present NOSRP (not yet revised) and the internationally accepted guideline (IPIECA) was provided in Chapter 3 of the Main Report. Considering the environmental sensitivities, it is desirable that a concrete zonal response plan for oil spills in Caspian Sea (Atyrau and Mangistau oblast) be made based on the revised NOSRP. The zonal plan should be made after discussion with related agencies and consultants in the working group.

12.10 Special Considerations on Marine Oil & Gas Field Development in the Caspian Sea

Compared with the open sea, there is limited capacity for natural water purification in the closed Caspian Sea. If the sea is polluted, it might be difficult to rehabilitate it within a short time. Therefore, special considerations for a closed sea should be introduced during the entire cycle of exploration, operation and decommissioning. History of offshore oil development in the world is filled with technical challenges and development of new technologies to overcome problems. In the case of the northern Caspian Sea, it is important to introduce new technologies for environmental protection and to monitor the water quality because the sea is closed and rather shallow. Among the suggested considerations for the exploration phase are:

(1) Drilling Plan

Burning is the only established technology to treat testing fluids, and emission of pollutants such as SO_2 and environmental pollution by non-burning hydrocarbons in the oil are a concern. In order to protect the environment, the drilling test period should be minimized as much as possible. Otherwise, Extended Reach Drilling (ERD) including the horizontal drilling technology should be applied in environmentally sensitive areas. It is desirable that the discharge of sewage from the drilling rig be prohibited, and that the water quality around the rig be monitored before, during and after drilling.

(2) Facility plan

Artificial islands are generally the preferred choice for offshore production facilities because the water depth in the northern area of Caspian Sea is shallow and the sea freezes in winter. Before construction, the installation site should be carefully investigated especially with respect to impact on the ecosystem and hydrological condition. As sophisticated ERD technology is becoming available, it is preferable to site facilities at environmentally less-sensitive locations and also reduce the number of secondary offshore facilities. As for pipelines, among the main issues to be considered are the selection of materials to prevent corrosion by H_2S, selection of routes considering the environmental sensitivity, and the shoreline approach method.

12.11 Safety

The crude oil from the chasm area has high pressure and high (10-20%) H_2S content, therefore not only environmental considerations but also safety considerations (e.g., blowout and leakage of H_2S containing gas) will be required.

12.12 Health, Safety and Environmental Management System (HSE-MS)

In recent years, international standards on environmental management systems (ISO 14000 series), occupational safety and health management systems (e.g., OHSAS 18000 series) and similar management methods have been widely introduced for environment protection and management. In the oil and gas sector, in which occupational health, safety, environmental issues and relationship with the local communities constitute particularly important aspects of operations, these issues are managed as a part of the Health, Safety and Environmental Managemental System (HSE-MS). The key elements of a HSE-MS are summarized in the Table below:

Table 12.12.1 Key Elements of HSE-MS

HSE-MS Element	Addressing
Leadership and commitment	Top-down commitment and company culture, essential to the success of the system.
Policy and strategic objectives	Corporate intentions, principles of action and aspirations with respect to health, safety and environment.
Organization, resources and documentation	Organization of people, resources and documentation for sound HSE performance
Evaluation and risk management	Identification and evaluation of HSE risks, for activities, products and services, and development of risk reduction measures.
Planning	Planning the conduct of work activities, including planning for changes and emergency response.
Implementation and monitoring	Performance and monitoring of activities, and how corrective action is to be taken when necessary.
Auditing and reviewing	Periodic assessments of system performance, effectiveness and fundamental suitability.

Source: E&P Forum, 1994

Major oil enterprises in the area already have HSE-MS systems. However, those enterprises that do not have a HSE-MS system, and those enterprises whose general HSE-MS is developed by the head company (e.g., KazMunayGas), need to fully understand the requirements of HSE-MS so they can develop more detailed systems. MoEP is aware of the benefit of environmental management systems, and already has an economic incentive for those companies that are certified by ISO14000 series and ISO9000 series. MoEP is encouraged to promote environmental management systems further by adopting the framework of such a system as the general structure for production environmental control.

12.13 Self-Monitoring by Enterprises

The new Environmental Code has introduced technical specific emission standards, integrated permitting, and production environmental control. In order to satisfy these requirements and also to manage HSE issues associated with the oil and gas operations, oil and gas enterprises are encouraged to strengthen their self-monitoring programs.

CHAPTER 13 ENVIRONMENTAL MONITORING

13.1 General Considerations

Figure 13.1.1 illustrates the relationship among environmental monitoring, pollution control programs by enterprises and government agencies, and environmental inspection/auditing.

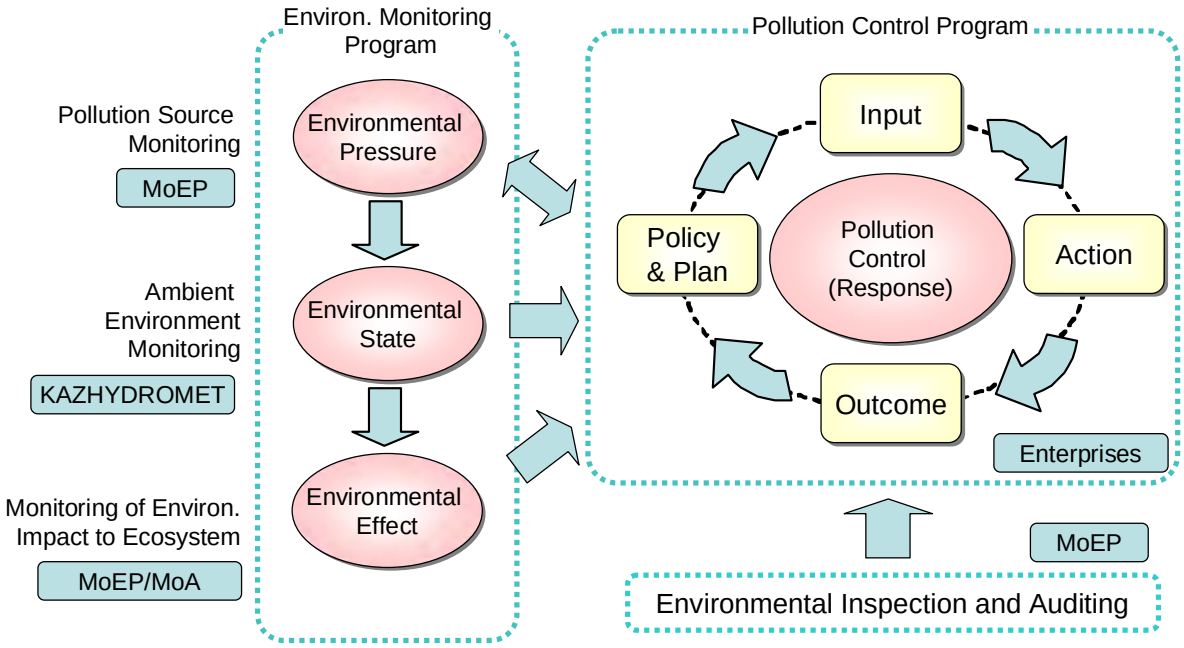


Figure 13.1.1 Relationship between Environmental Monitoring Program, Pollution Control Program and Environmental Inspection/Auditing

The environmental monitoring program should be able to provide information on Pressure-State-Effect of pollution. Then, the information is provided to the pollution control program (Response) in order to design, estimate resources requirements, implement and evaluate environmental measures. For these tasks, pollution control program also needs a separate set of information on the contents of policies and plans, input (e.g., budget and other resources), actions (e.g., activities carried out), outcome (e.g., reduction of pollution loads). The implementation of pollution control programs is checked by environmental inspection and auditing for regulatory compliance and possible improvement. These are the basis for "performance-based" environmental management.

13.2 Strategies

(1) Establishing an integrated environmental monitoring program

The current environmental monitoring system (monitoring of environmental pressure, state and effect) is highly fragmented and needs re-designing based on needs for environmental information. Thus, the Master Plan proposes a new framework of environmental monitoring system.

(2) Promoting dissemination of information

While various institutions, including both environmental authorities and private enterprises, are carrying out environmental monitoring, such information is largely unavailable to other

organizations mainly due to institutional problems, and this is preventing informed decision making. Coordination among these organizations should be improved.

(3) Modernizing the inspection system

The new Environmental Code introduced technical specific emission standards, complex permitting, production environmental control, and other instruments (see Chapter 4 and Chapter 11). Accordingly the inspection system needs major revision. As the details of such emission standards, permitting and self-regulation requirements are yet to be developed, it is still premature to decide the details of the new inspection system. Nevertheless, there are a number of general suggestions, and they are presented in this Chapter. Also see Chapter 11.

13.3 Ambient Monitoring

13.3.1 Objectives

- To monitor status of air quality, water/sediment quality, and natural ecosystem in and around the northern Caspian Sea in order to evaluate and forecast those changes due to possible impact from petroleum industry.
- To collect the information of activities by the petroleum industry with inspection on them to evaluate their adequacy as natural resource user in the northern Caspian Sea region.
- To set and monitor the environmental indicators, categorized pressure, status (condition and effect) and response, which are useful to control possible pollution due to the petroleum industry in and around the northern Caspian Sea.
- To collect information that contributes to operating the emergency response plan against oil spill accidents.
- To collect necessary information to formulate and verify a simulation model to predict spreading of oil slicks during a massive oil spill accident.

13.3.2 Monitored Parameters

(1) Water/Sediment Quality Monitoring

The proposed main parameters to be monitored by each category of ambient environmental monitoring are shown in Table 13.3.1.

Table 13.3.1 Proposal on Main Parameters to be Monitored

Category	Current status and trend of environment	Impacts on northern Caspian Sea by petroleum industries	Factors other than petroleum industries	Information to examine impacts on ecosystem
Periodical ambient environmental monitoring for formulation of a state monitoring system	pH, chemical oxygen demand, suspended solids dissolved oxygen, heavy metals, inorganic ions	oil products (total petroleum carbon), heavy metals	total nitrogen, total phosphorous, heavy metals	---
Ambient environmental monitoring following special programs	pH, chemical oxygen demand, suspended solid, dissolved oxygen, heavy metals, inorganic ions	oil products (total petroleum carbon), petroleum related pollutants, heavy metals	nitrogen, phosphorous, chlorophyll, heavy metals, pesticides	concentration of heavy metals and petroleum derived pollutants

Source : JICA Study team

(2) Air Quality Monitoring

In existing condition, particulate matter is analyzed as one of air quality monitoring parameter. It should be noted that the degree of impact of particulate matters on health depends on their particulate size. From the viewpoint of health risk management, it is recommended to analyze a fraction of particle matters less than 10 micrometer in diameter, PM 10.

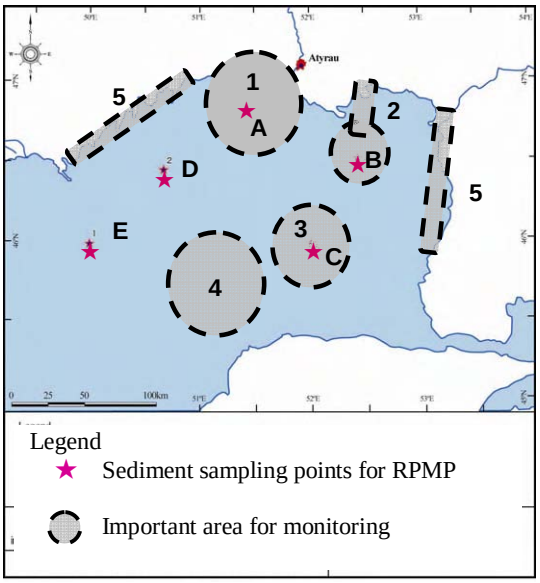
13.3.3 Monitoring Points

The important areas for ambient environmental monitoring are as shown in Table 13.3.2 and Figure 13.3.1. Figure 13.3.1 also shows the sediment quality monitoring points under Regional Pollution Monitoring Program (RPMP). These points should be adopted as the representative porints for continuous monitoring of water/sediment quality.

Table 13.3.2 Important Areas for Monitoring

No.	Area	Description
1	Estuary of the Ural River and adjacent areas	Inflow from the Ural River is the main source of terrestrial pollutants. The area is an important habitat for birds.
2	Kashagan oil field and its pipeline and adjacent areas	The area in and around the Kashagan oil field may become the main pollution source in the near future.
3	Centre of the northern Caspian Sea	This should be one of the representative areas for water quality monitoring in the survey area of this study.
4	Karamkas oil field	Large scale development may be carried out in the future.
5	Northern and eastern coast area	The area is important as bird habitat. It is difficult to implement monitoring due to the shallow water level, so monitoring points will be set under the special program.

Source : JICA Study Team



Source : JICA Study Team

Figure 13.3.1 Important Areas for Monitoring

13.4 Proposal on Pollution Source Monitoring and Spilled Oil Monitoring

Private oil industries implement self-monitoring based on the monitoring plan submitted and approved by MoEP. The monitoring programs of TCO and AgipKCO are highly demanding even at the international level, and considered internationally acceptable. These monitoring programs will be worth referring to by oil development companies in the Caspian Sea region.

Table 13.4.1 Example of Monitoring Items of Private Oil Enterprises

Project	Kashagan		Tengiz
Company	Agip KCO		TCO
Location	Offshore	Onshore	Onshore
Air	Fuel & Flare flow, NO_x SO_2, , RSH, PM etc	Fuel & Flare flow SO_2/H_2S NO_x, CO	Fuel & Flare flow, Temp, SO_2, NO_x, CO
CO_2 (Calc.)	○	○	○
Water	Flow, Temp, TSS, PH, Oil, COD, T-N, T-P etc,	Flow, Temp, TSS, PH, Oil, BOD,	Flow, Temp, TSS, PH, Oil, BOD, Heavy metal
Chemical	Input & output Drilling mud	Input & output	Input & output
Waste	Volume & disposal	Volume & disposal	Volume & disposal
Radiation (NORMs)	○	X	○

Source : Kashagan EIA report, TCO Annual monitoring report

Table 13.4.2 shows the monitoring parameters additional to the standard parameters that need to be monitored in order to evaluate pollution sources of oil and gas enterprises.

Table 13.4.2 Petroleum Related Parameters

Substances	Media
Constituents of petroleum Hydrocarbons, especially unsaturated hydrocarbons, are affected by photochemical reaction with nitrogen oxides, and change to ozone which is a secondary pollutant to cause photochemical smog.	Air
Volatile hydrocarbons Volatile hydrocarbons may evaporate to air when storage tanks are opened and petroleum is transported. From oily wastewater, volatile hydrocarbons may evaporate. Some of volatile hydrocarbons show carcinogenic, such as benzene.	Air
Hydrogen sulphide Hydrogen sulphide is included in associated gas generated from oil wells.	Water
Polycyclic aromatic hydrocarbons (PAHs) A part of polycyclic hydrocarbons (PAHs) included in petroleum are hazardous substances showing carcinogenic, and it needs to examine environmental risk. These substance may be controlled under Stockholm Convention in the future.	Air, Water/sediment

Source : JICA Study Team

In the future, the oil development activities in the northern Caspian Sea increase will increase, and the capacity for pollution source monitoring and oil spill monitoring have to be strengthened. When pollutant sources are unclear, fingerprint analysis is adopted as one of the measures to attempt to identify the pollution sources. Tall ball monitoring, which does not need chemical analysis, was also suggested in the Master Plan.

13.5 Environmental Inspection and Self Monitoring of Private Enterprises

With the promulgation of the new Environmental Code, the system of environmental control by the authority, namely State Environmental Control, and the system of self-regulation by the enterprises, namely the Production Environmental Control, are about to change markedly. This will significantly affect activities of oil enterprises as well as territorial MoEP / inspectors.

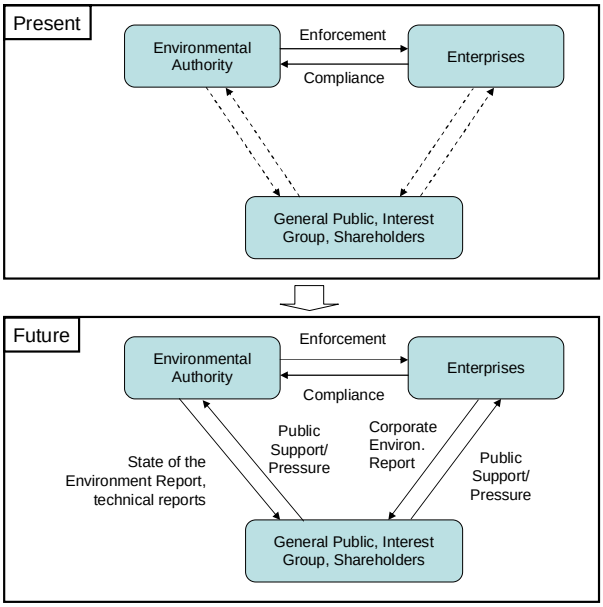
As the details of the new regulations are yet to be developed, it is difficult to design new inspection/self-monitoring system. Overall, however, the new inspection system is likely to shift its focus toward upstream compliance, such as adoption of Best Available Technique (BAT), rather than downstream compliance, such as satisfaction of emission / discharge standards for a large number of parameters. Hence, the training of inspectors and HSE officers on international best practices will be urgently needed.

On the other hand, monitoring of emission and discharges will continue to be important in order to prove/disprove the extent of environmental violations and resulting damages to the environment. The new system is expected to reduce the number of required monitoring parameters to some 40 toxic parameters, and also reduce the frequency of inspection depending on the environmental performance. It is hoped that such reduction in requirements will enable inspectors and HSE officers to prioritize day-to-day environmental control activities.

CHAPTER 14 INFORMATION FEEDBACK AND ENVIRONMENTAL COMMUNICATION

14.1 Introduction

This chapter discusses the use of environmental information in order to induce environmentally responsible behaviour by oil and gas enterprises and government organizations. Figure 14.1.1 shows how information can augment overall environmental management by involving all parties of SCEM into environmental management.



Source: JICA Study Team

Figure 14.1.1 Augmenting Environmental Management Capacity Using Environmental Information

14.2 Environmental Reporting by Public Authorities

14.2.1 Environmental Reporting by Environmental Authorities

The purpose of the State of the Environment Report is to comprehensively report on environmental conditions (e.g., qualities of air and water), environmental pressures (e.g., pollution loads), environmental impacts to humans and ecosystems, as well as governmental actions to control environmental problems. The State of the Environment Report is usually available to the public, and can answer most common questions the general public has, such as whether the environment is safe to live in, what are the main environmental problems in the area, and what the government is doing to control local environmental problems. Such information leads to public support for environmental management. Because the Atyrau area does not have such a report, it is suggested that the territorial office of MoEP, akimat, KAZHYDROMET, and other relevant organizations produce a report jointly. Such effort may be spearheaded by either the territorial office of MoEP or akimat, and the central MoEP should provide guidance to territorial MoEPs about how to produce such reports.

In addition to the State of the Environment Report, environmental authorities should also issue high quality technical reports targeting specialists. This Master Plan suggested various technical studies, such as follow-up environmental impact studies, evaluation of best available techniques, study on economic instruments, etc. The results of such studies should be reported as technical reports.

14.2.2 Environmental Reporting by Public Organizations

In addition, all governmental organizations, including MEMR, MoER, and MoA, are encouraged to include environmental aspects relevant to their duties in their evaluation reports. Such reports should discuss the environmental goals, environmental performance of the organization with respect to resources (e.g., budgets, human resources), programs, activities, achievements, and the plans for the future environmental activities.

14.3 Corporate Environmental Report

The “image” of the company to shareholders and other interest groups is becoming increasingly important for management of an enterprise, and sometimes this becomes the

major reason to adopt environmentally sound practices. Therefore, more and more enterprises produce corporate environmental reports to disclose information on their environmental performance and their environmental efforts. Table 14.3.1 summarizes the typical structure of a corporate environmental report in the oil and gas sector.

Table 14.3.1 Typical Structure of Corporate Environmental Report in the Oil and Gas Sector

Typical Report Sections	Examples of Topics
Executive Performance Summary and CEO Statement	• Report overview and organization's vision and strategy regarding such matters as: the benefits provided by its products/services, potential impacts of products and operations and a discussion of sustainable development
Company/Corporation/ Organization Profile and Boundaries	• Major products and services • Operational structure, divisions, subsidiaries, joint ventures • Countries of operation • Size of reporting organization (employees, quantities of products, net sales) • Key stakeholders • Governance structure • Significant changes in organization size, structure, ownership since last report • Basis for reporting joint ventures, subsidiaries, partnerships, etc. • Restatement of any key information stated in previous reports
Principles, Policies, Mission, Value Statement, Codes of Conduct	• Health, Safety and Environment (HES) • Social (e.g., employment, community engagement) human rights (e.g., labour, equal opportunity, security, suppliers/contractors) • Economic (e.g., anti-corruption, contracting) • Industry association participation
Management Systems	• Type or scope (ISO 14001 or other) • Objectives and targets • Implementation and certification status • Assessments • Contractor/Supplier (EHS) performance/management systems
Performance	• Major performance improvement programmes • Internal communication and training • Performance indicators • Internal and external auditing

Source: IPIECA & API, 2005

Although production of a corporate environmental report should be left to the initiative of each enterprise, it would become difficult to compare environmental performance of enterprises if each enterprise started to produce completely different reports. Thus, it is suggested that KazEnergy (or Kazakhstan Association of Nature Resources Users for Sustainable Development) sets a general guideline on corporate environmental reporting for the oil and gas sector, and also sets indicators that are consistent with the environmental regulations of Kazakhstan.

14.4 Environmental Communication through EIA

An EIA is an ideal process to pursue sustainable development because all parties of the society, namely the enterprise (proponent of the project), government and the citizens including environmental NGOs and other interest groups are at the same table. In this forum they can discuss possible options / alternatives and mitigating measures based on comprehensive EIA documents that cover proposed development plans, social and environmental conditions, legal requirements, and anticipated social / environmental impacts and risks, as well as assumptions used to make such predictions and proposed mitigating and monitoring measures.

The Kazakh government has already recognized the importance of EIA, and expanded the scope of the traditional State Ecological Review to include such consultative processes. However, consultative processes are usually highly dynamic, and can be unpredictable and frustrating because the interests of various stakeholders, including local residents, local industries, other governmental organizations, and politicians, are at stake. Although there is no standard scheme that can be used for consultation, the Master Plan suggested some advice and further references about how to carry out effective EIAs.

14.5 Environmental Database

The new Environmental Code has proposed establishment of the Unified State Monitoring System of Environment and Natural Resources (USMS ENR) as a multi-purpose information system. The USMS ENR is going to be open to general public for free, and covers (i) monitoring of the state of the environment, (ii) monitoring of natural resources, and (iii) special monitoring. KAZHYDROMET and Informational Analytical Centre for Environment Protection are already developing GIS systems that become the core of USMS ENR, and Kazakhstan is on the right track with the development of environmental databases. Nevertheless, development of environmental information databases is a substantial task, and MoEP is advised to take an incremental approach to develop the USMS ENR database, considering (i) capacity of end-users to use information, (ii) support to KAZHYDROMET and the Information Analytical Centre to officially launch the database, (iii) linkage to other information sources, and (iv) development of information databases to be used internally by territorial MoEPs

In addition to the USMS ENR, development of databases of pollution sources / enterprises is recommended. Because development of the system requires some expertise, it is suggested that a prototype database is developed by the central MoEP (e.g., Environmental Control Committee) for all territorial MoEPs.

14.6 Depository of International Guidelines and Regulations

Because many environmental authorities do not have sufficient information on international regulations and guidelines in environmental management and best practice in the oil and gas sector, it is recommended that MoEP, MEMR, KazEnergy and other organizations pool translated documents and share information. Collaborations with Russian and other CIS authorities would be beneficial for all parties.

14.7 Accessibility of Environmental Information

Environmental data and information are often not disclosed simply because subordinates cannot decide whether or not the information can be made public. Managers of governmental organizations should carefully consider the nature of the information, and decide the level of information disclosure. As for the mode of dissemination, the Internet is probably the most versatile tool to disseminate information, and it does not require cost for reproduction and shipping. Further improvement of the website is highly recommended. Other modes of dissemination of information, such as printed reports, booklets, textbooks for schools, brochures, TV/radio programs, technical articles, etc., should also be considered as such means can be very effective in disseminating information, and many people do not have access to the Internet.

CHAPTER 15 CONCLUSIONS AND RECOMMENDATIONS

15.1 Conclusions

This study was implemented in order to develop a master plan to control environmental problems associated with the oil and gas sector in the Caspian region of Kazakhstan, and to assist development of local capacity to monitor and manage the environment. It was implemented over 1.5 years (March 2006 – September 2007) in three phases: (i) analysis of the current situation (Phase I, Chapters 2-6), (ii) implementation of the Pilot Project (Phase II, Chapters 7-9), and (iii) development of the Master Plan (Phase III, Chapters 10-14).

Overall, the study found that the Kazakhstan government and the oil and gas enterprises in the area have already made significant progress in pollution control. The major findings from the study are as follows:

- Many enterprises observe a general ban on the discharge of wastewater to the Caspian Sea and have adopted re-injection of associated water into the ground as an alternative to the use of poorly maintained evaporation ponds. Some oil enterprises are already equipped with sophisticated systems to combat oil spill accidents, and have already constructed controlled-type waste disposal sites in order to minimize the environmental impacts of solid waste. MEMR and the oil enterprises are already working together to control flaring and sulphurous by-products, although the development of appropriate technologies is a major challenge due to the high pressure and high H_2S content of the oil reservoirs in the area.
- Likewise the regulatory control of pollution has been improved in recent years. Kazakhstan already has basic systems for environmental permits, emission/discharge standards, pollution charges, etc., and these instruments have been enforced through State Ecological Reviews, environmental inspection, litigation, and other means. While these systems were largely inherited from the Soviet era, the government had made a number of efforts to improve the effectiveness of the regulatory systems, which include re-establishment of collapsed monitoring programs, introduction of EIA, and development of a National Oil Spill Response Plan.
- One of the most significant achievements in recent environmental management is the enactment of a new Environmental Code in early 2007. This fundamental environmental law addresses the previous inadequacies of the regulatory systems, such as un-enforceable emission standards, and introduces modern concepts, such as a permit system based on best available techniques and production environmental control. Overall, the regulatory system in Kazakhstan is moving toward self-regulation by enterprises, focusing on upstream environmental control in the production process, such as the requirements on modern production technologies, in addition to end-of-pipe control.
- Because of these efforts, and also because the northern Caspian Sea is a vast area, and historical oil development activities were mainly concentrated in the onshore areas, the environmental conditions in the Caspian Sea are still relatively good.

However, with the development of offshore oil fields, oil production is expected to increase from 24 million tonnes/year in 2005 to 140 million tonnes/year in 2015, and emissions/discharges of pollutants will also increase as estimated in Chapter 10. Hence, Kazakhstan needs to urgently establish and implement more effective pollution control systems. In this regard, Kazakhstan still has a substantial amount of work to do. Among the main issues are:

- The secondary laws and detailed regulations that are needed to implement the new Environmental Code have not yet been developed, and without such a regulatory foundation, it will not be possible to enforce the new pollution control measures.

- The further development of technical solutions is required to resolve some issues, which include sulphur disposal, control of associated gas and water, closure of abandoned leaky wells, restoration of oil contaminated soils, and waste management. The adoption of more integrated approaches, such as beneficial utilization of associated gas and a sophisticated reservoir pressure management combined with re-injection of surplus gas and wastewater, might improve the environmental efficiency of operations.
- The oil and gas sector is highly diverse, and while some enterprises are already operating at the international level, others companies are lagging behind. There is a need to raise the sector-wise environmental performance to acceptable levels.
- The capacity for environmental monitoring also needs reinforcement, as it has suffered a period of regression due to the collapse of the Soviet Union and subsequent economic hardships. In order to accelerate the development of monitoring capacity, this study carried out a Pilot Project during the course of the study. The Pilot Project targeted KAZHYDROMET and the territorial office of MoEP in Atyrau and covered environmental sampling, analysis, quality control, and use of GIS and satellite image analysis in environmental management.

15.2 Recommendations

The capacity of a society to overcome environmental issues is known as the Social Capacity for Environmental Management (SCEM), and the government, enterprises and citizens are the three main parties of SCEM. In order to improve environmental management, the capacities of these actors have to be improved and evolved. This study considered how to improve the capacities of these actors, and proposed a Master Plan (see Chapters 10-14), which was to be implemented in three phases, namely (i) review/assessment phase, (ii) system re-development phase, and (iii) trial implementation phase. MoEP and other stakeholders are hereby recommended to follow the Master Plan to improve the capacities of all actors and achieve better environmental management in order to both protect the environment and to pursue sustainable development in the Caspian region.

- A good starting point for implementation of the Master Plan is the review of this report. All relevant organizations, especially MoEP, MEMR, MoER, MoA,, KAZHYDROMET, Ministry of Economy and Budget Planning, and oil enterprises/KazEnergy are urged to review this report, and consider where they stand now, and where they have to go with their efforts to establish more effective environmental management systems.
- MoEP is urged to organize an Environmental Committee on the Caspian Sea consisting of environmental administrators, ecologists, institutional/organizational experts, pollution control experts, economists, public health experts, etc. These members should examine the environmental sensitivities of the Caspian region, the links between environmental pressures–state–effect, and the institutional/organizational gaps between the current practices and those being introduced by the new Environmental Code. [Chapter 11]
- In parallel, MEMR in collaboration with MoEP, is urged to organize a Technical Committee on Oil and Gas Development consisting of pollution control experts, HSE managers, environmental administrators, engineers, geologists, and others. These members should examine the gaps between the current practices of the oil and gas enterprises and international best practice. The participation of oil and gas enterprises is essential, and this may be co-ordinated by KazEnergy. [Chapter 12]
- Based on these studies, MoEP should spearhead the re-development of effective environmental regulations by organizing specific taskforces. The core of the new regulatory system will be the wide adoption of best practice by the enterprises. The environmental

authorities need to promote and enforce such efforts by updating the permit systems, emission/discharge standards, inspection, EIA, etc. [Chapter 11]

- In order to evaluate and improve the new environmental management systems, the enterprises as well as MoEP/KAZYDROMET, akimats and other organizations should regularly monitor and report environmental performance. This includes monitoring of the state of the environment (e.g. air and water pollution), environmental pressures (e.g. pollution loads), and environmental effect (e.g. impact of oil and gas development activities on local ecosystems). In this regard, an improvement of the quality of environmental information is needed, because without reliable information, it is impossible to improve environmental management systems. Support to the Regional Environmental Monitoring Centre in Atyrau, and to the territorial MoEPs on a more scientific approach to inspections and emissions/discharge monitoring is recommended. [Chapter 13]
- The team also recognized that, currently, 'environmental management' means the enforcement of regulations by regulators and compliance by enterprises. The use of other social forces, such as public pressure from the general public and shareholders on the environmental and financial accountabilities of enterprises and government organizations, has been relatively limited. Such public pressures can become significant driving forces to improve the environmental accountability of enterprises and governmental organizations. MoEP as well as oil enterprises and other organizations are strongly recommended to be strategic about the dissemination of information to a wider audience of stakeholders. [Chapter 14]
- Implementation of the Master Plan requires budgeting, bureaucratic procedures to co-ordinate with other organizations, approval of laws and regulations by appropriate decision-making bodies, etc. These procedures alone can take significant time and resources. Hence, the team recommends that MoEP and the other organizations concerned take an incremental approach and start with tasks that can be done by setting achievable short-term targets. The suggested first short-term target is to review this report and then to organize the proposed committees, which are certainly achievable short-term tasks.

Finally, all members of the team would like to register their appreciation for all the co-operation they have received during the course of the study. It is impossible to name all of our helpful partners – they include MoEP, MEMR, MoER, MoA, MEBP, KAZHYDROMET, the territorial offices of MoEP in Atyrau, geology committee, oil companies, and environmental analytical laboratories, among others. The study could not have been accomplished without the participation of these organizations. Similar collaboration among Kazakh organizations will form the foundation on which the Master Plan will be successfully implemented.