CHAPTER 3 EXISTING AND PLANNED OIL AND GAS FACILITIES

3.1 Introduction

The oil and gas industry in the Caspian Sea region (Atyrau and Mangistau oblasts) is composed of oil and gas development enterprises, oil and gas refineries and oil and gas transporting corporations.

Oil development is the predominant activity in Atyrau oblast, while co-development with gas is pursued in Mangistau oblast. The crude oil produced is transferred by pipeline or railway, and partially refined at Atyrau refinery for domestic use, but most of the crude oil is exported by pipeline via an oil terminal.

The oil production from comparatively shallow strata has been continued even after the independence. However, development of high pressure, high H_2S content oil from deep strata is growing with the participation of foreign oil development companies introducing new technology, and the production volume is increasing rapidly.

This trend is accelerating with the development of the Kashagan oil field on the continental shelf by Agip KCO, which is now constructing offshore and onshore facilities with the plan to start production in 2010, and studies of other projects in the area are also underway. Oil development in the Caspian Sea region of Kazakhstan is expected to increase rapidly.

This chapter outlines the existing oil and gas facilities as well as the anticipated future development of the oil and gas industry in the region according to the “national program of Caspian Sea region sector development”, and then examines the future environmental impact and emergency response.

3.2 Existing Oil and Gas Facilities

3.2.1 Oil and Gas Company

The oil and gas companies in Atyrau and Mangistau oblast are summarized in Table 3.2.1. Except 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 3.2.1 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 letter's company is subsidiary of KazMunayGas
Source : JICA Study Team

3.2.2 Oil Reserves

The recoverable reserve of the Tengiz field is 1.06 billion tonnes, and that of the Kashagan field is 2.02 billion tonnes. Among the KazMunayGas' oil fields, the recoverable reserve of the Uzen field is 0.19 billion tonnes, and the total recoverable reserve owned by KazMunayGas is 0.27 billion tonnes. The total recoverable reserves of the Caspian continental shelf is expected to increase with further seismic survey, though existing oil development in onshore shallow strata has passed its peak production.

3.2.3 Oil and Gas Production

The oil production volume of each company is shown in Table 3.2.2. The total gas production by KazMunayGas was 1.3 billion m^3 in 2003.

Table 3.2.2 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

3.2.4 Oil and Gas Production Facilities

The oil and gas facilities currently operating are as shown in Table 3.2.3. The locations of these facilities are shown in Figure 3.2.1

Table 3.2.3 Oil and Gas 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	

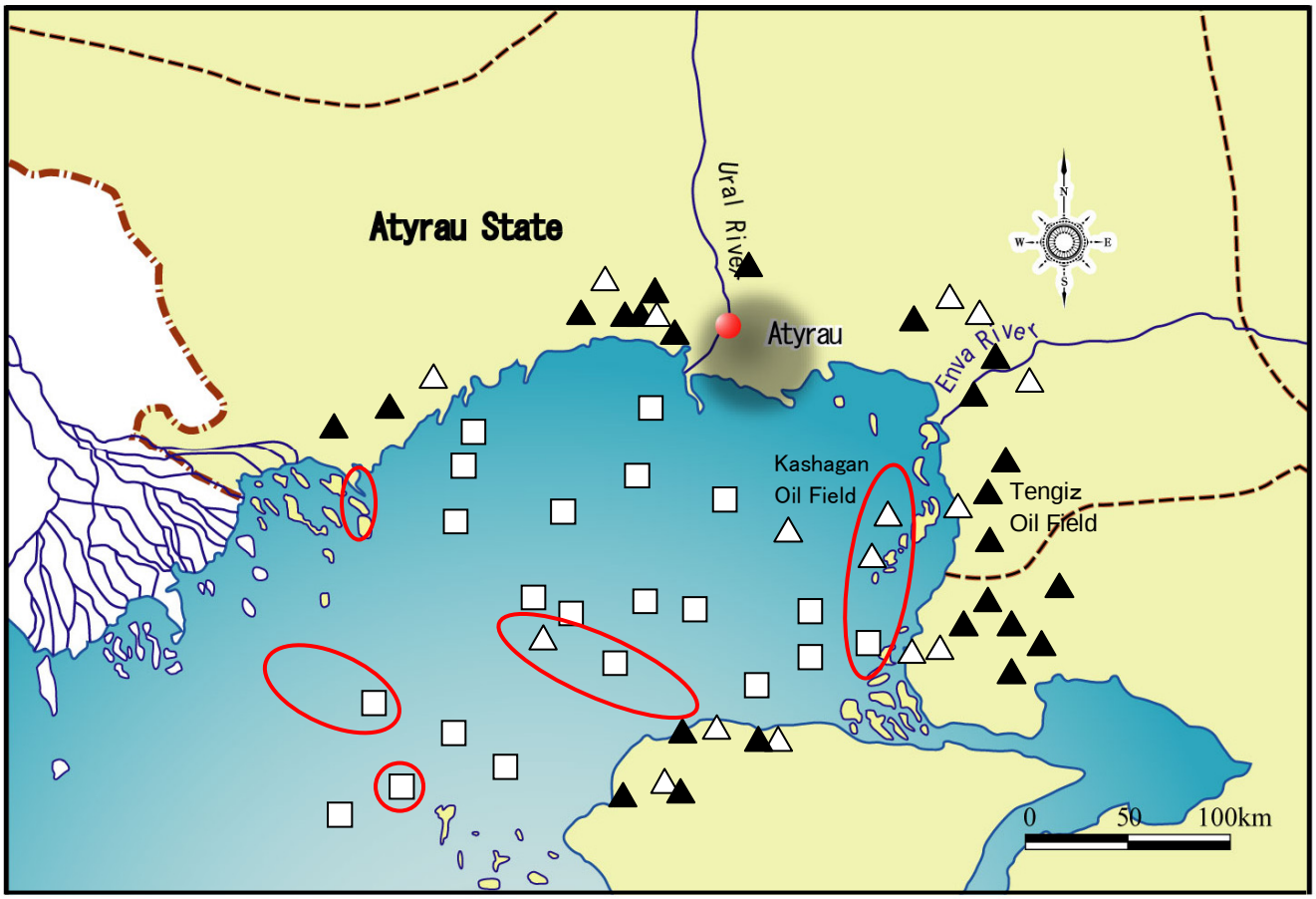
Note: TCO facility, Data source: CEP Industrial Survey Part 1 Pollution Loads May 2000

The general features of oil production facilities in Atyrau oblast surveyed during the field visit are as follows. Except for the facilities of TCO and facilities of Agip KCO under construction, onshore facilities are similar to each other.

Table 3.2.4 Oil Production Facilities in Atyrau oblast Surveyed During the Field Visit

Facilities	Embamunaigaz		Sazankurak	TCO	Agip KCO
	Kamyshitovoy	Prorva	Sazankurak	Tengiz	Khashagan
Production well	Yes	Yes	Yes	Yes	(Yes)
Produced water injection	Yes	Yes	Yes	Yes	（No）
Abandoned well	Yes	Yes	Yes	(Yes)	None
Associated gas injection	No	No	Not necessary	No→Test	(Yes)
Oil Collection facility	No	No	No	Yes	(Yes)
Production facility	Yes	Yes	Yes	Yes	(Yes)
Refining facility	No	No	No	Gas refining	(Gas refining)
By product (Sulphur)	No	No	No	Yes	(Yes)
Transport facility	Pipeline	Pipeline	Railway	Pipeline＋ Railway	（Pipeline）
Protection for water level rise	Bank	Bank	Not necessary	Bank	(Artificial island)

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



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

（Produced water injection）

（Oil production by sucker rod）

Figure 3.2.2 Photographs of Production Facilities

The CEP report in 2000 stated that almost all oil companies discharged produced water into the desert or evaporation ponds without treatment, but the results of the field survey in 2006 shows the produced water is injected underground. Apparently these companies had followed the environmental directive and changed their disposal method to underground injection using abandoned wells.

With respect to flare gas, almost all companies were yet to undertake flare gas reduction measures. But in accordance with the oil law of 2004, which prescribes that flare gas emissions be restricted except for emergency situations, all companies submitted flare gas reduction plans in July 2006 and have initiated actions to reduce emissions. The countermeasures for flare gas reduction will be realized by means of underground injection and utilization as sales gas or internal fuel gas and raw materials for the petrochemical industry.

In the past, there was no controlled waste landfill in the area, and waste generated from the oil and gas industries was dumped in the desert. But oil industries such as Atyrau refinery, TCO, and Agip KCO are constructing their own controlled waste treatment and disposal facilities.

3.2.5 Oil Refinery and Gas Refinery

Outlines for the oil and gas refineries are shown in Table 3.2.5. The locations of the refineries are shown in Figure 3.2.4.

Table 3.2.5 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)

Oil refinery (sulphur recovery unit)

Gas refinery (sweetening unit)

Figure 3.2.3 Photographs of Oil and Gas Refineries

These facilities were designed to meet the demand of the export market, and built with environmental considerations for minimizing the impact arising from the operation.

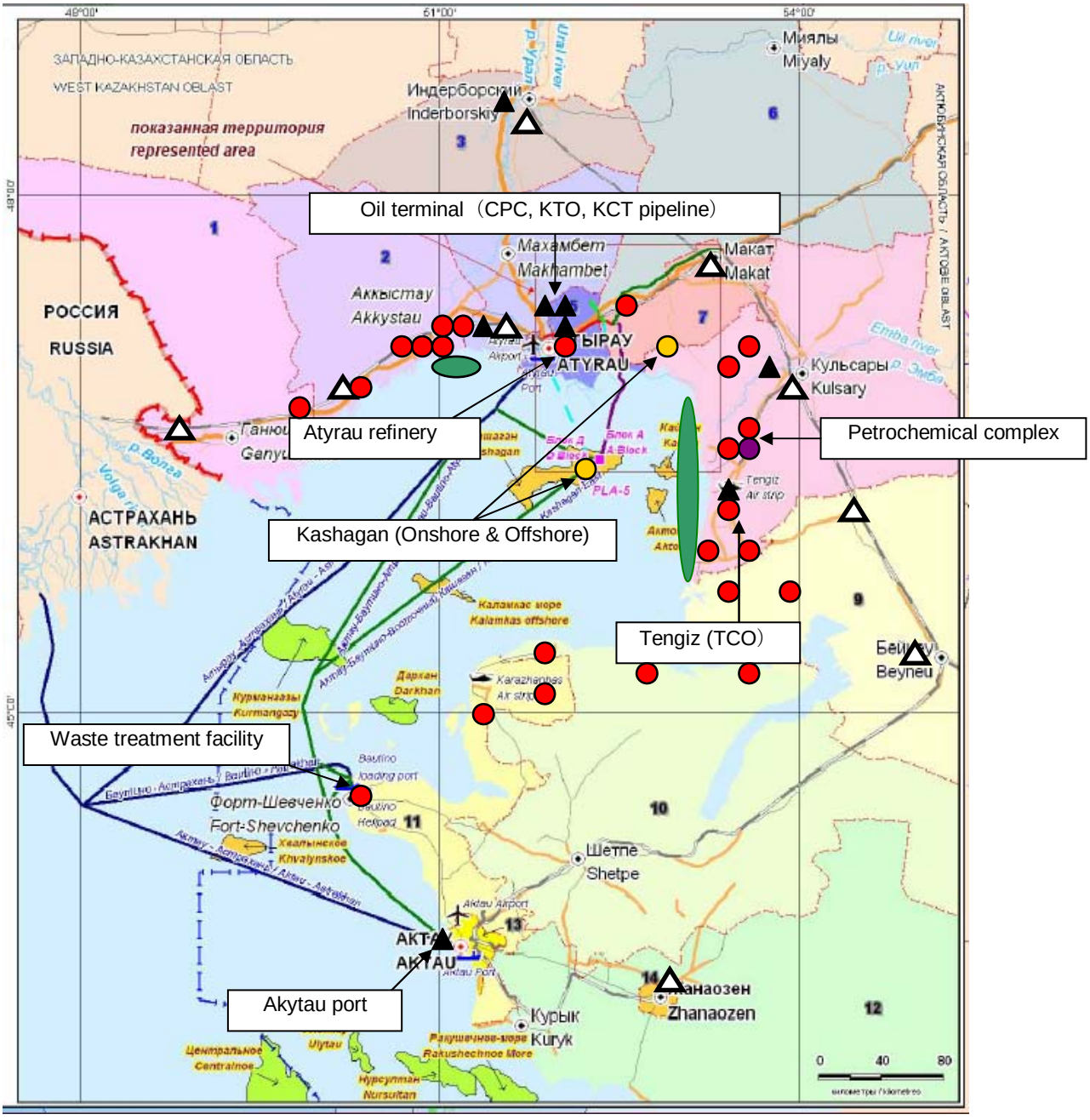
3.2.6 Oil and Gas Transportation (Terminal)

The oil and gas terminals in the area are summarized in Table 3.2.6. The locations of the terminals are shown in Figure 3.2.4 (also see Figure 3.3.1 for the export routes), and photographs of an oil transport terminal and an evaporation pond are shown in Figure 3.2.5.

Table 3.2.6 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 reply for questionnaire (Jun-Jul. 2006)



Source: Development map in North Caspian Sea, Information during field survey (Jun-Jul. 2006

Figure 3.2.4 Oil and Gas Facilities in North Caspian Sea Region

Crude Oil Transport Terminal (FRT)

Wastewater treatment (evaporation pond)

Figure 3.2.5 Photographs of Oil Transport Terminal and Evaporation Pond

There are storage tanks and transfer pumps for oil transportation and compressors for gas transportation. Wastewater from the terminal is discharged to an evaporation pond after treatment. However, Floating Roof Tanks (FRTs) for reducing VOC emissions are not generally applied yet.

3.3 Oil and Gas Development Plan

The long-term national development plan for the Caspian region to 2015, entitled "Oil & gas sector development national project in Caspian Sea region", was developed by the Ministry of Energy and Natural Resources and KazMunayGas, and approved on May 16, 2003 as the President Ordinance No.1095.

The plan aims to develop and export the huge oil resources in the Caspian Sea region, which account for more than 64 % of the Kazakhstan's oil reserves. According to this document, the following action plan will be developed and implemented including the related infrastructure improvement:

- First stage (2003-2005) : Comprehensive condition arrangement
- Second stage (2006-2010) : Acceleration of development
- Third stage (2010-2015) : Stabilization of production

The planned volumes of oil and gas production and exportation are almost the same as the estimates by foreign agencies.

3.3.1 Oil and Gas Reserves

National and international geological specialists believe there are 12-17 billion tonnes of geological resources in the Caspian Sea area of Kazakhstan. The estimated productive volumes of these resources are as follows:

- Oil : 4.356 billion tonnes
- Condensate : 0.061 billion tonne
- Gas : 518 billion m^3

The estimate includes 1.648 billion tonnes from the Kashagan stratum in the North Caspian Sea.

3.3.2 Oil and Gas Development and Production

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 3.3.1 Estimated Oil Production

Production area	Oil production volume (million tonne)		
	2005	2010	2015
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 3.3.2 Estimated Oil Production from the North Caspian Sea Area in the Future

Production area	Oil production volume from Caspian Sea area (million tonne)		
	2005	2010	2015
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)

The gas intake volume arising from the gas associated with oil production is estimated as follows. A large volume of gas generation is estimated with the rapid increase in oil production.

Table 3.3.3 Estimated Generation of Associated Gas from Oil Production

Origin	Gas volume from Caspian Sea area (Associated gas)		
	2005	2010	2015
Gas intake	0.3 billion m^3	24 billion m^3	63 billion m^3
Underground re-injection	0.3 billion m^3	16 billion m^3	40 billion m^3
Surplus gas	0.0 billion m^3	8 billion m^3	23 billion m^3

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

The crude oil supply to oil refineries is as follows. The Caspian Sea area will become the main source of crude oil for the three domestic refineries in Kazakhstan.

Table 3.3.4 Crude Oil Supply to Domestic Refineries

Production Area	Crude oil supply volume to domestic refineries (million tonne)		
	2005	2010	2015
Caspian Sea area	0.5	6.6	11.9
Others (onshore)	9.1	8.2	6.6
Total	9.6	14.8	18.6

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

The increase in crude oil exports from Kazakhstan, which is based on the actual volume in 2000, is estimated as follows. The transportation capabilities, such as pipeline & tanker route and their capacities are evaluated based on this estimate.

Table 3.3.5 Increase in Crude Oil Export

Case	Increasing volume of crude oil export (Based on 2000, million tonne)		
	2005	2010	2015
Case-1	27	79	138
Case-2	27	88	168
Case-3	27	93	198

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

In order to execute this plan, the following actions will be practiced in each stage.

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

The long-term plan also states that the dominance of natural resources development in the Caspian region by foreign developers should be avoided, and participation of national oil and gas companies in the development should be promoted. The plan also requires foreign developers to propose methods of utilizing associated gas and by-product sulphur.

According to the long-term plan, the estimated oil and gas productions in Atyrau oblast area are as follows:

Table 3.3.6 Estimated Oil and Gas Productions in Atyrau oblast According to the Long-Term Plan

Category	Unit	2005 year	2010 year	2020 year	2030 year
Oil production	million tonne	29.0	65.0 (50.0)	74.0 (90.0)	74.0(90.0)
Gas production	million m^3	8.7	20.0	24.5	24.5
Oil refining	million tonne	5.0	5.0	5.0	5.0

Source: estimated volume as of 2003 (volume in 2006-2008 year action plan) of Atyrau oblast

3.3.3 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 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 tonne/year in the Caspian Sea region), which is forecasted to be in 2012.

The construction plans for the new export oil pipelines are listed in Table 3.3.7 and the proposed oil and gas pipeline routes are shown in Figures 3.3.1, 3.3.2a and 3.3.2b.

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 the following new pipelines are being carried out:

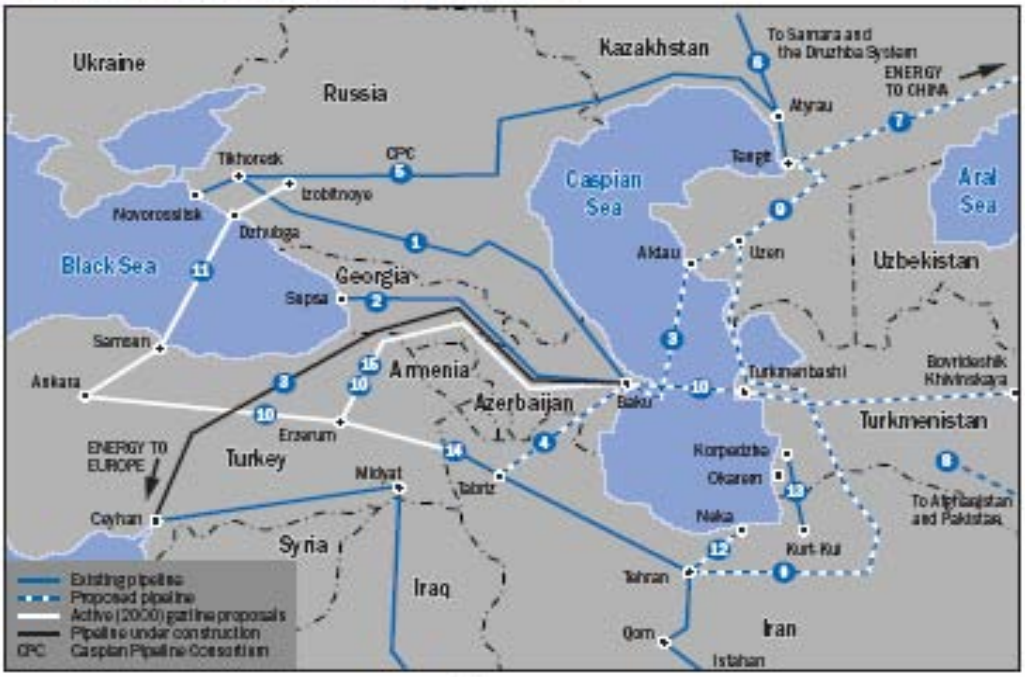
- Trans Caspian Gas Pipeline: Kazakhstan-Turkmenistan-Azerbaijan-Georgia-Turkey
- Trans China Gas Pipeline: Turkmenistan- Kazakhstan-China
- Trans Indian Gas Pipeline: Kazakhstan-Turkmenistan-Afghanistan-Pakistan-India

Table 3.3.7 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 (possible)
Baku-Novorossiisk	Baku-Novorossiisk via Dagestan Russia	204	120,000	360,000 (planned)
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 (planned)
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

Data source : CRS Report for Congress, updated Mar.2005

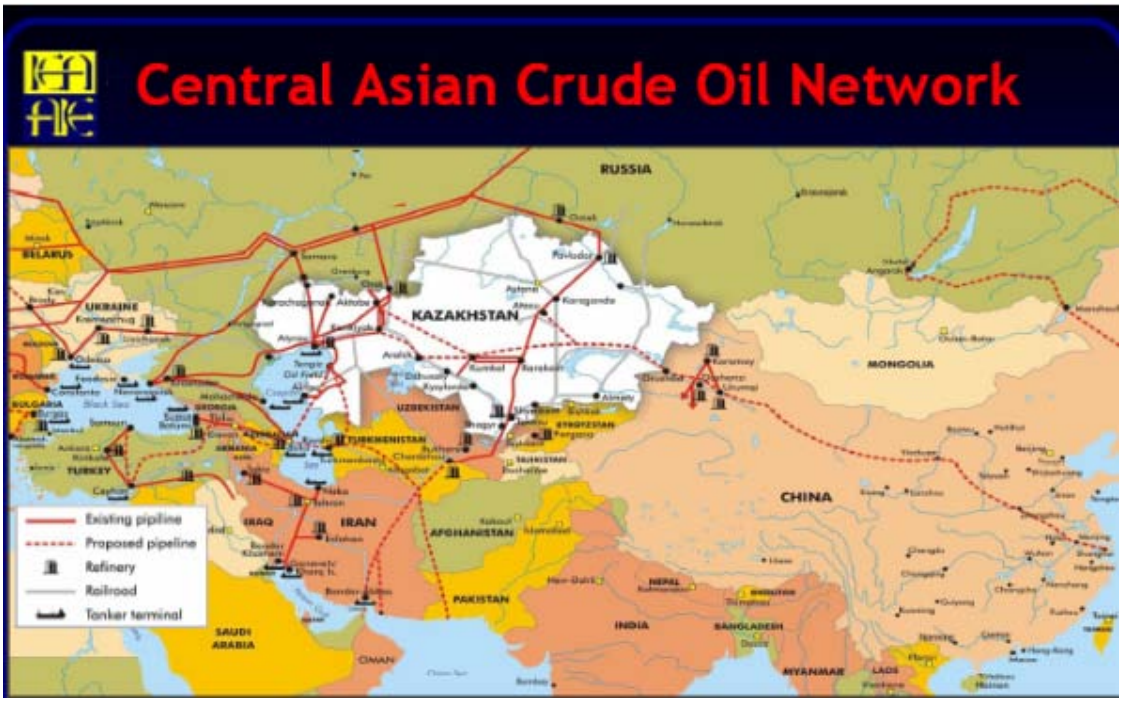
Caspian Sea Oil and Natural Gas Export Routes



Source: EIA, Country Information on Kazakhstan

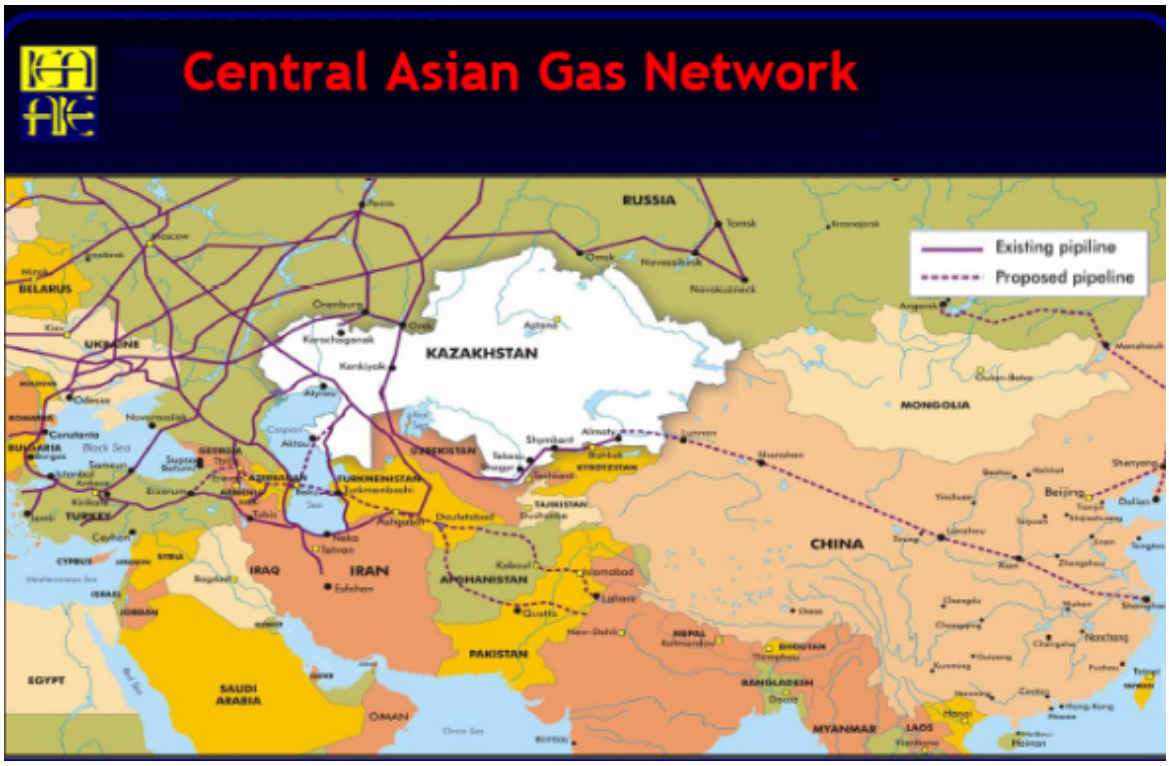
1	Baku Novorossiisk
2	Baku Supsa — Pipeline capacity to be potentially increased in the future.
3	Aktau-Baku-Tbilisi-Ceyhan — May also be extended to Aktau to incorporate major Kazakh reserves.
4	Baku-Iran
5	CPC — Started to transport oil from Tengiz in March 2001.
6	Atyrau-Samara-Druzhba system.
7	Tengiz-China
8	Chardzhou-Pakistan — With possible tie-in from Turkmen and Kazakh fields on/near the Caspian.
9	Tengiz/Uzen-Kharg.
10	TransCaspian Gas.
11	Blue Stream Gas line
12	Neka-Tehran
13	The KKK gasline — Opened in 1997
14	Tabriz-Erzerum gas connector — Iranian section completed by end of 1999.
15	Baku to Turkey gas pipeline — New 16 bcm\y line involving the linking of existing lines in Azerbaijan and Georgia with a new line in eastern Turkey.

Figure 3.3.1 Caspian Sea Oil and Natural Gas Export Route
（ planned at 2002）



Source: Kazakhstan Oil & Gas 4th annual conference June 2004

Figure 3.3.2(1) Central Asia Crude Oil Network Plan



Source: Kazakhstan Oil & Gas 4th annual conference June 2004

Figure 3.3.2(2) Central Asia Gas Network Plan

3.3.4 Petrochemical Industry

To utilize the huge volume of associated gas from oil production, construction and operation of petrochemical facilities is envisioned as one of the third stage activities, in order to satisfy demands for petrochemical products in Kazakhstan and to develop the domestic petrochemical industry. The outline of the petrochemical project under study is as follows:

- Location: Near Tengiz field (Karaton)
- Raw gas: Associated gas (Surplus gas) from Tengiz and Kashagan field via pipeline
- Process: Surplus gas decomposition and synthesis (production of ethylene, propylene, ammonia etc)
- Secondary process: Polyethylene, polypropylene etc (not decided)
- Shipping: Akytau port or new port at north coast of Mangistau oblast
- Production: Operation will not be started until 2015

3.3.5 Countermeasures for Surplus Gas (Flare gas)

Surplus gas from oil and gas development has in the past been burnt-off in flare stack as flare gas. But to reduce emission of pollutants such as SO_2, NOx, black smoke and global warming gas (CO_2), and for energy saving, there is an international trend towards the reduction of flare gas.

For example, the World Bank has developed a guideline "GGFR: Global Gas Flaring Reduction") in cooperation with the national oil companies of oil producing countries and international oil companies including ChevronTexaco, and participating companies are implementing voluntary plans for flare gas reduction.

http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTOGMC/EXTGGFR/0,menuPK:578075~pagePK:64168427~piPK:64168435~theSitePK:578069,00.html

In Kazakhstan, according to the oil law 2004, the following plans exist (see Chapter 12):

- TCO: refining of surplus gas to produce LPG for sale, and testing underground re-injection since November 2006
- AgipKCO: treatment of surplus gas for sale
- Further increase of oil production results in more surplus gas generation; therefore a petrochemical plant will be planned for utilization surplus gas.

3.3.6 By-product

By-products from the oil and gas industry include:

- Sulphur (generated from the sulphur recovery units in oil and gas development and refining)
- Coke (generated from delayed coker in oil refining)

There is no plan to revamp oil refining during 2007- 2015. However, generation of by-product sulphur is expected to increase rapidly with the increase in oil and gas production in the area.

Table 3.3.8 Estimated Volume of By-products

Source	2005year (tonnes/day)	2015year (tonnes/day)	Remarks
TCO	2,500-3,500	5,000-7,000	-
AgipKCO	0	3,000-4,000	First phase development
Others	100-300	800-1,000	Oil refinery etc
Total	2,600-3,800	9,800-12,000	-

Source: EIA report of Agip KCO, Information during field survey

There is only a small market for sulphur in Kazakhstan, for sulphuric acid production, so the sulphur should be exported. The sulphur export to China has stayed at the rate of 600,000-1,200,000 tonne/year since 2005, though increase of by-product sulphur due to increase in exploitation of high H_2S crude oil will require reconstruction of infrastructure for sulphur utilisation and export. Therefore, oil and gas companies that produce sulphur and relevant governmental agencies are now studying methods to utilize and/or dispose of sulphur. The progress of these studies is described in 12.5 of this report.

3.3.7 Infrastructure Development

In accordance with the rapid oil and gas development in the Caspian Sea region mentioned above, development of the following supporting infrastructure is being considered:

- Atyrau: River port, base of " Kazakhstan CaspiShelf" and "Atyrau NeftigasGeorogy", industrial organization, factories, college of technology, and air port
- Akytau: Sea port, industrial organization, factories, college of technology, and air port
- Bautino: Support base of oil development (First stage)
- Loading/Unloading facilities for large ships: Akytau port, Bautino port and Kurik port
- Dredging of Ural river using underwater equipment
- Dock for construction and repair of specialized vessel
- Others (roads, railway, water transport (construction of new tankers: 12,000DWT×3))

3.4 Environmental Issues and Countermeasures

3.4.1 Major Environmental Issues of Oil and Gas Project

Oil and gas projects (oil and gas development, oil and gas refining, and oil and gas transportation) have environmental impacts in each phase of their project lives such as planning, development, construction, operation, and decommissioning. The main environmental issues for which countermeasures should be considered are as follows:

(1) Oil and gas development projects

(Exploration phase)

- Seismic survey (method and timing)

（Development phase）

- Drilling plan (Selection of mud and disposal of waste mud and cuttings)
- Blow-out accident
- Well test

（Planning phase）

- Selection of number of facilities and their location & structure (artificial island, platform and onshore)
- Pipeline planning (route selection, method (buried/non-buried, approach to coast))

（Operation phase）

- Emission from combustion equipment
- Emission of vent gas (Volatile organic compounds: VOCs)
- Flare gas burning
- Disposal of produced water
- Disposal of process and domestic wastewater
- Disposal of oily waste (Crude tank sludge etc)
- Odour (H_2S, mercaptan etc.)
- Noise
- Naturally occurring radioactive materials (NORMs)
- Oil spill accident

(Decommissioning)

- Abandoned wells and facilities

(2) Oil and gas refining project

（Planning phase）

- Selection of facility location and refining process

（Operation phase）

- Emission from combustion equipment
- Emission of vent gas (Volatile organic compounds: VOCs)
- Disposal of process and domestic wastewater
- Disposal of oily waste (Crude tank sludge etc)
- Odour (H_2S, mercaptan etc.)
- Noise
- Oil spill accident

(3) Oil and gas transportation (terminal) project

（Planning phase）

- Selection of facility location.

（Operation phase）

- Emission from combustion equipment
- Emission of vent gas (Volatile organic compounds: VOCs)
- Disposal of process and domestic wastewater
- Disposal of oily waste

- Noise
- Oil spill accident

3.4.2 Pollution from Past Oil and Gas Industrial Activities

Situations where there is pollution arising from past oil and gas industrial activities and related pollution control measures taken so far are as follows.

(1) Oil contaminated soils

The long-term national development plan states that contaminated soils in the western part of Kazakhstan occupy about 194,000 ha and the total oil volume is up to 5,000,000 tonnes. In Atyrau oblast, the oil and gas companies had developed their own contaminated land remediation programs, and started the remediation works in 2004. According to "Annual Environmental Report of Atyrau Oblast", progress of the remediation works and remaining contaminated land area are as follows:

Table 3.4.1 Contaminated Land in Atyrau Oblast

Company	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
KazMunaiGas-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)

The status of contaminated land remediation in Mangistau oblast is similar to that of Atyrau oblast. The values in the annual environmental report of Mangistau oblast are based on collected data over 9 months spanning 2004 and 2005 rather than a full year.

Table 3.4.2 Contaminated Land in Mangistau Oblast (Year 2004－2005)

Company	Area with contaminated land (ha)	Area restored (ha)	Remaining area with contaminated 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

The examples of oil-contaminated soil (land) in Kazakhstan found during the field survey are as follows:



（around the road） （coast of salty lake） (production field)

Figure 3.4.1 Photographs of Contaminated Soils

(2) Flare gas burning

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 Atyrau oblast, the flare gas volume is not independently tallied, but included as a part of the pollutant emission volume. On the other hand, the flare gas volume is assessed each year (9 months summary) in Mangistau oblast.

Table 3.4.3 Flare Gas in Mangistau Oblast (During 9 months)

Company	2004 (10^6 m^3)	2005 (10^6 m^3)
Uzenmunaigaz	2.820	6.493
Zhetybaimunaigaz	1.780	0.002
Kalamkasmunaigaz	0.635	0.002
Karazhanbasmunaigaz	6.960	4.619
Total	12.195	11.116

Note: 0.002 means only pilot burner burned
Data source: Annual Environmental Report of Mangistau Oblast

According to the oil law of 2004, flaring of associated gas is in principle not permitted, and each company submitted their flare gas reduction program by July 2006. The plans have been examined and approved by MoEP after discussing adjustments with the Ministry of Energy and Natural Resources and the Ministry of Emergency Response. The details are described in Section 12.2 of this report. The existing situation with flare stacks as discovered during the field survey is shown below:



（TCO production facility） (Atyrau refinery) (Oil Production field (ground flare))

Figure 3.4.2 Photographs of Flare Stacks

(3) Inundated Abandoned Wells

With the rise of the water level of the Caspian Sea, oil leaks from abandoned inundated wells that were not properly shut off during the former Soviet era have become an important environmental issue in the area. The Committee of Geology is in charge of this. The present situations are as follows:

- Surveys of 1,383 abandoned wells including inundated abandoned wells have already been finished and their locations and status were recorded, and the Committee of Geology produced a GIS map of the wells. (The inundated abandoned wells were surveyed along the Atyrau oblast coast, but not in the Mangistau oblast coast) The locations of abandoned inundated oil fields is shown in Figure 3.4.3)
- Ninety abandoned inundated wells have a high risk of leaking oil. Of these 90 wells, 48 wells have no owners and are under the responsibility of the Committee of Geology, while the owners of the remaining 42 wells have been identified. One of the unowned wells that has not been properly capped caused a leak in May 2006[1].
- The 48 unowned wells are being treated by the Committee of Geology's yearly plan for spill prevention; 5 wells in 2004, 7 wells in 2005, 12 wells in 2006, 8 wells in 2007 and the treatment works will be finished in 2009. The owner wells are being treated by the owners under the government's contract, and the Committee of Geology is not responsible for those.
- Thirty-four of the 48 unowned wells have already been treated or being treating or under tender (treating plan and methods are approved by negotiation with MoEP and the Ministry of Emergency Response).
- The critical point for the treatment is the access to inundated wells. (It is impossible to access from the land, and is also difficult to access by a working vessel from sea due to the shallow water (water depth 1.5m less))
- Considering the special working conditions, the Committee of Geology is soliciting applied technologies for well treatment (The contractor is required to provide a 7 year guarantee)
- The Committee of Geology has shut down 44 onshore abandoned wells that have no owners and a high risk of leakage.

The examples of the abandoned inundated wells are shown in Figure 3.4.3. These pictures were provided by the Committee of Geology.

(abandoned inundated wells） (transformed well by ice) (shut off work of abandoned well)

Figure 3.4.3 Photographs of Abandoned Inundated Wells

[1] The situation of the oil leak from the abandoned inundated well in May 2006 was:
- Spill location: North Caspian Sea east coast （Pribrezhnoye）
- Spill volume was small therefore committee of geology decided to start shut off works (it takes 18 days for cementing). The Ministry of Emergency Response was not dispatched.
- Environmental protection agency has confirmed the situation.
- The Committee of Geology in Atyrau does not have the shut off work equipment, but contactor AKBENIN do.

(shut off worked well (cementing)) (Onshore well (monitoring)) (Onshore abandoned well)

Figure 3.4.4 Photographs of the Situation of Abandoned Wells

The abandoned inundated wells of identified owners are shut off by cementing and the abandoned onshore wells of identified owners are monitored by the owner.

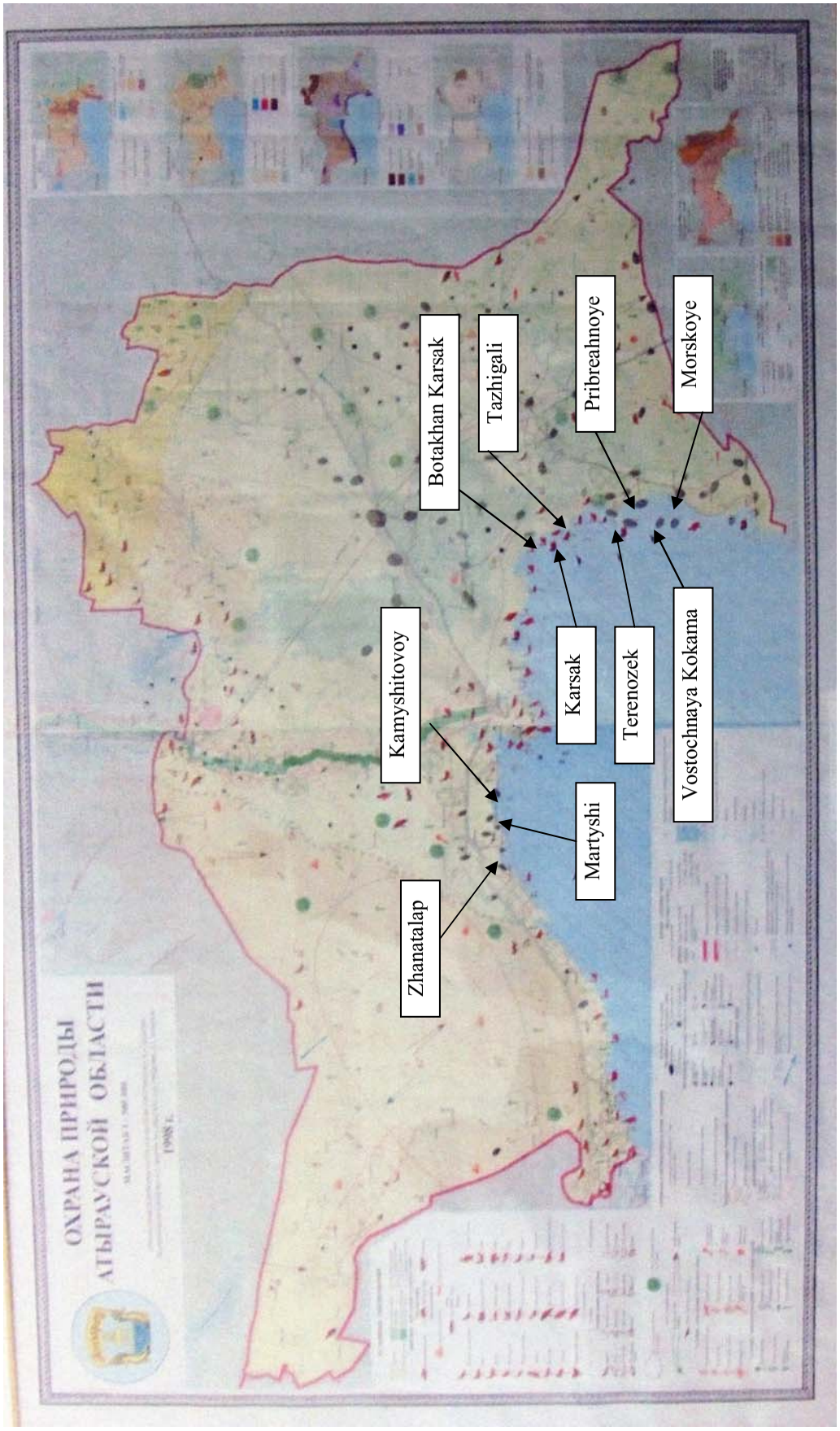


Figure 3.4.5 Abandoned Inundated Well Area in Atyrau Oblast

(4) Waste

Waste mud and cutting waste from onshore drilling works used to be dumped to surrounding desert, causing soil contamination. Oily sludge from operation and maintenance of onshore facilities has also been disposed of in a similar manner. These oily wastes are now partially stored in sludge pits, and remediation of contaminated soils is being undertaken according to the remediation programs of the companies.

In the case of the offshore oil and gas development (Kashagan oil field), all waste mud and cuttings and oily waste are transferred to land (Bautino), and after thermal treatment for oil removal, the waste is disposed of at a landfill site. Therefore no waste is disposed of in the sea. Agip KCO has constructed a new thermal treatment facility at a location 10 km or more away from residence area. This is already in operation, and the existing facility in Bautino is going to be shut down to prevent the claimed odours.



(new treatment building) (new thermal treatment facility) (disposal site of treated cuttings)

Figure 3.4.6 Photographs of the New Thermal Treatment Facility Near Bautino

The amount of waste generation by major oil industries in Atyrau oblast is as shown in Table 3.4.4. The amount of waste is decreasing with the improvement of waste management.

Table 3.4.4 Generation of Waste by Major Oil and Gas Companies in Atyrau oblast

Company	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)

Oil companies in Atyrau oblast have plans to construct their own waste management facilities according to international standards, and some of them are already constructing such facilities. Oil companies in Mangistau oblast store the following oil contaminated soil and oily sludge, and construction of waste management facilities according to international standards has not been realized.

Table 3.4.5 Stored Volume of Waste (as of Sep. 2005) in Mangistau oblast

Company	Stored volume (tonnes)	Kind of stored waste
Uzenmunaigaz	421,125	Oil contaminated soil & oily sludge
Zhetybaimunaigaz	354,280	Oil contaminated soil & oily sludge
Kalamkasmunaigaz	NA	Oil contaminated soil & oily sludge
Karazhanbasmunaigaz	90,742	Oil contaminated soil, oily sludge & drill cuttings
Drilling company	NA	Drill cuttings
Total	866,147	

Source : Annual Environmental Report of Mangistau Oblast

Examples of the waste management facility seen during the site visit are shown in Figure 3.4.7.

(Atyrau refinery waste disposal site)

（not well managed waste site）

(TCO waste management site)

Figure 3.4.7 Photographs of Waste Disposal Facilities

Normally sulphur is not considered as waste. However, if stored for a long time (3 months) without sale, it may be considered as waste. 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 tonnes by 2020.

（storing of blocked sulphur）

（smashing and loading of blocked sulphur）

Figure 3.4.8 Photographs of Stored Sulphur

3.4.3 The Issues of Present Environmental Control

Based on experience in environmental inspection and auditing, Atyrau MoEP has listed the following issues to be addressed in order to improve environmental control:

- The system for estimating environmental impact (damage) has not been fully established (damages to atmosphere and surface water (sea water) cannot be estimated)
- There is little information about present conditions of the Caspian Sea.
- Delay of treatment for abandoned inundated wells (lack of suitable access technology) and insufficient monitoring
- The inspection system for offshore development has not been established (offshore Sanitary Protection Zone has not been defined)

It should be noted that this (Kashagan project) is the first project to develop the Caspian Sea continental shelf, and environmental monitoring methods during a well test and other activities are not defined yet.

Mangistau MoEP has listed the following issues to be addressed in order to improve environmental control:

- There are many oil spill incidents, and removal of old tanks and contaminated soil is carried out regularly. However, there is no good method for disposal of contaminated soils.
- With regard to flaring, some companies allow flaring of associated gas while using fuels brought from outside. It is recommended that flaring be reduced by utilizing associated gas as an internal fuel source.
- About 70% of waste disposal sites (waste dumping sites) in Mangistau oblast are not in compliance with the state environmental sanitary standard, and there is a shortage of disposal sites for hazardous waste (class 2 & 3 that includes oily sludge and cuttings) (Agip KCO is an exception). The report: “Comprehensive environmental programme in Mangistau oblast 2005-2007” proposed improvement of waste disposal sites. However, this plan has not been realized.
- The environmental monitoring around oil and gas industrial facilities is yet to be implemented except in the Aktau area.
- Karaturun and Komsomolskoe in Mangistau have 22 inundated wells including 14 production wells. An investigation in 1994 revealed traces of oil spills at four inundated wells while the remaining 18 wells were not inspected. Some of the oil fields are at risk of inundation if the water level rises. However, the water level of the Caspian Sea has been receding since 1996, and the risk is not imminent. .

In the CEP survey report in 2000, the following issues were listed, but these issues have partially improved till now.

- Lack of data (quantity and quality) for environmental management
- Delay of introduction of wastewater treatment facilities in the oil and gas industry
- Disposal of untreated produced water and process wastewater to evaporation ponds
- Risk of pollutant run off from the evaporation pond (Ural River left side) during flooding
- Industrial waste dumping to the Ural River
- Risk of the oil contaminated area in oil field being spread by flooding

3.5 Prevention of Oil Pollution

The environmental risk associated with oil spill accidents during exploration, production, and decommission phases of the oil industry in the Northern Caspian Sea area can be substantial. In particular, environmental impact of a larger volume oil spill accident during oil production or transportation by a tanker or a pipeline is a major concern. The government and oil production companies have to recognize the need to establish an effective and proven crisis management capability.

The government of Kazakhstan has already embarked on development of the National Contingency Plan for Oil Spill Response (Decree No. 676, May 2000). The Ministry of Emergency Response is the responsible organization for this. The existing plan is undergoing revisions, and revised version that reflects the latest information on oil production activity and environmental data will be released in 2007.

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

(1) Typical Outline of a NOSRP

The following three subjects should be covered in an oil spill contingency plan:

- The strategy section should describe the scope of the plan, including the geographical coverage, risks, and roles / responsibilities of those charged with implementing the plan and the proposed response strategy. This is the most important section of a NOSRP.
- The action and operations section, which should set out the emergency procedures that will allow rapid assessment of the spill and mobilization of appropriate response resources. This part describes more detailed response activities. If there is adequate information, it should be add to the plan.
- The data directory should contain all relevant maps, resource lists and data sheets to support oil spill response efforts in the case of a real spill. It should be designed according to the agreed strategy. Especially, the latest sensitivity map is important for the preparation of the NOSRP.

(2) Review of the Existing NOSRP

The existing NOSRP, which was received from the branch office of the Ministry of Emergency Response in the beginning of May 2006, was reviewed based on an international guideline of IPIECA (International Petroleum Industry Environmental Conservation Association) for minimizing the environmental damage by oil spill disaster. The suggestions and comments are listed in Table 3.5.1, “Review of Existing NOSRP based on IPECA guideline”.

- 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 are given in Table 3.5.1. Descriptions of response procedures, availability of response materials and equipment, and the telegram communication system are not adequate.

3.5.2 Revision of NOSRP

Revision of the existing NOSRP is urgently needed for the above reasons. The review process for the new NOSRP will be considered with these items.

Table 3.5.1 Review of Existing NOSRP based on IPIECA

No.	Checking Items to be prepared in NOSRP	Existing NOSRP	Comments
	Strategy		
1.0	Introduction and scope	○	
1.1 1.2 1.3 1.4	Authorities and responsibilities, coordinating committee Statutory requirements, relevant agreements Geographical limits of plan Interface with other plans/representation at joint control centers		Most of items were specified in the existing plan, but the plan needs details.
2.0	Risk of Oil Spill	○	
2.1 2.2 2.3 2.4 2.5 2.6 2,7	Identification of activities and risks Types of Oil likely to be spilled Probable fate of spilled oil Development of oil spill scenarios Shoreline sensitivity mapping Shoreline resources, priorities for protection、Special local considerations		Most items were specified in the existing plan, but the plan needs details.
3.0	Spill response strategy	X	
3.1 3.2 3.3 3.4 3.5 3.6	Philosophy and objectives Limiting and adverse conditions Strategy for offshore zones Strategy for coastal zones Strategy for shoreline zones Strategy for oil and waste storage and disposal		Actual strategy plans are not specified for zones of area for protection.
4.0	Equipment, supplies and services	X	
4.1 4.2 4.3	On water oil spill equipment Inspection, maintenance and testing Shoreline equipment, supplies and services		Availability of clean-up equipment is not specified.
5.0	Management, manpower and training	△	
5.1 5.2 5.3 5.4 5.5 5.6	Crisis manager and financial authorities Incident organization chart Manpower availability (on-site, on-call) Availability of additional manpower(labors) Advisors and consultants Training/ safety schedules and drill/exercise programme		Responsibility and relationships of organization are not clearly described.
6.0	Communications and control	X	
6.1 6.2 6.3	Incident control room and facilities Field communications equipment Reports, manuals, maps, charts and incident logs		Communication system is not specified in details.
	Action and Operations		
7.0	Initial procedures	△	
7.1 7.2 7.3 7.4 7.5 7.6	Reporting incident, ,preliminary estimate of response Tier Notifying key team members and authorities Establishing and staffing control room Collecting information (Oil type, sea/wind forecasts, aerial surveillance, beach reports) Estimating fate of oil slick(24,48,and 72 hours) Identifying resources immediately at risk, informing parties		These items are depending on the Tier 2 program.
8.0	Operational planning and mobilization procedures	---	
8.1	Assembling full response team		Detailed items are not

8.2 8.3 8.4 8.5 8.6 8.7 8.8	Identifying immediate response priorities Mobilizing immediate response Preparing initial press statement Planning medium-term operations (24,48,and72 hour) Deciding to escalate response to higher Tier Mobilizing or placing on standby resources required Establishing field command post and communications		necessary at this moment. However, they should be considered in the Tier 2 program in the future.
9.0	Control of operations	---	
9.1 9.2 9.3 9.4 9.5 9.6 9.7 9.8	Establishing a management team with experts and advisors Updating information (sea/wind/whether forecasts, aerial surveillance, beach reports) Reviewing and planning operations Obtaining additional equipment, supplies and manpower Preparing daily incident log and management reports Preparing operations accounting and financing report Preparing releases for public and press conferences Briefing central government and local officials		Detailed items are not necessary at this moment. However, they should be considered in the Tier 2 program in the future.
10.0	Termination of operations	---	
10.1 10.2 10.3 10.4	Deciding final and optimal levels of beach clean-up Standing-down equipment, cleaning, maintaining, replacing Preparing format detailed report Reviewing plans and procedures from lessons learnt		Detailed items are not necessary at this moment. However, they should be considered in the Tier 2 program in the future.
	Data directory (Maps /Charts)	△	
1 2 3 4 5 6 7 8 9 10	Coastal facilities, access roads, telephones, hotels, etc. Coastal charts, currents, tidal information (ranges and streams), prevailing wind Risk locations and probable fate of oil Shoreline resources for priority protection Shoreline types Sea zones and response strategies Coastal zones and response strategies Shoreline zones and clean-up strategies Oil and waste storage/disposal sites Sensitivity maps/atlas		Not all data are collected. This study might be able to provide additional information on GIS and Sensitivity Map.
	Lists	---	
1 2 3	Primary oil spill equipment: booms, skimmers, spray equipment, dispersant, absorbents, oil storage, radio communications, etc (Manufacturer, type, size, location, transport, contact, delivery time, cost and conditions) Auxiliary equipment: tugs and work boats, aircraft, vacuum trucks, tanks and barges, loaders and graders, plastic bags, tools, protective clothing, communications equipment, etc (Manufacturer, type, size, location, transport, contact, delivery time, cost and conditions) Support equipment: Aircraft, communications, catering, housing, transport, field sanitation and shelter etc. (availability, contact, delivery time, cost and conditions)		Detailed items are not necessary at this moment. However, they should be considered in the Tier 2 program in the future.

4	Sources of manpower: security, firms, local authorities, contractor, caterers (availability ,numbers, skills, contact, cost and conditions)		
5	Experts and advisors: environment, safety, auditing (availability, contact, cost and conditions)		
6	Local and national government contacts: (name, rank and responsibility, address, telephone, fax, E-mail)		
	Data	---	
1 2 3	Specifications of oils commonly traded Wind and weather Information sources		Detailed items are not necessary at this moment. However, they should be considered in the Tier 2 program in the future.

Notes: Evaluation of Item

○: Good (More expanded in future)
△: Inadequate (Partial Specified)
X: Bad (Not Specified)
---: Future additional collection of data, if possible

CHAPTER 4 ENVIRONMENTAL ADMINISTRATION

4.1 Environmental Laws and Regulations

4.1.1 Environmental Laws

As with most legislation, Kazakhstan inherited its environmental laws from the Soviet Union. The Soviet system of environmental law, with its characteristic fees and fines, environment funds, environmental 'expertise', etc., is familiar in all CIS countries. Following independence in 1991, Kazakhstan enacted new environmental legislation to replace the Soviet laws. The principal new instrument for environmental management was the Law on Environmental Protection (1997). Other statutes related to the environment, which were introduced after independence include: the Water Code (1993), the Law on Ecological Expertise (1997), the Law on Specially Protected Natural Territories (1997), the Law on Energy Saving (1998) and the Air Pollution Law (2002). A new Tax Code was also passed in 2001, which includes provisions for payments for the use of natural resources. Regulations concerning the requirement for environmental inspections were introduced in 2005, and in 2006 the law requiring industrial enterprises to have obligatory environmental insurance came into force.

These new laws gradually superseded the Soviet-era legislation. However, at the start of the present study, the statutory situation remained confusing, for the following reasons:

- The legal framework was complex, as in some cases the new legislation co-existed with old regulatory instruments.
- Some of the new legislation quickly became dated and revisions became necessary, but the amendments did not necessarily improve the internal consistency of the legislative structure.
- New laws are primary legislation, the provisions of which are introduced and/or amended by numerous subsequent regulations and decrees. These may include such fundamental issues as the institutions to be responsible, standards, fees, etc.
- There were inconsistencies, overlaps and gaps in coverage, in spite of the already large number of statutory documents.
- The many statutory instruments may have been applied selectively by administrators.

In an attempt to keep up to date with the legal situation, the headquarters of the Ministry of Environmental Protection (MoEP) maintained an electronic file copy of the 1997 Law on Environmental Protection, with embedded hyperlinks to its database of relevant amendments, regulations, decrees, etc. This ultimately included almost 300 hyperlinks, which illustrated the need for 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 at the end of 2006, when it replaced the Law on Environmental Protection of 1997. 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. The text below attempts to describe the existing situation, along with the changes that are gradually being made by implementation of the Environmental Code

4.1.2 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.

For the SER, the environmental authorities, assisted by a state-appointed panel of experts, evaluates the proposed project. The proposed design and environmental protection measures planned by the proponent are compared with numerous regulatory requirements, including sanitary-hygienic and environmental standards. After evaluating the proposed activity, the environmental authority has to deliver a negative or positive 'SER Resolution', which is a legal document that allows an activity to be implemented (or not), and is one of the prerequisites for the award of environmental permits for the project. The SER is a very rigid procedure which concentrates on legal requirements, and rarely considers alternative solutions for a proposed activity. (This problem is further compounded by translation problems, in which the 'expertise' / SER may be incorrectly referred to as an EIA.)

A requirement for EIA as conceived in the West has been added to that for 'expertise', the EIA being conducted by certified individuals and firms on behalf of the project proponent. The procedures for conducting EIA were promulgated 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. The definition of EIA and PER in the Environmental Code now complies with usual international practice, including for example, the phasing of EIA work, the categorisation of projects for EIA, the environmental media to be considered, the characterisation of impacts, and the consultation. As such, the character of SER/EIA/PER in Kazakhstan is evolving toward a flexible tool for environmental consideration of proposed projects.

The oil companies report that they are subject to increasing demands for SER / EIA, which is now being requested for relatively minor changes or additions to operations, rather than for new facilities alone.

4.1.3 The Environmental Permitting System and Environmental Standards

Every industrial enterprise is required to have a 'Nature Use Permit' for its polluting activities, which until recently, had to be renewed annually. In addition, there is a system of permits and licenses for access to, and use of, natural resources. For industrial discharges, the conditions of the permit (now referred to as an 'Emission Permit') are developed by the MoEP. For natural resources, administration is the responsibility of the Forestry, Fishing and Hunting Committee of the Ministry of Agriculture (MoA) for these three activities, the Water Resources Committee of MoA for access to and use of water, and the Geology Committee of the Ministry of Energy and Mineral Resources for oil/gas and minerals.

Following the recent adoption of the new Environmental Code, the system of permitting and environmental standards for industry is in transition. The arrangements set out below describe both the existing system and the changes that will shortly come into effect.

The industrial Emission Permits specify the Maximum Permissible Emissions (MPE) for emissions to atmosphere, Maximum Permissible Discharges (MPD) for liquid effluent discharges, and solid waste disposal limits for each individual process. (In the Soviet system, single-medium permits were issued, so this degree of integration in Kazakhstan is a welcome advance.) The MPDs / MPEs are developed by the enterprise or by licensed consultants, and are then negotiated with the oblast office of MoEP. The number of individual activities included in a permit has been very comprehensive. For example, the permit for a major oil company would include MPEs not only for its flares, refinery emissions, etc., but also for the emissions from its fleet of road vehicles, and even for the road dust generated by their use. The number of individual parameters controlled has also been very great – up to several hundred. However, the number of parameters will in future be reduced to the twelve or so compounds which are considered to be the most important pollutants produced by the enterprise in question.

The total number of parameters that may be used in permitting will also be reduced to the 40 most hazardous compounds. National limits will be set for these pollutants, and quotas for

their discharge will be set by region. Permits will be issued centrally by MoEP, so that it will be possible for the Ministry to gradually reduce the amounts allowed to be discharged nationally.

The method of setting MPDs / MPEs is based on a combination of the Maximum Permissible Concentrations (MPCs) of pollutants and the Environmental Quality Target Values for various classes of receiving environment. Lists of MPCs are published by the SanEpi Service for numerous parameters.

Industrial enterprises are considered to be within a defined 'sanitary protection zone', beyond which the MPC must be achieved. The area of this sanitary protection zone, or mixing zone, is determined by the environmental authorities depending upon the use of the environment. The MPD / MPE is the maximum mass of a substance in an effluent or emission that is allowed to be disposed of per unit of time, in order to comply with the MPC at the boundary of the sanitary zone of the receiving environment. Determination of the MPD / MPE is a very complex calculation, which takes into account, inter alia, the discharges / emissions from other users of the same environment. A manual for the calculation of MPDs has been produced by MoEP, but this includes so many provisos that calculation is a 'black art' which is impenetrable by most technicians, let alone the general public.

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. These Technical Specific Emission Standards 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).

A list of the best available technologies for some industrial sectors and processes will be developed by MoEP in consultation with other interested national executive bodies and legal entities. Similarly, a list of industrial facilities, which may receive Complex Permits instead of Emission Permits, will be drawn up by MoEP and approved by the Government. The process of drawing up such lists can be expected to be very time-consuming, so it will be more than a year before the new system of BAT standards and Complex Permits can be applied to the oil / gas industry.

Despite the integration between media and the partial application of BAT, the permitting system still has some disadvantages, as described below. (Where application of the new Environmental Code will address a described problem, the proposed new arrangements are noted in *italics*.)

- Because of the complications in calculation and then negotiation of MPDs / MPEs, the process may not appear to be transparent.
- The fact that various local circumstances are taken into account means that the MPDs / MPEs for individual companies are all different. There has been a feeling that new international enterprises are burdened with stricter standards than existing old industries. *However, it is planned that the use of Technical Specific Emission Standards will be expanded over a period of about four years to encompass all relevant companies. The older companies will then be obliged to either accept stricter control, or adopt BAT, or close down.*
- The requirement for annual renewal of permits and recalculation of MPDs / MPEs has meant that enormous amounts of time and effort have been spent on the process by enterprises, consultants and administrators. For the major oil companies, the annual renewal process could take up to a year. *However, in future, permits will be issued for three or five years, depending upon the category of the enterprise, and the permits will*

also specify the funding to be applied to environmental protection activities within that period.

- The system is applied with a degree of strictness that sometimes appears to be punitive. For example, if a new discharge turns out to be less than the calculated MPD, the actual discharge concentration is used as the MPD. This is perhaps a means of ensuring continued improvement in line with the principle of BAT, but it means that a company could be fined for discharging an effluent which would have complied with their original MPD.
- Despite the integration of MPDs /MPEs for all media within one permit, there is still some way to go in the achievement of an Integrated Pollution Prevention and Control (IPPC) system as understood in the EU and OECD. Firstly, there is an emphasis on standards and control, rather than co-operation between regulators and companies to achieve pollution prevention. Secondly, there is relatively little concern for the transfer of pollutants between media. For example, it would be preferable for the sulphur derived from oil processing to be disposed of as solid elemental sulphur, rather than discharged as H_2SO_4 acid in effluent or emitted as SO_2 gas. It is by no means clear that companies can benefit financially or administratively from taking the preferred environmental option. Oil companies regularly pay heavy penalties for the amount of sulphur they put into storage awaiting sale, because it is classified as a waste rather than a product. *However, the further moves towards the application of BAT should bring about more communication between MoEP and the oil companies, which should improve both of the situations referred to above.*
- Because of uncertainty over the uses of water bodies, they are often simply classified as for fishery use by default. This is the most highly protected category of water body, and therefore many enterprises end up having to meet unnecessarily low MPDs. For example, the large evaporating basins at Atyrau are classified as recreational waters, despite the fact that they only receive effluent discharges. Discharges to effluent treatment facilities are not normally required to have MPDs, but in this case they are, thus putting an unnecessary burden on the oil companies that discharge to the basins.
- MPCs have been published for a very wide range of parameters, some of them having no real environmental relevance. As a result, enterprises have had MPDs that have required them to remove harmless constituents from their effluents, and in some cases, to produce an effluent that is cleaner than the receiving water. In many cases, companies simply pay the resulting fines rather than attempt to meet an impossible standard. *However, the dramatic reduction in the number of MPC parameters as described above should completely avert this problem.*
- Thus far, the permitting system seems to have been more effective in generating revenue than in controlling pollution (see also 4.1.4 below).

Kazakhstan has had a very heavy and expensive permitting system, which has not achieved the high standards that it appeared to demand. It is to be hoped that the new Environmental Code will address the issues referred to above by:

- simplifying the permitting process,
- making it more transparent and equitable,
- using sensibly derived Environmental Quality Target Values more akin to the local Environmental Quality Objectives (EQOs) used in the EU,
- further increasing the introduction of BAT and 'cleaner production' concepts,
- and reducing the administrative burden of permitting.

In an attempt to improve pollution prevention in an equitable and cost-effective manner, the concept of 'Environmental Memoranda' was launched. These are voluntary tripartite

agreements entered into by the MoEP, the akimat environmental authority and an industrial enterprise, and are akin to such 'voluntary agreements' used in some other industrialised countries, in particular, Japan. The object is to define an agreed programme of environmental improvements and/or protection measures, which will meet environmental management objectives whilst avoiding the imposition of fines.

These memoranda have no status in law and there is no provision for them to be adopted in the new Environmental Code. Experience in their use has been very limited, and to date has been disappointing, apparently because new representatives of enterprises will not stand by memoranda signed by their predecessors. MoEP therefore has little expectation of their wider use. However, it is recommended that MoEP should continue to promote voluntary environmental agreements of some kind because of their potential to improve industrial environmental performance by 'using the carrot rather than the stick' (see also the reference to Oblast Environmental Programmes in section 4.1.4 below and the future of voluntary agreements in section 11.6 below).

4.1.4 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 'Fine' rates are ten times (10 x) the 'Fee' rates. The imposition of 'Fines' relies on the self-reporting of the enterprises, backed up by checking and monitoring by the akimat environmental authority (DUCER). The large oil companies do not perceive the 'Fines' as penalties for breaking the law, but as one of their normal operating costs, which, like other costs, they endeavour to minimize.

The 'Fee' rates are based on the toxicity of the various compounds in the pollution stream or waste. The oblast office of MoEP determines the MPEs / MPDs and advises on base fee rates, but the fees are set in detail by oblast authorities (DUCER) at levels they consider sufficient to cover the cost of their environmental administration. As a result, there are great variations in the fee rates applied in different oblasts. However, financial transfers can be made between oblasts and central government in both directions, in order to subsidise those oblasts that have relatively little fee income.

Up until 2000, the proceeds of resource fees and permits accrued to one of the 16 Environmental Funds (14 oblasts, Almaty and Astana) to be spent, in principle, on environment-related purposes. The division of the proceeds of environmental payments between the central and oblast governments varied during the late 1990s. In 2001, allocation to the Funds became indirect, via the oblast budgets. Finally, in 2002, the hypothecation or 'earmarking' of pollution charges for environmental purposes ceased altogether.

Now the 'Fees' accrue to the oblasts, whilst the 'Fines' accrue to the central State budget. Of the fees collected by the oblasts, 50% goes into the general oblast budget and 50% goes into environmental rehabilitation work as defined in the three-year Environmental Programme of the oblast. There is pressure to increase the environmental rehabilitation portion to 70%, and it is accepted by Government that the ultimate aim is to allocate 100% of the fee income to environmental rehabilitation, ie. the 'earmarking' of environmental fees for environmental purposes alone.

The three-year oblast Environmental Programmes are 'funded' by contributions from both the oblast and the enterprises. However, the enterprise part is far greater than that from the oblast. Moreover, the 'contributions' from enterprises are, in fact, expenditure on their own environmental improvements. The oblast Environmental Programme is therefore simply a framework for bringing together planned industrial improvements and oblast environmental spending. The incentive for enterprises to participate in such Environmental Programmes is

that, if they do not spend on new technology for environmental protection, their pollution fees will be increased. The MoEP has a list of environmental protection activities that are deemed to be acceptable as contributions to Environmental Programmes. It can be seen that the operation of these programmes is another step towards the introduction of BAT, and the process of negotiating planned industrial environmental improvements is very close to the development of Environmental Memoranda referred to in section 4.1.3 above.

The Atyrau akimat boasts the success of this system by quoting that the total expenditure of their first Environmental Programme (2003-5) was T. 57 billion (= US$ 500 million). This consisted of 120 projects for the reduction of air pollution (annual emissions reduced by t 6,000) and industrial waste generation, the protection of water resources and improvement of soils. For the 2006-8 programme, total expenditure has been increased to T. 100 billion (= US$ 800 million). Clearly, most of this expenditure will actually be by the oil companies.

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 of payments (fines) for emissions and discharges above MPEs / MPDs engenders an acceptance of the status quo, and again fails to provide an incentive for improvement.
- 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 system for calculating fees is not transparent.
- The imposition of fees and fines is inequitable, with major international oil companies paying a disproportionate amount.
- The imposition of fines is inflexible; no minor exceedance of MPEs / MPDs is tolerated, even when it is due to normal start-up procedures.
- 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 fees charged. In Atyrau oblast, fee rates have been increased by up to twenty times between 2001 and 2005. The normative fee for the discharge of SO2, for example, increased from $50/tonne in 2002 to $400/tonne in 2006. The oil companies confirm that whilst their emissions and discharges have been reduced over this period (e.g. the TCO flare gas volume and SO2 emissions reduced by 90% between 2002 and 2005), the total amount paid per annum in fees and fines has continued to climb. The DUCER of the akimat has noted that, whilst oil companies previously paid fines without complaint, they now go to court to defend themselves – the DUCER takes this as a sign that the level of fees and fines charged is now effective. It also seems that there is a move back towards the 'earmarking' of fee revenue for environmental purposes. However, the other criticisms still stand, particularly the complexity, opacity and inequitability of the system.

It is interesting to note that, 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 (see section 11.5 below for a recommended change to the system).

4.2 Organizations Involved in Environmental Management

4.2.1 Ministry of Environmental Protection

The main Kazakhstan institution working in the field of environmental management is the Ministry of Environmental Protection (MoEP). This ministry was the Ministry of Natural Resources and Environmental Protection until August 2002; its forest and water resource management responsibilities have been transferred to the Ministry of Agriculture (MoA), and its responsibility for mineral resources has been transferred to the Ministry of Energy and Mineral Resources. MoEP has no responsibility for Health & Safety or Occupational Health issues. However, it does conduct joint inspections of industrial facilities with the Ministry of Health San-Epi Service (health), the Ministry of Emergency Response (safety) and akimat land use planning departments (construction regulation).

MoEP has 111 technical staff in its Astana headquarters, and 31 staff of 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). All MoEP technical staff are graduates in appropriate disciplines. MoEP provides limited training to its staff. For example, the Environmental Analysis Center in Astana provides capacity development programs on environmental administration, licensing, use of natural resources, environmental auditing and environmental insurance. Further training of the staff is desirable so that its staff can keep up with technical development in the various industrial sectors.

The structure of the MoEP organisation is shown in Figure 4.2.1 below.

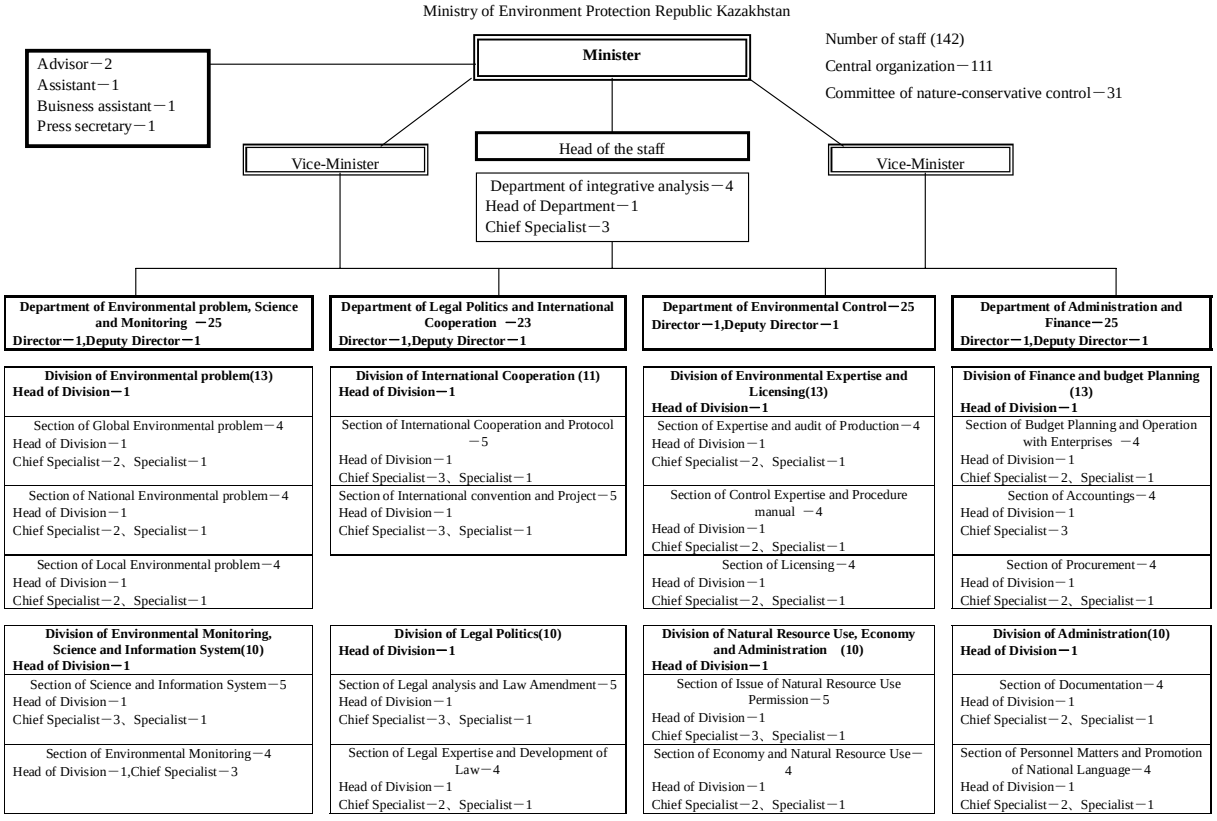


Figure 4.2.1 Organization Chart of MoEP

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, which has sustainable development as its overall objective. This describes the country's environmental

problems of local, national and global importance, along with proposed solutions. 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. (Actions to combat desertification are also included.) Three-year Action Plans are developed under the Concept, and the present Plan runs until 2007. MoEP is currently developing the list of issues to be addressed in the next Plan from 2008, and is using the National Environmental Action Plan (NEAP) as a basis for prioritisation.

4.2.2 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. KAZHYDROMET undertakes governmental contracts for meteorological and environmental monitoring, development of the state database of rivers and lakes, agro-meteorological research for agricultural production, and other scientific researches. It has 2,443 staff, and has the following sub-organizations.

- General affairs department
- Hydro-meteorological centre
- Information centre
- Hydro-meteorological network centre
- Hydro-meteorological forecasting centre
- Environmental monitoring centre
- Financial department
- HYDROMET centres in 14 oblasts

KAZHYDROMET implements environmental monitoring at the state level, and is responsible for quality control of the monitoring information. It has a programme of regular monitoring of soil, air and water quality. In cities, it has a particular focus on air quality monitoring, and also takes samples of snow and rain as indicators of air pollution. KAZHYDROMET makes quarterly and annual reports of its monitoring results, which are passed to MoEP for any action deemed necessary by the latter. It is emphasized that 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. KAZHYDROMET can also act as consultants to MoEP if required. KAZHYDROMET acts as Kazakhstan's representative in all international fora related to environmental quality, meteorology and associated disciplines.

4.2.3 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 focii 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.

4.2.4 Ministry of Emergency Response

(1) Responsibilities of the Ministry

The headquarters of the Ministry of Emergency Response is in Astana, where its Committee for Inspection and Management of Emergencies is based. 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', which is funded from the central State budget. The service is based in Atyrau and has a satellite office in Mangistau oblast. The Atyrau office, which started in 2002, has a staff of 10 trained safety officers, but this will be increased to 14 when their proposed new North Caspian Emergency Response Centre is established. This is expected to provide a technical support vessel with booms, fire-fighting equipment, etc. At present, the marine inspection service has no physical capability to respond to oil spills, and in the case of spills from abandoned wells, Agip KCO has responded (as a goodwill gesture rather than a responsibility).

In May 2000, the Ministry published a National Oil Spill Contingency Plan (also see Chapter 3), which is a broad document covering oil spill response on land, sea and rivers. In common with international practice, this categorises spills and appropriate responses into three tiers as follows:

- Tier 1: < 10 tonnes – local company responsibility.
- Tier 2: 10-200 tonnes – requiring co-operation between national companies.
- Tier 3: > 200 tonnes – national emergency requiring international assistance from Oil Spill Response Ltd (OSRL) based in Southampton, UK.

The national Oil Spill Contingency Plan does not provide any details of response such as contact persons, etc. Similarly, the Ministry does not have any oil spill response equipment or any capability in the modelling of spill movements. However, each of the oil companies operating in the Caspian is required to have its own Oil Spill Contingency Plan, and these have to be approved by the marine inspection service. (See also section 4.2.4.2 below on company oil spill contingency plans.) During the present study, the National Oil Spill Contingency Plan was under revision by the Ministry of Emergency Response, with advice from MEMR, MoEP and MoT. All comments and revisions have been received and the revised plan is expected to be published later in 2007.

Oil spill response drills (practices) are conducted every year. During the last year, one has been conducted by Agip at company level, and another at national level. The marine inspection service considers the new Kashagan oil field and the oil pipeline to Baku to be the major risks on which oil spill contingency plans should be focussed.

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.

(2) Responsibilities of the Oil Companies

In comparison with government agencies, the major oil companies are very well prepared, in terms of both planning and equipment, for the prevention of oil spills, and appropriate response if a spill should occur. A good example is provided by the huge Kashagan offshore oilfield, currently being developed by a consortium of ExxonMobil, TotalFinaElf and Agip

KCO, which will start producing oil in 2008. Agip KCO is the operator of this consortium and is responsible for oil spill contingency planning and oil spill response.

As stated above, each oil company operating in or near the marine environment is required to have a government approved Oil Spill Contingency Plan (OSCP). Agip KCO has an approved OSCP and, like all of the major companies, pays an annual 'insurance' subscription to OSRL. (In the event of a Tier 3 spill, OSRL will mobilise a response team and equipment for the containment, recovery and clean-up of spilled oil. This 'equipe' is rapidly deployed by Hercules transport aircraft to the nearest airfield to the spill site.) The Agip KCO oil spill response team has a staff of 14, and is part of the HSE Department which has a staff of about 100. This team carries out planning, inspection and oil spill training exercises (a full Tier 3 exercise is planned for 2007). The company has produced an ecological sensitivity map of the northern Caspian, and has the mathematical model 'Oil Map' to track spills, taking into account wind and current flows. They also use high resolution satellite imagery.

At its Baltino marine supply base, Agip KCO has a 1,000 m2 oil spill response facility with command centre, equipment store, etc., and also has stores of oil spill response equipment at other strategic locations within its field of operation. (The Baltino base has ISO 14001 certification for its Environmental Management System.) An additional marine base and oil spill response centre is to be constructed at Atyrau on the Ural River. Agip KCO has quarterly co-ordination / communication meetings with other oil companies, and has hosted workshops on oil spill response, environmental management and other HSE topics for government officials. The company has also taken officials to OSRL for awareness / training in oil spill planning and response techniques. Agip KCO has experienced only one oil spill of more than 100 litres in five years of operation. (Other major oil companies are also well prepared, e.g. TengizChevrOil (TCO), which operates the Tengiz field and has access to the international oil spill response resources of Chevron and OSRL.)

In addition, a new oil spill response company (Taza Tengiz Lamor) has been established in Aktau. It is already staffed by 7 or 8 response specialists and equipped with response equipment (oil booms, skimmers and pumps). On contract, it can respond to an oil spill event anywhere in the northern Caspian Sea (see also section 12.5 below).

4.2.5 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).

4.2.6 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.

4.3 Control of Pollution Sources

4.3.1 Introduction

As described in sections 4.1.3 and 4.1.4 above, 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 includes official environmental audits1 and inspections, and by 'Production Environmental Control' (= self-reporting of environmental performance by the companies concerned). In this section, a short explanation of these enforcement processes is given in section 4.3.2, followed by a preliminary assessment of the current enforcement system in section 4.3.3, and the possible directions of improvement in section 4.3.4.

The basic principles of environmental auditing (Ecological Audit) and environmental inspection (Environmental Protection Enforcement) were set out in the 1997 Law on Environmental Protection, and inspection arrangements were then defined in a decree at the end of 2004. The system has subsequently been refined by the new Environmental Code, which describes the arrangements for State Environmental Control (enforcement) including Environmental Inspection, and Production Environmental Control (self-reporting). Within the MoEP structure, monitoring is the responsibility of the Committee for Environmental Control.

The State Environmental Inspection Service is made up of Inspection Departments in each of the oblast offices of MoEP. There is a total of more than 500 inspectors, who work to a unified set of rules on inspection procedures for all industries. Separate units deal with air, water and land, but in the case of the oil and gas industry which affects all environmental media, integrated inspections are carried out and a single report produced.

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.

4.3.2 System of Monitoring, Inspection and Auditing

(1) Production Environmental Control

'Production Environmental Control' refers to those control activities carried out by the companies themselves, as described below.

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. An example of monitoring items for an oil and gas company is shown in Table 4.3.1. The parameters are selected mainly in accordance with the regulations of auditing and inspection by MoEP, and other items may also be included depending upon the company.

[1] In Kazakhstan, 'auditing' generally refers to financial auditing, and all government activities of environmental auditing and inspection are usually referred to as 'inspection'.

Table 4.3.1 An Example of Self-Monitoring Parameters

Category	Monitoring parameters	Frequency
Atmosphere	Emissions of: SO_2、H_2S、CO、NOx、HC（CH_4）and calculated concentration of: （CO、NO_2、SO_2、PM、HC）	2-4 times/year
Water (Produced water)	pH, Hardness, Ca, Mg, Cl^-, SO_4^{2-}, Fe, SS（Dissolved solids）, Residue on evaporation, Concentration of oil products	2-4 times/year
Ground Water	pH, SS, Hardness, Ca, Mg, HCO_3^-, CO_3^{2-}, Cl^-, SO_4^{2-}, Residue on evaporation, NH_4^+, Fe, Oil products, Cu, Zn, Ni, Cd, Pb	2-4 times/year
Soil	Ca, Mg, SO_4^{2-},Cl^-, Oil product, Sulphate, HCO_3^-, CO_3^{2-}, Cd, Zn, Pb, Na^+＋K^+, Cu, Ni	2-4 times/year

Source: ：a company's monitoring report

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. Figure 6.2.1 shows examples of such reports, which provide about 100 pages of detailed data.

According to the new Environmental Code, there is now public access to the annual plans and monitoring results of companies.

Figure 4.3.1 Examples of Annual Monitoring Reports

(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. According to the Environmental Code, five types of inspection may now be conducted, as follows:

- Planned inspections, conducted once per year. (Under the Environmental Code, enterprises which have, for a period of three years, implemented their environmental management programmes, submitted good and timely monitoring reports and have not violated any environmental legislation, will only be inspected once every three years.)
- Unplanned inspections, undertaken at any time in response to environmental emergencies, violations of environmental laws, etc. (can be of an individual industrial operating unit or a whole company)
- 'Cross inspections' undertaken in response to information uncovered during other inspections

- 'Patrol inspections' which are simultaneous inspections of several business premises to determine compliance with environmental legislation.
- Integrated inspections, conducted by MoEP in conjunction with other specialised government agencies. In the case of major complex inspections, e.g. for an oil refinery, MoEP may sign an integrated inspection memorandum for joint inspection with several other agencies, e.g. the akimat, the Ministry of Agriculture, Ministry of Emergency Response, Prosecutor's Office, etc. This is clearly of benefit to all concerned, the inspectors and the inspected, but such integrated inspection is not conducted on a regular basis.
- Oil companies may also be subject to other individual inspections / audits, e.g. by the SanEpi service, the Marine Inspection Service (see 4.2.4 above), etc.

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.

(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. The administrative code (see Table 4.3.2) specifies the fines applicable to each type of violation.

Table 4.3.2 Administrative Codes for Pollution Control

Category	Code No.	Compared items（example）
Atmosphere	105	Total emissions volume from point source
	110/115	Solid emission total / Gas emission total (included in No.105)
	120-125	SO_2, H_2S, CO, NOx, HC, others emission volume (included in No.115)
Water	333	Total pollutant discharge volume in waste water
	334-353	COD、Oil、Chlorides, Nitrites, Phosphates, Sulfates, SS、Iron, Dissolved solids, Nitrates, Ammonium nitrogen, Surfactants, Phenol, Methanol, Hydrogen sulfides, Sulfides, Glycol, DEA, MDEA discharge volume (included in No.333）
Waste	403	Total generated volume
	404-408	Each class（class 1-5） waste volume (included in No. 403)
	415	Temporary storage volume of products and materials (Sulfur, Metal scrap)

Source: Environmental protection agency environment monitoring report

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. In that case, the inspector must present the court with proof of the need for closure within three days of issuing the order. The court will then determine whether the suspension of operations should be continued. In extreme cases, inspectors may request the annulment of a company's permits to operate issued by the relevant ministries.

(4) Environmental Audits

The term 'environmental audit' was formerly used as the equivalent of 'annual inspection'. However, environmental auditing has now been defined in the new Environmental Code to have the same meaning as in OECD countries, i.e. a detailed review of the environmental performance of a company or site, including its environmental monitoring results, management system, etc. Two types of audit are defined. Obligatory audits will be required when environmental damage has occurred, at the re-organization of a company which conducts hazardous activities, or in the case of bankruptcy. Voluntary audits may be initiated by companies themselves or by insurers, investors, etc. that have an interest in the company.

(5) Historic Pollution

Historic industrial pollution from the oil industry presents a particular challenge for the inspection service and for MoEP as a whole. In the case where a new investor takes over an existing enterprise that has historically caused pollution, such as oil-contaminated land, clean-up measures will be demanded by MoEP. These are enforced by writing the required measures into the company's Nature Use Permit. However, where such measures will be a major undertaking (as is the case for oil enterprises in Mangistau), the operating contract stipulates that the cost of clean-up will be borne by the government by adjustment of the Production Share Agreement (PSA), and the remediation is implemented as a government project. Such contracts also specify sanctions if the company does not honour its agreed clean-up responsibilities, and these sanctions will involve measures to be taken by the inspection service. (The issue of old uncapped oil wells in the coastal zone is discussed in section 3.4.2 above.)

4.3.3 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 1.1 billion Tenges, and the total fees (normative payment) based on nature use permit were 3.7 billion Tenges.
- 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 in section 4.1.4 above.

4.3.4 Effectiveness of the Enforcement System

The effectiveness of the enforcement system should be evaluated from both the efforts and resources put in, and what is achieved.

The total pollution loads from the major Atyrau oil and gas companies have generally decreased between 2004 and 2005 (see Table 4.3.3). In the case of Tengizchevroil, the reduction was attributed to the reduction of flare gas (SO_2 emissions reduced by as much as 90% during 2002-2005). In the case of Agip KCO, the reduction of test drilling is the reason for the reduction of pollution loads.

Table 4.3.3 Pollution Loads from Major Oil and Gas Companies in 2004 and 2005

Company	2004			2005			Change
	Total	Solid	Gas	Total	Solid	Gas	2004/5
Tengizchevroil	56,112	350	55,762	53,876	184	53,692	-2,236
Agip KCO	2,038	117	1,921	1,488	68	1,420	-549
Embamunigas	8,314	211	8,104	8,929	380	8,549	+614
Atyrau Oil Pipeline	1,667	3	1,664	1,436	1	1,435	-231
Atyrau Refinery	7,218	27	7,191	5,493	17	5,476	-1,725

Source: Atyrau MoEP Annual Report, 2005

However, it is difficult to evaluate the effectiveness of the existing enforcement mechanism from this data, as the companies have various reasons to reduce emissions of pollutants other than to meet the environmental regulations, such as to boost the company's environmental image to society and to the shareholders, or to make the operation more efficient and thereby reduce costs.

Another problem is the lack of linkage between the pollution control effort and ambient environmental monitoring. It seems that pollution control activities are carried out without any evaluation of their effectiveness to improve ambient environmental conditions; there is little co-ordination between KAZHYDROMET's monitoring of ambient environment quality and the pollution control efforts of Atyrau MoEP and the akimat's DUCER.

Overall, the current system has the reputation of being complex, strict, non-transparent, and more successful in generating revenues than controlling pollution.

CHAPTER 5 ENVIRONMENTAL MONITORING

5.1 Introduction

5.1.1 Basic Framework of Environmental Monitoring in Kazakhstan

Environmental monitoring activities have been carried over from the Soviet era, and the current framework for environmental monitoring is still based on the system inherited from the Soviet era. The current framework is based on the Law on Environmental Protection, enacted in 1997, which prescribes implementation of environmental monitoring for not only environmental protection but also sensible use of natural resources with dissemination of monitoring results to the public under the Unified State Monitoring System for Environment and Natural Resources (USMS ENR), which is still to be established. The law also requires each natural resource user to implement self-monitoring activities, and report the monitoring results to agencies working for environmental protection. In addition, the law calls for establishment of a single state environmental monitoring system for monitoring of environmental conditions and natural resources.

Table 5.1.1 Environmental Monitoring Requirements in Law on Environmental Protection

Article	Requirement
Article 24. State monitoring of the environment and natural resources	- It is required to implement environmental monitoring for environmental protection by state agencies. - To implement environmental monitoring, it is required to unify environmental monitoring system. - It is required to utilize monitored information for decision making on economic activities considering wise-use of natural resources. - It is required to disseminate monitored information to public.
Article 25. Monitoring by users of natural resources	- It is required for a natural resource users to implement environmental monitoring to identify the impact caused by the natural resource users' activity - It is required for natural resource users to report their monitoring results to the agencies working for environmental protection.

Source: Law on Environmental Protection

Table 5.1.2 summarizes the demarcation of environmental monitoring responsibilities among relevant organizations in Kazakhstan.

Table 5.1.2 Demarcation of Environmental Monitoring Responsibilities in Kazakhstan

Organization	Roles and Responsibilities
Ministry of Environmental Protection (KAZHYDROMET)	- Implementation of inspection on air, water and soil pollution sources - Monitoring of air quality, water quality, radiation, hydrological and meteorological conditions - Maintaining of monitoring databases
Regional *oblasts* and city executive bodies (*akimats*)	- Implementation of inspection and monitoring at local level and report violations to the responsible bodies - Implementation of environmental monitoring including emission measurement
Ministry of Health	- Setting maximum permissible concentrations (MPCs) and preservation of sanitary zones around the industrial plants on the basis of health effects - Assessment of emission sources and their physically hazardous effects
Ministry of Agriculture	- Monitoring of water used for agricultural irrigation - Preparation of cadastres of soil and water resources
Ministry of Interior	- Monitoring of vehicle emission gas - Management of traffic police activities
Enterprises	- Monitoring of their own emission using both emission measurements and mass balance calculations - Obligation to keep records and to report on quarterly and yearly bases to the authorities and the statistical office

Source : Environmental Performance Review of Kazakhstan (2000) UNECE

The new Environmental Code promulgated in early 2007 has adopted the same general monitoring framework, although MoEP is gearing toward 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 Center and KAZHYDROMET.

5.1.2 Indices to Evaluate Environmental Pollution Condition

(1) Maximum Permissible Concentrations (MPCs)

Maximum Permissible Concentrations (MPCs), which were inherited from the Soviet era, are the levels below which the pollution of air, water, and soil are "safe". At present, more than 1,000 MPCs exist for air and water quality parameters. MPCs of the main air quality parameters and water quality parameters are shown in Tables 5.1.3 and 5.1.4 respectively.

Table 5.1.3 MPCs of Main Air Quality Parameters

Parameter	MPC (mg/m^3)	
	Maximum (by each measurement)	Daily Average
Carbon monoxide	5.00	3.00
Sulphur dioxide	0.50	0.05
Nitrogen dioxide	0.085	0.04
Particulate matter (Note)	0.5	0.05
Lead	0.001	0.0003

Note : Particulate matter is determined by RD 52.04.186-89
Source : Environmental Performance Review of Kazakhstan (2000) UNECE

Table 5.1.4 MPCs of Main Water Quality Parameters

Parameter	Unit	MPC	
		Fishery Purpose	Drinking Purpose
pH	-	7 –8	7 - 9
Dissolved Oxygen	mgO_2/l	> 6.0	> 6.0
Chlorides	Cl mg/l	300	250
Salinity	Mg/l	1,000	1,000
Copper	Cu mg/l	0.001	1.0
Zinc	Zn mg/l	0.01	3.0
Nickel	Ni mg/l	0.01	0.1
Cadmium	Cd mg/l	0.005	0.001
Mercury	Hg mg/l	0.0005	0.0005
Chromium	Cr(VI) mg/l	0.001	0.05
Arsenic	As mg/l	0.05	0.05
Iron	Fe mg/l	0.05	0.3
Lead	Pb mg/l	0.03	0.03
Ammonium	mg N/l	0.4	2.0
Nitrites	mg N/l	0.02	0.913
Nitrates	mg N/l	9.0	10.16
Phosphates	mg P/l	0.35	3.5
COD	mg /l	15.0	30.0
BOD_5	mg O_2/l	3.0	3.0
Oil products	mg /l	0.05	0.1
Phenols	mg /l	0.001	0.001
Cyanides	mg /l	0.05	0.05

Source : KAZHYDROMET

(2) Integrated Air and Water Pollution Index

The ratio of the concentration of pollutant to its MPC is the most common method to evaluate pollution level. In addition, integrated pollution indices calculated from MPCs and actual concentrations of pollutants are widely utilized for integrated air and water quality assessment.

Air quality is assessed according to the Air Pollution Index (API), or IZA5 index, which is calculated from the concentrations and MPCs of five representative pollutants (i.e., CO, SO_2, NO_2, PM, NH_3) and their toxicity classes (respectively, 4, 3, 2, 3, 4 in numerical value) using the following formula. Air is considered polluted if this index is higher than 5.

$$API = \sum_{i=1}^{5} \{ (Pi/MPCi)^{Wi} \}$$

Where Pi : Concentration of pollutant i in air;

MPCi : Maximum permissible concentration of pollutant i.

Wi : toxicity class of pollutant i (weight).

Water quality is assessed according to the Water Pollution Index (WPI). The WPI is defined as the sum of ratios of six water quality parameters to respective MPCs. The six water quality parameters are Biological Oxygen Demand (BOD_5), Dissolved Oxygen (DO), and four other pollutants selected, based on their relative concentrations. The WPI is calculated by the following formula:

$$WPI = \{ \sum_{i=1}^{6} (P_i/MPC_i) \} / 6$$

where Pi : Concentration of pollutant i in water;

MPCi : Maximum permissible concentration of pollutant i.

Depending on the value of WPI, status of surface water is categorized as follows:

	Category[1]	Range of Water Pollution Index (WPI)
I	Very clean	WPI <= 0.3
II	Clean	0.3 < WPI <= 1.0
III	Moderately polluted	1.1< WPI <= 2.5
IV	Polluted	2.5 < WPI <= 4.0
V	Dirty	4.0 < WPI <= 6.0
VI	Very dirty	6.0 < WPI <= 10.0
VII	Extremely dirty	10.0 <WPI

(3) Maximum Permissible Discharges (MPDs)

Emission / discharge standards are defined as Maximum Permissible Discharge (MPDs[2]). A MPD is not a fixed figure but calculated depending on several factors, such as the utilization condition of the surrounding environment, background concentrations of each pollutant in the environment, and hydrological condition of water bodies receiving discharged wastewater. Under the environmental legislation in Kazakhstan, anyone who discharges gas or wastewater to the environment has to obtain permission, and satisfy the MPD of each pollutant.

[1] These are direct translation of Russian terms, and “dirty” is more polluted than “polluted”.
[2] In case of emission of gas, it is referred to as emission limit value (ELV), also see Chapter 4.

5.2 Environmental Monitoring by KAZHYDROMET

5.2.1 Overview of Environmental Monitoring in the Northern Caspian Sea Region

Environmental monitoring in the northern Caspian Sea region was implemented by KAZHYDROMET during the Soviet era, and it still has an important role for the environmental monitoring as shown below:

- There is a clear demarcation for monitoring activities between MoEP and KAZHYDROMET. MoEP has the responsibility for monitoring emission sources, while KAZHYDROMET is in charge of monitoring of ambient environment.
- Several national and local organizations, such as Ministry of Agriculture, Ministry of Health, and the akimat office, implement monitoring of land and sea areas. Periodic monitoring activities are also carried out by KAZHYDROMET in the Caspian Sea.
- KAZHYDROMET is the main organization that deals with the environmental monitoring activity required by the Caspian Environment Programme in Kazakhstan.
- KAZHYDROMET predicts fluctuation of Caspian Sea water level using MIKE 21, a hydrokinetics model, which can predict the water level up to 120 hours ahead.

Currently, KAZHYDROMET has two branch offices with environmental laboratories in the region, one in Atyrau and one in Aktau. Moreover, KAZHYDROMET has upgraded the environmental laboratory of the Atyrau HYDROMET to be “the Regional Environmental Monitoring Center” in order to manage regional environmental monitoring activities in the entire northern Caspian region.

5.2.2 Facilities and Equipment

Atyrau HYDROMET Center used to suffer from severe shortage of equipment and chemicals. However, recently MoEP has procured a large number of equipment items to establish the Regional Environmental Monitoring Center. The main analytical equipment items purchased for the Regional Environmental Monitoring Center are shown in Table 5.2.1. Except for a sediment grab sampler, they now have most of the sampling and analytical equipment required to analyze general environmental pollutants. However, some of the newly procured equipment is yet to be registered in accordance with the GOST regulation. Also, installation of the equipment has not been carried out because the building of Atyrau HYDROMET is being renovated.

Atyrau HYDROMET Center also has issues on sampling. Their sampling ship can be operated only in the coastal area of the Caspian Sea due to the design problem of the ship, so currently Atyrau HYDROMET Center needs to hire a vessel to take water and sediment samples in the open sea area of the Caspian Sea.

Table 5.2.1 Sampling and Analytical Equipment at Atyrau HYDROMET Center

Category	Experience	Number of Equipments
Air Quality Analysis	Air quality sampling station	1
	Air sampling equipment	2
	Portable gas analyzer	1
Water Quality Analysis	Water sampler by layer	1
	Portable pH meter	2
	Laboratory pH meter	2
	Laboratory electrical conductivity meter	2
	Portable electrical conductivity meter	2
	Portable oxygen meter	2
	Laboratory oxygen meter	2
	Portable ion meter	2
	Atomic absorption spectrometer	1
	Gas chromatograph (FID detector)	1
	Spectrophotometer	2
	Portable spectrophotometer	5
	BOD analyzer	2
	IR spectrophotometer	1

Source : Atyrau HYDROMET Center

5.2.3 Human Resources

Table 5.2.2 lists the analytical experts at Atyrau HYDROMET. The current number of staff is not sufficient to implement regional environmental monitoring, especially of water quality, and more experts are needed to establish the Regional Environmental Monitoring Center. In addition, it is essential to train those experts to operate new analytical equipment purchased, such as the infrared spectrometer and the gas chromatograph, which are used to identify oil pollution related to the petroleum industry.

Table 5.2.2 Analytical Experts at Atyrau HYDROMET

Category	Experience	Number of Experts
Air Quality	More than 10 years	1
	More than 5 years	3
	Less than 5 years	4
	Total	8
Water Quality	More than 10 years	0
	More than 5 years	0
	Less than 5 years	3
	Total	3

Source : Atyrau HYDROMET Center

5.2.4 Development of Monitoring Plan

Atyrau HYDROMET Center is carrying out environmental monitoring in the northern Capsian region in accordance with the yearly environmental monitoring plan developed by the head office of KAZHYDROMET. Presently planning is the task of head office, and Atyrau and Aktau HYDROMET Center implement monitoring activities based on instructions from head office.

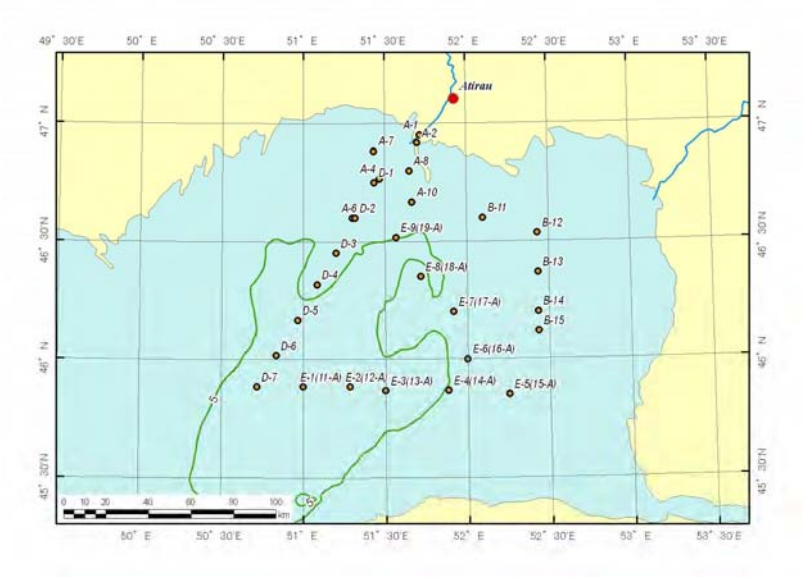
5.2.5 Sampling Points

(1) Air Quality Sampling Points

According to Atyrau HYDROMET Center, 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 downstream of the Ural River and the Caspian Sea are set 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 these stakeholders.



Source : Atyrau HYDROMET Center

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

5.2.6 Sampling Frequency

The frequencies of air quality monitoring and water quality monitoring stipulated in the yearly environmental monitoring plan are shown in Table 5.2.3.

Table 5.2.3 Sampling Frequencies

Category	Frequencies
Air Quality	4 times per every day
Water Quality	4 times per year
Sediment Quaity	1 time per year

Source : Atyrau HYDROMET Center

5.2.7 Analytical Method and Quality Control

Analytical methods and quality control system follow the systems from the Soviet era such as SNIP and GOST. The principles of these analytical methods are similar to internationally accredited methods, such as ISO, and they are consistent with the national regulations (see Table 5.2.4 for comparison with Japanese methodologies). However, there is a need to coordinate analytical methods if the data are to be compared with those of other countries, especially with those of littoral countries under the framework of CEP (TACIS/CEP, 20013). In this regard, it is also worthwhile to consider adoption of an international quality control system, such as ISO 17025 for analytical laboratory.

Table 5.2.4 Analytical Method

Analyzed parameter	Analytical method	
	Analytical Method	Comparison with Japanese methods
Air Quality		
Carbon oxide (CO)	- spectrophotometry	Principal is same
Sulphur dioxide (SO_2)	- spectrophotometry	Principal is same
Nitrogen dioxide (NO_2)	- spectrophotometry	Principal is same
Water Quality		
Dissolved Oxygen (DO)	- Winkler method	adopted
Biochemical Oxygen Demand (BOD_5)	- 5 days of cultivation at 20 ^oC	adopted
Copper（Cu）	- spectrophotometry	adopted
Chromium（Cr）	- spectrophotometry	adopted
Arsenic（As）	- spectrophotometry	adopted
Iron（Fe）	- spectrophotometry	adopted
Ammonium nitrogen（NH_4^+-N）	- indophenol blue absorption spectrophotometry	adopted
Nitrate nitrogen（NO_3^--N）	- spectrophotometry with naphthylethylenediamine absorption after copper-cadmium column reducing	adopted
Fluorine（F）	- spectrophotometry	adopted
Phenol	- spectrophotometry with aminoantipyrine	adopted
Oil	- hexane extraction	adopted

Source : Atyrau HYDROMET Center

5.2.8 Analyzed Parameters

Table 5.2.5 summarizes the monitoring parameters analyzed by Atyrau HYDROMET Center. However, apparently not all parameters are analyzed regularly. Only some parameters were reported in the reCenterport describing analytical results of Ural River water. (The results of monitoring in Ural River and the Caspian Sea are presented in Chapter 2).

[3] TACIS, A Water Quality Monitoring System for the Caspian Sea, December 2001

Table 5.2.5 Analyzed Parameter

Category	Parameters
Air Quality	(1) SO_2 (2) CO (3) NO_2 (4) H_2S (5) NH_4 (6) Particulate 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^{2+}, Fe^{3+}) (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 Center

From the perspective of monitoring of pollution from the petroleum industry, analysis of special parameters should be considered. For air quality, for example, it is desirable to analyze particulate matters and volatile carbons that pose health risks, such as BTEX (Benzene, Toluene and Xylene). For water quality, Total Petroleum Hydrocarbons (TPH) is one of important indices of pollution associated with the petroleum industry. To evaluate long-term environmental risk associated with the petroleum industry, monitoring of toxic substances released from the petroleum industry, such as Polycyclic Aromatic Hydrocarbon (PAH), is also important. Finally, monitoring of biological parameters, such as phytoplankton and zooplankton, should also be taken into consideration in the future.

5.2.9 Data Analysis, Reporting and Feedback of Environmental Monitoring Information

The most common method of evaluating monitoring data is by comparison with MPCs, and frequently, analytical reports describe only the ratios of analytical results to MPCs, or API and WPI as integrated indices of pollution. There is no doubt that this is a reasonable way to report otherwise complex environmental information. However, such indices can oversimplify the real picture because simple comparison of numbers makes us forget about the complex, non-uniform, dynamic nature of the environment. For example, the desirable water quality in the shallow northern Caspian Sea can be different from the desirable water quality in the deep Caspian Sea, but the same MPCs are often used for such water bodies. Therefore, these indices should be used carefully, and a more complete state of the environment should be reported.

To store air quality monitoring data, the Atyrau HYDROMET Center has a database application, which was provided by KAZHYDROMET under the concept of Unified State Monitoring System for Environment and Natural Resources (USMS ENR). However, water quality monitoring data were usually sent to the head office of KAZHYDROMET in Almaty, and are managed at the office. Atyrau Hydromet Center has a part of the data in an Excel file, but does not have some of the analytical data, such as the results of the sediment quality analysis in summer 2006.

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

Even with the existing activity mentioned above, sharing of information is still another area that needs improvement. For example, Atyrau MoEP prepares the annual environmental report every year, but there is no description about the environmental status of the Caspian Sea or its coastal area based on the monitoring results from KAZHYDROMET. It is important to enhance the exchange of environmental monitoring information between Atyrau HYDROMET Center and Atyrau MoEP, and to disseminate monitoring results to relevant stakeholders.

5.2.10 Issues on Environmental Monitoring by KAZHYDROMET

As discussed above, the following issues have to be addressed in order to establish effective environmental monitoring by KAZHYDROMET.

- It is necessary to develop local capacity for reviewing and revising the yearly environmental monitoring plan in order to reflect local environmental conditions in the monitoring activities.
- It is necessary to review analytical parameters, and introduce parameters related to the petroleum industry, as oil and gas development in the area will increase rapidly in the future.
- The number of staff of the Atyrau HYDROMET Center (Regional Environmental Monitoring Center) should be increased. Also, the staff should be trained so that they become competent in using newly procured equipment, such as the infrared spectrometer and the gas chromatograph, which can be used to identify pollution associated with the petroleum industry.
- It is necessary to re-examine sampling locations according to the data needs of MoEP, akimat, and other stakeholders.
- It is necessary to examine the need to adopt internationally recognized analytical methodologies and quality control systems in order to exchange monitoring results with other countries around the Caspian Sea.
- It is necessary to examine how to disseminate environmental monitoring results, and how to utilize monitoring information effectively in environmental management.

5.3 Environmental Monitoring Activities by Other Organizations

5.3.1 MoEP and Enterprises Discharging Pollutants

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 submit the environmental monitoring report quarterly to MoEP. Atyrau MoEP checks their monitoring data, and charges fines if they find pollution loads above the MPDs. (see Chapter 6 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 cross-checking of monitoring data by the enterprises. This laboratory may be housed in the building of Atyrau HYDROMET Center, thought this has not been decided.

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 Regional Pollution Monitoring Program (RPMP) under Caspian Environment Programme (CEP)

Under the Caspian Environment Programme (CEP), there is a program called the "Regional Pollution Monitoring Program (RPMP)", to start an environmental monitoring program on sediment in the whole Caspian Sea area. The monitoring items under the RPMP are as follows:

- Sampling date and time (GMT)
- Coordinates on geographical and / or decimal form
- Bottom depth (in meters with the necessary precision)
- Sampling characterization (e.g. "silt", "whole mud" etc)
- Supplementary parameters such as sea water temperature and salinity at the bottom and at surface, pH, transparency, etc
- Organic content (Total Petroleum Hydrocarbons: TPH, Total Organic Carbon: TOC), and Grain Size Data
- Chlorinated pesticides (Lindane and DDT)
- Trace Metals (TM): Al, Cu, Fe, Hg, Zn

According to the schedule for the RPMP discussed in May 2006, the draft RPMP will be finalized in September 2006. After that, the littoral countries of the Caspian Sea will join the program, and start monitoring sediment qualities. When the Regional Environmental Monitoring Center is established, it is expected that the Center will have a leading role in implementing monitoring in Kazakhstan and to report the results to other countries surrounding the Caspian Sea.

5.3.4 Environmental Monitoring by the Oil Industries

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

Table 5.3.1 Example 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, RSH	CO, SO_2, NO_2,HC, H_2S, PM, RSH	CO, SO_2, NO, NO_2,HC, H_2S, RSH
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.	X	X
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_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)	○	X	○

Source : Kashagan EIA report, TCO Annual monitoring report

5.4 Remote Sensing and GIS in Environmental Monitoring

5.4.1 Present Conditions and Needs in each Organization for Remote Sensing and GIS

(1) KAZHYDROMET

Since 2002, KAZHYDROMET has been forecasting oceanographic-phenomena and freezing of the Caspian using Scanviewer 4.0, a common image-processing software, to view imagery of the meteorological satellite NOAA. However, when this study was started, they were not processing satellite imagery, and there was no engineer in KAZHYDROMET who can use satellite image processing software.

The person in charge of GIS at KAZHYDORMENT was keen to introduce satellite image processing for environmental monitoring, however, satellite imagery analysis software was expensive, and had not been introduced. Thus, as a part of the Pilot Project implemented in this study, Leica ERDAS Imagine was procured and introduced to KAZHYDROMET. This is the same software the person in charge of GIS had hoped to introduce.

ASTER and ENVISAT are among the satellites/sensors that can be used for environmental monitoring in the region. ASTER is a photo sensor and is mounted on the Japanese satellite TERRA. While ASTER acquires data frequently, with a cycle of about 16 days, but as it is a photo sensor the selection of good scenes needs good conditions as the weather affects the data. It is possible to request an observation by ASTER. On the other hand, ENVISAT is a European satellite with a C band radar sensor effective in detection of oil slicks on the water surface. In the Caspian Sea northern coast area, ENVISAT data is being acquired with a cycle

of about 35 days. ENVISAT can always obtain good data regardless of the weather, since it is a radar sensor. Both data can be obtained through the Internet.

An environmental monitoring GIS of the whole of Kazakhstan has been developed at KAZHYDROMET since the 2004 fiscal year. The software currently used is MapInfo. The monitoring points of the Atyrau oblast are included in this system. The map information on 1/1 million is used as the base map, which has already been digitized as MapInfo data. The data, which are divided into each oblast, include administrative boundaries, major cities, factories, islands, lakes, harbours, roads, railroads, stations, airfields, rivers, and soils as main items. The environmental monitoring data in each oblast, such as air, river, and water quality, are also contained in this system. These data are linked to the tabular form data of every location.

KAZHYDROMET has already been building a WebGIS system which can display GIS data on MapServer (free WebGIS tool). Using this system, it will become possible to use the Internet to check monitoring results or to input monitoring data into the system from the monitoring Centers in the country. Management of the user's right to access is also possible. Although the present GIS data is in MapInfo format, KAZHYDROMET has a vision to adopt the MapServer compatible ArcGIS as the future GIS core, with the database converted to MS-SQL Server from Access, which is used now. Although this is still in a trial production stage, KAZHYDROMET is preparing to install a web server that can be accessed from rural areas in the near future. Currently, the environmental monitoring data from each oblast are sent to KAZHYDROMET by FAX or mail, and input into an outdated DOS-based database created in FORTRAN in 1995. All the monitoring data in the past is stored in this database and it is still used continuously, as the new system is not working yet. In the near future, it will be necessary to transfer data to the new system.

(2) MoEP

At the Information-Analytical Center of Environmental Protection, which is an organization of MoEP, a natural resources database (forest, specially nature preserve, animals-and-plants, fishery facilities) has been created using GIS. Data formats are ART, ArcInfo, and Excel and scales are 1/1 million at the national scale and 1/200,000 for the oblast unit and the Caspian Sea area. The 1/200,000 map data are under preparation and not available.

(3) The Central Geology Committee

The Central Geology Committee created a GIS database of the positions and pertinent information of 1,383 inundated abandoned oil wells. Such information becomes important basic information in evaluating the results of environmental monitoring.

(4) Atyrau HYDROMET Center

Because the task of Atyrau HYDROMET Center is data collection, the needs for satellite imagery and GIS for the purpose of analysis are low. The laboratory staff of the Atyrau HYDROMET Center enters analytical results into the blank MS-Word forms sent from KAZHYDROMET, and e-mails them to Almaty KAZHYDROMET. After the new system starts, the analytical data will be firmly managed with the server in Almaty because the direct entry of the monitoring results into the database server becomes possible. Likewise, it will become possible to check monitoring data from Atyrau.

In the meantime, it seems sensible to develop a temporary system so that Atyrau HYDROMET Center can refer to the monitoring data compiled by KAZHYDROMET by using a free GIS data viewer. Such a system will feed back the monitoring results to Atyrau, and improve the sense of responsibility for environmental monitoring in Atyrau or Mangistaus.

(5) Atyrau MoEP

Although a 1991 LANDSAT-TM picture, created for a presentation in the past, is framed at the Atyrau MoEP, there is no section at Atyrau MoEP that can perform image processing, and there is no record of any use of the latest satellite images. Atyrau MoEP's main interest in the use of satellite image analysis is the application to surveillance and/or identification of pollution sources, and given the present data acquisition cycle of the satellites, analysis accuracy, etc., it seems that the needs for satellite imagery are not particularly high at the Atyrau MoEP.

As far as the management of inspection information is concerned, environmental reports and monitoring data submitted by enterprises are mainly kept on paper. There is a wish to manage information on enterprises and their environmental data on a map. However, the time pressure and the limited budget prevent them from developing such a system. Therefore, it is necessary to develop an environmental database that has a link to the data of enterprises. Evidently the design of the environmental database is different from the environmental monitoring database of the KAZHYDROMET.

It was noted that MoEP has a desire to evaluate the impact (damage) of a well test to the environment. In order to predict the environmental impact of a well test, it is necessary to develop a simulation model in consideration of the position of the oil field, the scale of the well test, and the other factors (climate, local hydrodynamics, etc.) that affect transport of contaminants. Since GIS does not have the function of a simulator, it is necessary to do the simulation separately. However, it is possible to use GIS as a tool for summarizing information required for a simulation. Moreover, in order to evaluate the impact of a well test quantitatively, it is necessary to carry out detailed, densely arranged environmental monitoring before and after the well test. Such information may be compiled as a database and used as a tool to identify pollution sources. KAZHYDROMET and MoEP should cooperate and carry out such analysis.

(6) KazMunayGas

KazMunayGas has been carrying out environmental monitoring by satellite image data and the construction of a GIS database since 2005. KazMunayGas's environmental monitoring targets are their facilities in the northern part of Caspian Sea. The outline of environmental monitoring is shown in Table 5.4.1.

Table 5.4.1 Environmental Monitoring by KazMunayGas

Items of monitoring	Description	Used Data (Freq. of Data Acq..)
① Air Pollution Monitoring	✓ Temperature monitoring of flare by thermal infrared ✓ Comparison between temperature data from satellite and output of flare gas ✓ Air diffusion model (IAP Model: original model of KGC which is on the basis of OND86 Model and considers meteorological data)	TERRA/AQUA (24 hours)
② Sea Pollution Monitoring	✓ Extraction of oil slick by interpretation ✓ Development of oil slick D/B ✓ Study on distributional pattern of oil slick by oil slick diffusion model (MIKE-21)	RADASAT-1 (1 month)
③ Soil Pollution Monitoring	✓ Extraction of soil Pollution and water pollution (evaporation pond) by interpretation	QuickBird (1 or 2 times per year)
④ Drift Ice Monitoring	✓ Classification of ice (thickness) and monitoring of crack by RADASAT-1 ✓ Monitoring of drift ice front and calculation of speed by TERRA/AQUA	RADASAT-1 (1 month) TERRA/AQUA (24 hours)
⑤ Environmental Monitoring in the facilities of oil and gas fields	✓ Extraction of surface information by interpretation ✓ Digitalization of existent information (facilities, topography, and so on) ✓ Automatic change detection by satellite image data which is acquired at different timing	QuickBird (1 or 2 times per year)

Source: JICA Study Team

KazGeoCosmos (hereafter KGC) contracts to perform the activities of KMG's environmental monitoring, and to construct the GIS database for the accumulation of the results of environmental monitoring. KGC tackles the upgrading of not only hardware but also software for the environmental monitoring. KGC is equipped with a ground receiving station for satellite data (TERRA/AQUA, TERRA/MODDIS, RADASAT-1, and IRS-1C/1D) in Atyrau and an aircraft equipped with a high-resolution camera (Vexel UltraCAM-X) and hyperspectral sensor (ITRES CASI-1500). In addition, KGC developed a progressive GIS database system, which consists of a GIS database by ArcSDE and WebGIS server by ArcIMS. The headquarters and branch offices of KMG, KazTransOil, and other companies as the clients of KGC can browse the GIS database via the WebGIS server and the Internet.

(7) State Environmental Monitoring System (USMS ENR)

MoEP plans to construct the State Environmental Monitoring System for Environment and Natural Resources (USMS ENR), which will cover all over Kazakhstan. MoEP plans on integrating various database data of the Ministries on KMG's GIS platform for the environmental monitoring.

KMG's environmental monitoring and their GIS database assign importance to the information of their facilities, pollutant monitoring, and diffusion simulations. Various environmental information (sea, vegetation, soil, inland waters, land cover, and so on) for the base map and the target for protection should be collected separately for the USMS ENR. A fusion and unification of base maps that the Ministries and organizations own (ex. Natural resources database of MoEP, the GIS database of the positions and pertinent information on the 1,383 inundated abandoned oil wells created by the Central Geology Committee, the database for agriculture, fishery and forestry of the Ministry of Agriculture (the detail is unknown), and so on), is essential to implement the USMS ENR.

5.4.2 Analysis of the Present Conditions using LANDSAT/ETM+

Before the field survey, 12 scenes of LANDSAT/ETM+ data shown in Figure 5.4.1 were purchased, and analysis of the present conditions of the region was performed. Figure 5.4.2 is the mosaic image that joined all 12 scenes. Since the red color is assigned to the vegetation band (Band4), reed bed along the shore is shown in red. It is evident that the shore is widely and densely covered by reed. The image also shows regions of the sea milky white in color, which are presumably turbid water bodies containing clay flowing into the Caspian Sea from the eastern river (Scene P166-R028).

Furthermore, high resolution processing (Pan-sharpen processing) was performed on these data, and pictures with a spatial resolution of 15m were created and scrutinized. This revealed specific features in Table 5.4.1. The expanded pictures corresponding to the equivalent numbers are shown in Figure 5.4.3(1)-(3), and their positions are shown in Figure 5.4.2.

A-C shows offshore trial-drilling bases. A is the Aktota trial-drilling base. The images A-1 and 2 were acquired on September 8 and October 19, 2002 , respectively. In A-1, a black belt hanging south from the base can be recognized. Moreover, in (1)-2, the white belt is prolonged toward north from the west side of the base. Although it is difficult to identify whether these are leaked oil, it is clear that the satellite images caught something outflowing from the base.

B-1 and 2 are the images of Kairan trial-drilling bases acquired on September 8 and October 19, 2002. The outflow of the substance from the base is not seen.

C is the image of the Kashagan trial-drilling base and a few vessels are visible around the base. There is a thin black belt that flows west from the base. It may appear like a black belt because of the difference in the concentration of the suspended matter.

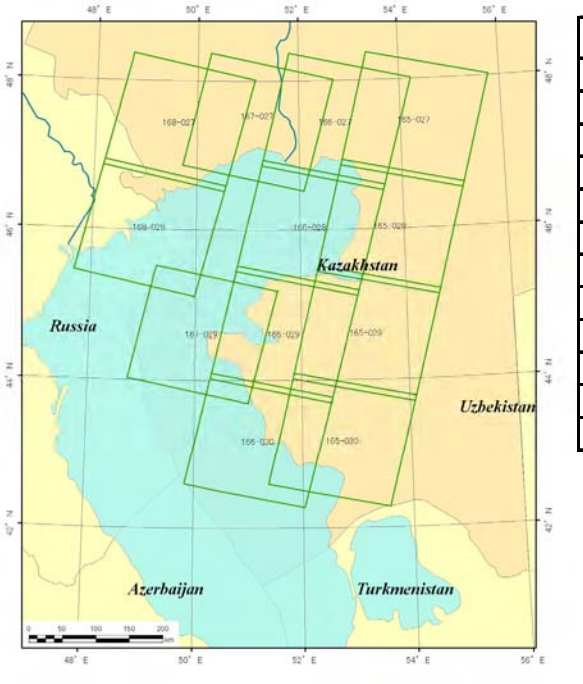
D is a vessel on the ocean. It appears that a long and slender belt-like substance comes out of a vessel. This may be suspended matter, dumped waste oil or a fishnet.

E is dense suspended matter discharged from a vessel. It seems that mud discharged from a gravel transport ship used for base development.

F-I are the inundated oil wells distributed over the eastern coast of the Caspian Sea. The leakage of oil cannot be discerned.

J is the Tengis oil complex and the shining red points at the Center of the picture (five points) are the flares from stacks.

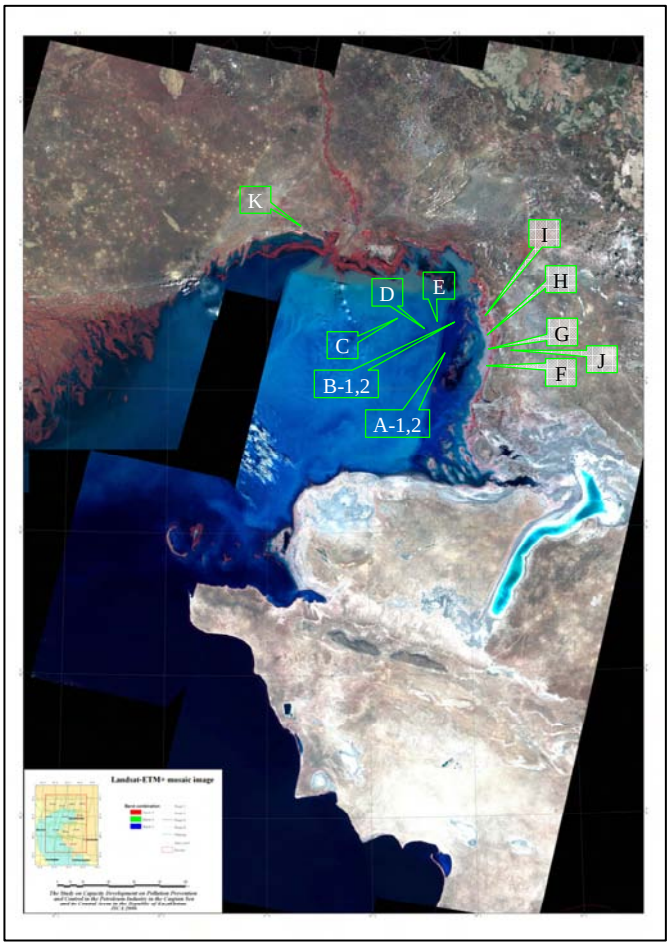
K is the only place within the 12 scenes analyzed this time that has a possibility of an oil leak. K-1 was acquired on August 30, 2002 and K-2 was acquired on September 24, about one month after. At the easternmost end of K-2, a black belt extending toward the sea from the seashore can be seen. This belt is absent in K-1. From this location, the deep-colored portion spreads towards the inner part of a western bay. It could be that an oil leak occurred from the point at the easternmost end, and spread towards the west. However, this may be showing the rising of water level, and from this picture alone it is not possible to conclude that this was an oil leak.



Path	Row	Date
165	027	2002/09/01
165	028	2002/10/19
165	029	2002/10/19
165	030	2002/10/19
166	027	2002/09/24
166	028	2002/09/08
166	029	2002/09/08
166	030	2002/09/08
167	027	2002/08/30
167	029	2002/09/15
168	027	2001/09/03
168	028	2001/10/05

Figure 5.4.1 LANDSAT/ETM+ Scene Coverage and Data List

Source: JICA Study Team



Red:Green:Blue=
Band4:Band3:Band2

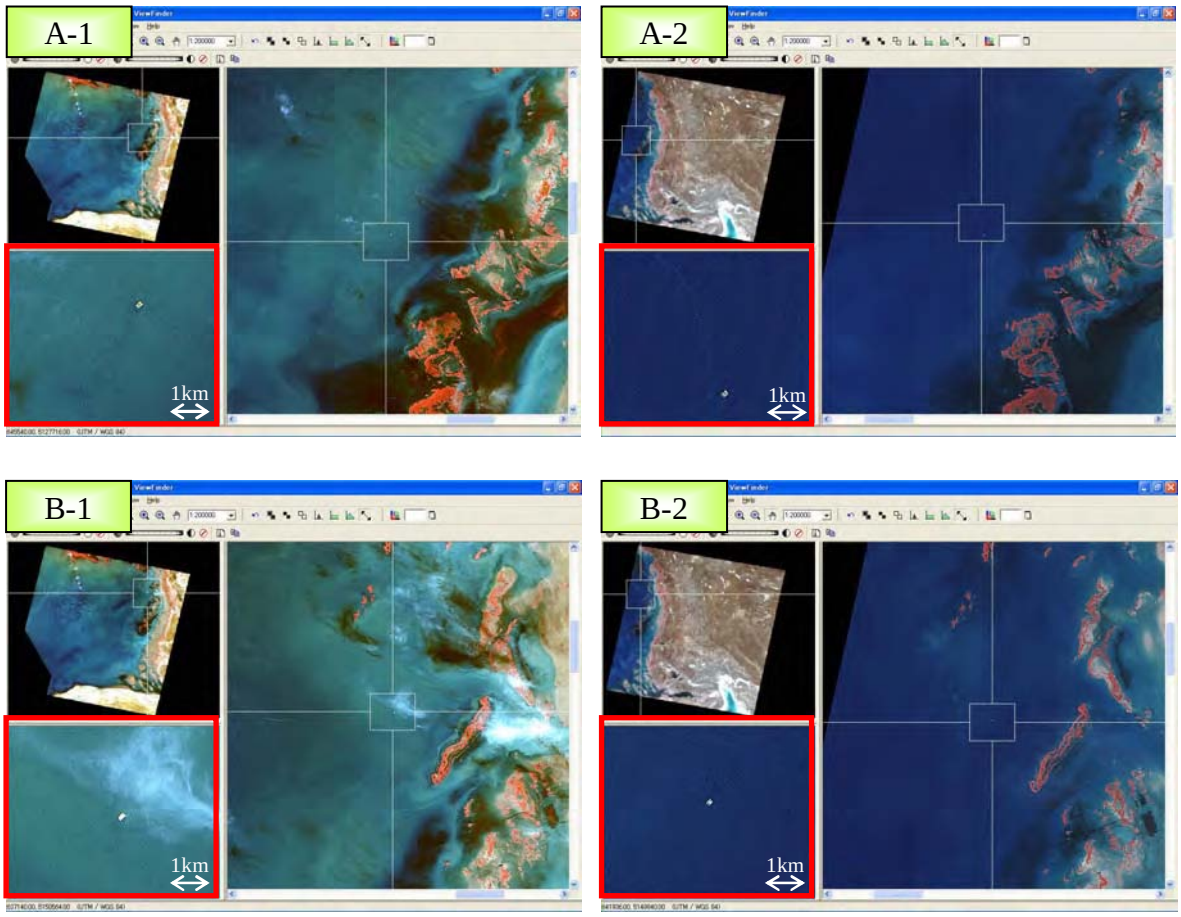
Source: JICA Study Team

Figure 5.4.2 LANDSAT /ETM+ Digital Mosaic Image

Table 5.4.2 The Trial-drilling Base, Vessel, Submersion Waste Oil Well recognized from the High Resolutionized Image

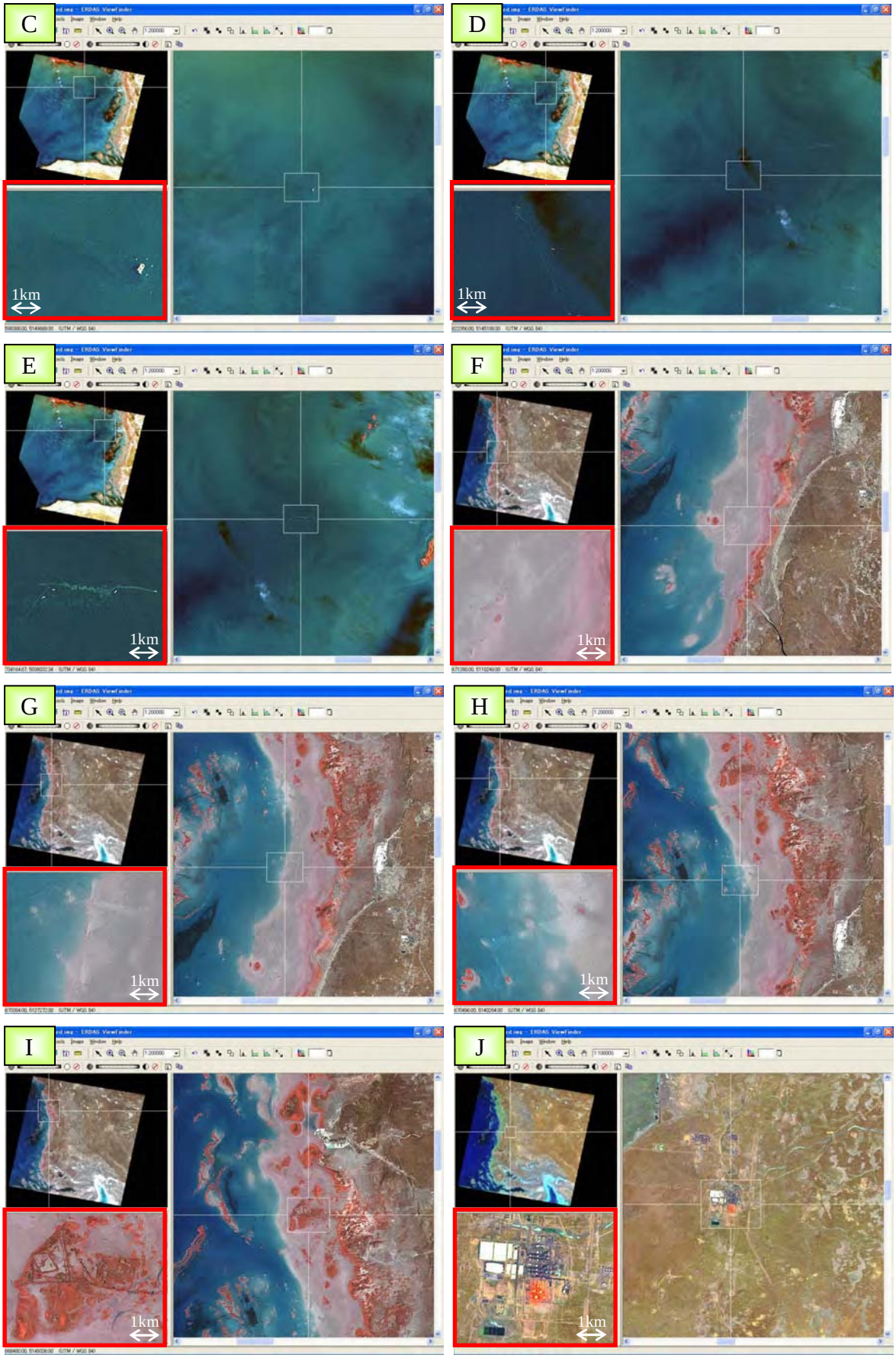
No.	Contents	Acquisition date (2002)
A-1	Aktota trial-drilling base	Sep, 8
A-2	Aktota trial-drilling base	Oct, 19
B-1	Kairan trial-drilling bases	Sep, 8
B-2	Kairan trial-drilling bases	Oct, 19
C	Kashagan trial-drilling base	Sep, 8
D	The belt-like object may be suspended matter, dumped waste oil, or a fishnet	Sep, 8
E	Suspended matter(mud?) discharged from a vessel	Sep, 8
F	Inundated oil well and equipment	Oct, 19
G	Inundated oil well and equipment	Oct, 19
H	Inundated oil well and equipment	Oct, 19
I	Inundated oil well and equipment	Oct, 19
J	Flare in the Tengiz oil complex	Oct, 19
K-1	Before leakage	Aug, 30
K-2	(Presumed) oil leaked from the east end point flowing west in the bay	Sep, 24

Source: JICA Study Team



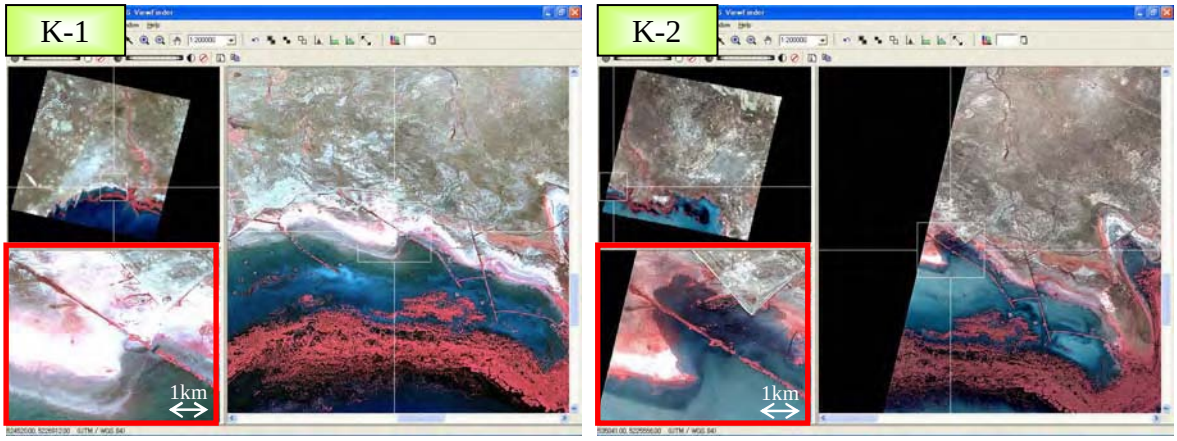
Source: JICA Study Team

Figure 5.4.3 LANDSAT/ETM+ Enlarged High Resolutionized Image (1)



Source: JICA Study Team

Figure 5.4.4 LANDSAT/ETM+ Enlarged High Resolutionized Image (2)



Source: JICA Study Team

Figure 5.4.5 LANDSAT/ETM+ High Resolutionized Image (3)

5.5 Examination of Current Capacity for Environmental Monitoring

5.5.1 Introduction

This section reviews the current monitoring activities in the northern Caspian Sea, and the capacities for environmental pollution monitoring associated with oil development in the area. The issues that are important to improve environmental monitoring are reflected in the proposed monitoring framework presented in Chapter 13. Some of the issues were addressed in the pilot activities mentioned in Chapter 8.

5.5.2 Examination of Monitoring Capacity and Identification of Issues

(1) Examination of Institutional Aspects of Environmental Monitoring

1) Demarcation of Environmental Monitoring

Atyrau HYDROMET Center carries out the state environmental monitoring prescribed in the Environmental Code. Atyrau MoEP and Department of Use and Control of Environmental Resources (DUCER) of Atyrau oblast also implement limited ambient environmental monitoring as a part of their duties for pollution control and natural resource management. However, the current ambient monitoring activities are too limited to evaluate regional-scale, long-term conditions of the environment. This is partly because none of these regional organizations have jurisdiction for overall environmental conservation. Coordination of activities and sharing of monitoring information among relevant organizations are not adequate. Details of the water, sediment and air monitoring by these organizations are described in the following sections.

The oil enterprises also implement environmental monitoring to assess the environmental impact of their own facilities. For example, Agip KCO has a monitoring plan, in accordance with a request from the DUCER of Atyrau oblast, to assess the regional impacts of the oil processing facilities it has under construction. Other enterprises also carry out limited monitoring activities around their facilities.

(2) Examination of Organizational Aspects of Environmental Monitoring

1) Formulation of Environmental Monitoring Plans

As mentioned in Section 5.2.4, presently, planning is the task of the head office and Atyrau and Aktau HYDROMETs implement monitoring activities based on instructions from head office. One could say that this is consistent with the concept of "a unified environmental monitoring system" required by the Law on Environmental Protection. On the other hand, this head office direction will make it difficult to fine tune monitoring activities based on the local conditions of pollution sources and the environment.

2) Monitoring Parameters

(a) Water Quality Monitoring in the Caspian Sea

The parameters for ambient monitoring should be set considering various factors affecting environmental conditions of the Caspian Sea. Currently, the Atyrau HYDROMET Center and Atyrau MoEP implement monitoring in the Caspian Sea, and their analytical parameters are almost same. Recent monitoring parameters of the Atyrau HYDROMET Center are shown in Table 5.5.1, listed by each factor affecting the environment of the Caspian Sea.

Table 5.5.1 Water Quality Monitoring Parameters

Factors Affecting Environment of the Caspian Sea	Relevant Analytical Parameters
Extent of oil pollution	oil products, phenol
Accumulation and spreading of organic chemicals	detergents
Accumulation and spreading of heavy metals	manganese, ferrous, chromium, hexavalent chromium, copper, zinc, cadmium, nickel
Progression of organic pollution (Decrease in oxygen concentration in water)	chemical oxygen demand、suspended solid, dissolved oxygen
Trend of trophic condition	Total nitrogen, nitrate nitrogen, nitrite nitrogen, ammonium nitrogen, phosphate

Note : Other parameters analyzed are pH, sodium, potassium, magnesium, calcium, silica, chloride, sulfate, bicarbonate, fluoride, and boron.

Source : JICA Study Team

From the viewpoint of controlling pollution from oil development, it is necessary to add as monitoring parameters the pollutants associated with oil development activities. As an example, the monitoring parameters adopted by Agip KCO are shown in Table 5.5.2. Agip KCO implements, around their oil mining facilities, monitoring that focuses on oil production-related pollutants such as polycyclic aromatic hydrocarbons (PAHs) and heavy metals like lead and vanadium. Alkanes are also analyzed to monitor constituents of the petroleum. Depending on the progress of offshore oil field development in the area, it is necessary to consider including such substances in ambient environmental monitoring programs.

Table 5.5.2 Monitoring of the Caspian Sea by Agip KCO

Item	Contents
Monitoring parameters	(1) pH, (2) DO, (3) turbidity, (4) salinity, (5) nitrogen, (6) phosphorous, (7) As, (8) Ba, (9) Cd, (10) Cr, (11) Cu, (12) Fe, (13) Hg, (14) Ni, (15) Pb, (16) V, (17) Zn, (18) phenol, (19) hydrocarbon (total hydrocarbon, alkane), (20) PAHs
Sampling points	- 5 points around the facilities

Source : JICA Study Team

(b) Sediment Quality Monitoring

Sediment quality monitoring is implemented by the Atyrau HYDROMET Center, and the heavy metals same as the ones for water quality monitoring shown in Table 5.5.1, are included in the monitoring parameters. To evaluate change in environmental conditions, sediment monitoring is important, and it is desirable to carry out analysis of petroleum related substances. However, the Center did not have appropriate sediment sampling apparatus, and the small amount of sediment collected for analysis is limiting the parameters that can be monitored.

(c) Air Quality Monitoring

Both the Atyrau HYDROMET Center and the Atyrau oblast implement air quality monitoring in Atyrau city. Monitoring parameters adopted by the Atyrau HYDROMET Center are shown in Table 5.5.3. From the viewpoint of pollution control in the petroleum industry, one of the issues of the current selection of monitoring parameters is the lack of monitoring of hydrocarbons, especially unsaturated hydrocarbons, which cause photochemical smog through formation of secondary pollutants such as ozone. Monitoring of carcinogenic chemicals such as benzene and PAHs, should also considered.

Table 5.5.3 Air Quality Monitoring Parameters by the Atyrau HYDROMET Center

Item	Content
Monitoring parameters	(1) Sulfur dioxide (SO_2), (2) Nitrogen dioxide (NO_2), (3) Carbon monoxide (CO), (4) Hydrogen sulphide (H_2S), (5) Ammonia, (6) Particulate matter, (7) Meteorological parameters (wind speed, wind direction, humidity)

Source : JICA Study Team

3) Monitoring Points

(a) Water Quality Monitoring Points

The water quality sampling points in the Caspian Sea and the estuary of the Ural River set by the Atyrau HYDROMET Center are shown in Figure 5.2.1. These sampling points have been added as the monitoring plan was revised. However, the representative sampling points for long-term monitoring are yet to be established clearly.

Among the sampling points shown in Figure 5.2.1, the points around 53 degrees east longitude were set only for a special sampling program with a research institute, and periodic monitoring is not carried out at these points. There are no sampling points in the coastal area because the water depth is too shallow, 1 m or less, and areas that can be accessed from inland are limited. It is necessary to rearrange the sampling points around 52 degrees 30 minute north latitude and 46 degrees 30 minute east longitude considering the development of the Kashagan oil field.

Atyrau MoEP implements monitoring for the purposes of pollution source control, and they set monitoring points based on information such as occurrence of oil spill accidents or mass deaths of Caspian seals.

(b) Sediment Monitoring Points

Sediment sampling has been implemented at some of the water quality sampling points. Due to the lack of sediment sampling apparatus for shallow sea areas, sampling is carried out at the points where sampling is possible under the site conditions.

Atyrau MoEP does not implement any regular sediment monitoring.

(c) Air Quality Monitoring Points

Ambient air quality monitoring is carried out by the Atyrau HYDROMET Center and Atyrau oblast. Atyrau oblast does not have any fixed air monitoring stations.

The Atyrau HYDROMET Center has two air sampling stations in Atyrau city, but does not have any stations outside of the city. To monitor overall air quality in the region, and to evaluate air quality around oil refineries, sampling points should be placed strategically considering the locations of the oil fields, sulphur storage sites, and other pollution sources.

4) Database

To store air quality monitoring data, the Atyrau HYDROMET Center has a database application provided by KAZHYDROMET under the concept of Unified State Monitoring System of Environment and Natural Resources (USMS ENR). However, water quality monitoring data have usually been sent to the head office of KAZHYDROMET in Almaty, and are managed at the office. Atyrau Hydromet Center has a part of the data in an Excel file, but does not have some of the analytical data, such as, the results of the sediment quality analysis in summer 2006.

Atyrau MoEP stores monitoring data as printed material as they do not have a database, and it takes time to look up past monitoring data.

5) Human Resources

As mentioned in Section 5.2.3, the current number of staff is not sufficient to implement ambient environmental monitoring, especially on water quality, and more experts are needed to establish the Regional Environmental Monitoring Center.

(3) Examination of Technical Aspect of Ambient Environmental Monitoring

1) Technical Measures for Regional Information Collection

Currently, chemical analysis of samples taken in the field is the primary method of monitoring, and there are insufficient samples to monitor environmental conditions in the areas where access is difficult, such as some of the terrestrial oil fields and shallow coastal areas. Thus, use of satellite image analysis is suggested as a secondary tool for regional environmental monitoring. However, the Atyrau HYDROMET Center and Atyrau MoEP do not have experience in the use such a technique for monitoring.

2) Monitoring of Petroleum Derived Pollutants

The analytical experts of Atyrau HYDROMET Center have basic skills for chemical analysis. However, their experience in analysis of oil-derived pollutants by FT-IR or GC-FID, and heavy metals by AAS, is limited. These analytical instruments have been purchased to establish the Regional Environmental Monitoring Center. However, due to the delay of renovation work at the Center, the instruments have not yet been installed. The renovation work needs to be finished to enhance the analytical capacity of the Center using these instruments.

Atyaru MoEP has the same problems. A range of analytical equipment has been purchased, but it is inoperable due to the lack of a laboratory. Consequently, it is difficult to enhance their analytical capability.

3) Reliability of Analytical Laboratories

The environmental laboratories in Kazakhstan generally follow analytical methods and quality control systems established during the Soviet era, such as SNIP and GOST. The principles of these methodologies are similar to those of internationally accredited systems, and they are consistent with the national regulations. However, there is a need to coordinate analytical methods if the data are to be compared with those of other countries. In this regard, it is also worthwhile considering adoption of an international quality control system, such as ISO 17025 for the analytical laboratories.

(4) Examination of the Institutional Aspect of Pollution Source Monitoring

1) Monitoring Plan

According to the Environmental Code, responsibility for pollution source monitoring lies with each enterprise, which should prepare an annual monitoring plan for pollutants discharged, and submit environmental monitoring reports quarterly to MoEP. Inspection of these monitoring reports on pollution source, submitted by the enterprises, is primarily the task of Atyrau MoEP.

Additionally, as necessary to examine impacts of pollution, Atyrau MoEP implements air quality monitoring around petroleum related facilities and water quality monitoring in the Caspian Sea in cases of an oil spill or mass deaths of Caspian seals.

2) Monitored Parameters

Carbon monoxide, nitrogen dioxide, sulphur dioxide, and hydrocarbons are analyzed in the pollution source monitoring mentioned above. For these parameters, each enterprise determines its own Maximum Permissible Discharge (MPD), which is calculated depending on several factors, such as the utilization condition of the surrounding environment and background concentrations of each pollutant in the environment.

The water quality monitoring parameters are similar to those for the ambient environmental monitoring by the Atyrau HYDROMET Center, and petroleum-derived pollutants are not always measured, though oil products and phenols are analyzed as such pollutants.

3) Human Resources

Four officers of Atyrau MoEP are assigned for monitoring activities. However, they cannot carry out daily analytical works because there is no laboratory. Upon the establishment of MoEP's laboratory, these officers will need on-the-job training in order to improve their practical skills of sampling and analysis of inspection work.

(5) Examination of Technical Aspects of Pollution Source Monitoring

1) Monitoring of Petroleum Derived Pollutants

As mentioned above, Atyrau MoEP does not have a laboratory, and does not have enough experience to analyze petroleum-related pollutants. In order to independently evaluate pollution sources without relying on the self-monitoring reports of enterprises, it would definitely help to have training from analytical experts to provide an in-house capability to analyze such parameters.

2) Analysis of Constituents of Petroleum

Fingerprint analysis of petroleum is useful to identify pollution sources. This requires analysis and comparisons of the constituents of oils from the sources and from the fields. However, none of the analytical experts at MoEP has the experience to operate a GC-FID, an instrument to analyze constituents of oils, even though they have recently purchased such an instrument.

3) Compliance Inspection

MoEP has the responsibility for inspecting each enterprise's compliance with the discharge regulations. However, Atyrau MoEP dose not have an in-house laboratory, and their capacity to inspect environmental compliance is limited. Although Atyrau MoEP recently purchased a portable water quality analyzer, the officers need further training in environmental sampling and analysis, and the stock of the reagents for the instrument is insufficient.

For air quality monitoring, Atyrau MoEP has a monitoring truck equipped with a mobile air quality analyzer, and they can carry out ambient air quality monitoring as necessary. However, they have no means of collecting air samples from stacks, and they do not have the experience to monitor emitted gases at the enterprises.

(6) Examination of Institutional Aspects of Spilled Oil Monitoring

Kazakhstan has drafted a National Oil Spill Emergency Response Plan, which is currently being revised. The plan describes the procedure and demarcation to tackle oil spill accidents, but it does not explain details of monitoring requirements after oil spill accidents. Atyrau MoEP carried out water quality monitoring in the Caspian Sea in order to evaluate the impact of the oil spill accident from an inundated oil well confirmed in May 2006. However, Atyrau MoEP's effort to continuously monitor the impact of the spill is not coordinated with the Atyrau Hydroment Center's ambient environment monitoring program.

(7) Examination of Technical Aspects of Spilled Oil Monitoring

1) Monitoring Measures

Currently, post-accident monitoring in the Caspian Sea is implemented by visual observation using helicopter, and continuous water quality monitoring. The water quality monitoring parameters follow those for the ambient environmental monitoring by the Atyrau HYDROMET Center, and petroleum derived pollutants are not always monitored.

Remote sensing techniques, such as aerial photo analysis and satellite image analysis have not been adopted for oil spill monitoring. KAZHYDROMET has, since 2002, been forecasting oceanographic-phenomena and freezing of the Caspian by using meteorological satellite NOAA images, which are processed by common image-processing software. However, they have no experience in full-fledged satellite image analysis by using specialized software for satellite image processing, and there is no such system. Atyrau MoEP has no experience of satellite image analysis or the method.

(8) Examination of Institutional Aspects of Monitoring Information Dissemination

1) Tools for Dissemination of Monitoring Information

Atyrau MoEP prepares annual environmental reports. The reports describe trends in the discharge of pollutants and penalties on each enterprise violating emission standards, but the results of Caspian Sea monitoring and pollution source monitoring by Atyrau MoEP are not described.

The Atyrau HYDROMET Center provides the results of their air quality monitoring to DUCER. The monitored information by the Atyrau HYDROMET Center is sent to and stored in KAZHYDROMET. KAZHYDROMET compiles analytical results and prepares a quarterly newsletter "Environmental Status of Caspian Sea in Kazakhstan Area" and annual report "Monitoring Results of Environmental Status of Caspian Sea in Kazakhstan Area". The newsletter and report are distributed to MoEP, Atyrau Akimat, Mangistau Akimat, and Atyrau Hydromet Center. Under the existing system, more detailed information is provided to other organizations upon requests from other organizations. However, as it became evident from the stakeholder meeting organized as a part of the Pilot Project in this study (Chapter 8), there is a need for further information sharing among stakeholders.

2) Participation in International Monitoring Programs

Under the Caspian Environmental Program (CEP), there is a plan to implement an environmental monitoring program on sediment in whole Caspian Sea area, called the "Regional Pollution Monitoring Program (RPMP)". The main items monitored under RPMP are as follows:

- Organic content (Total Petroleum Hydrocarbon TPH, Total Organic Carbon TOC)
- Grain size data
- Chlorinated pesticides (Lindane and DDT)
- Trace metals (TM): Al, Cu, Fe, Hg, Zn

In 2006, all littoral countries of the Caspian Sea joined the program, and started the sediment monitoring activity. When the Regional Monitoring Center starts its full-scale monitoring activities, the Center will play a significant role in providing monitoring information to other countries surrounding the Caspian Sea.

As of August 2006, "The Framework Convention for the Protection of the Marine Environment of the Caspian Sea", which is the first legal agreement adopted by the five Caspian countries, became effective. In the future, the littoral countries will be required to implement monitoring activities under this international framework.

(9) Examination of Technical Aspects of Monitoring Information Dissemination

1) Development of the Environmental Information Database

Since 2004 fiscal year, the Information Technology Department of the headquarters of KAZHYDROMET has been developing the environmental monitoring database of the whole of Kazakhstan. The person in charge of GIS is considering installing Web GIS, which will enable branch offices of KAZHYDROMET to refer to the environmental monitoring data on the Internet. However, experts with the knowledge to use GIS are still limited.

The Information-Analytical Center of Environmental Protection, which is an organization of MoEP, also has the system, human resources, and capacity for GIS database construction. They have been constructing the natural resources database (forest, special nature preserve, flora and fauna, fishery, and so on) of the whole of Kazakhstan.

It would contribute to pollution control in the petroleum industry if environmental information relevant to the Caspian area, such as monitoring data on air, water/sediment, information on distribution of petroleum-related facilities and resources, distribution of flora and fauna to be conserved, etc., are gathered and integrated into an environmental management database.

This can be done by combining the data and information into a GIS database, which provides an effective platform to manage different information together. However, currently there is no such GIS database, and officers at Atyrau MoEP and the Atyrau HYDROMET Center are not familiar with GIS. When GIS is utilized in Atyrau MoEP and the Atyrau HYDROMET Center, it will be necessary to provide training about how to operate GIS.

5.6 Summary of Current Issues

The issues related to monitoring activities discussed above can be summarized as shown in Table 5.6.1.

Table 5.6.1(1/2) 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 to the Regional Environmental Monitoring Center	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

Source : JICA Study Team

Table 5.6.1(2/2) Existing Issues for Monitoring Activities on Petroleum Industry Pollution Control

Activities	Issues		
	Institutional Aspects	Organizational Aspects	Technical Aspects
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 Center to participate in the international monitoring program	a Securing means to disseminate monitoring information from the Regional Environmental Monitoring Center and other organizations	a Development of a GIS database to provide combine the various monitoring information. b Training of the staff of Atyrau Hyderomet Center and Atyrau MoEP about environmental databases.

Source : JICA Study Team

CHAPTER 6 ENVIRONMENTAL CO-OPERATION BY DONORS

6.1 Introduction

Since its independence in 1991, Kazakhstan has received a considerable amount of environmental assistance from the donor community. This has largely been related to:

- Assistance for the region of the Aral Sea and other ecological disaster areas.
- Conservation of biodiversity, related to ecosystems or individual species.
- Clean-up of former nuclear sites and other industrially polluted areas.
- The combat of desertification.
- The management of water resources
- Environmental administration and institutions
- Protection of the Caspian Sea

Interestingly, there has been relatively little donor-funded environmental assistance in relation to pollution from the oil industry (although work on protection of the Caspian Sea environment has inevitably encompassed some oil pollution issues). The present JICA initiative is therefore a timely contribution, particularly at the point where Kazakhstan is about to experience a massive increase in offshore oil production from the Kashagan oilfield. (The Kashagan field is estimated to contain between thirty and fifty billion barrels of oil, making it potentially the second largest oilfield in the world; only the Ghawar field in Saudi Arabia, at eighty billion barrels is larger.) Table 6.1.1 provides a list of donor-funded projects undertaken in the environmental field since 1995, including on-going projects such as the present JICA project.

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

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

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"
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
2003 – to date	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
2006-2007	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

6.2 Environmental Projects of Donors

6.2.1 Caspian Environment Programme

Most of the donor funding for protection of Kazakhstan's Caspian Sea environment has been channelled through the Caspian Environment Programme (CEP), which has involved all five littoral states around the Caspian. The CEP is an umbrella programme which has used grant funding from the Global Environment Facility (GEF), with United Nations Development Program (UNDP) as the implementing agency. However, United Nations Environment Program (UNEP), World Bank (WB), Technical Assistance to the Commonwealth of Independent States (TACIS), European Bank for Reconstruction and Development (EBRD), United States Agency for International Development (USAID) and other donor funds have been used for various elements within the programme. Table 6.2.1 lists the CEP projects conducted in Kazakhstan. In Kazakhstan, the administration of CEP studies / projects is handled by the Almaty office of UNDP.

The first phase of the CEP was initially diagnostic, and defined the nature and scale of the environmental problems to be addressed. This was followed by the development of Action Plans to deal with the problems at national and regional level. The CEP has now moved into its second phase, and the Programme Co-ordination Unit (PCU) has moved from Baku to Tehran. There is now a strong emphasis on the individual countries taking responsibility for action at national level using their own funds; all activities in Kazakhstan's National Action Plan are part of regular government programmes.

The second phase of the CEP has three main components, as follows:

- GEF Phase II (CEP-SAP) – Towards a Convention and Action Plan for the protection of the Caspian Sea environment.
- EU/TACIS – Sustainable Management of Fisheries Programme
- EU/TACIS - Sustainable Development of Coastal Communities Programme

One element of the CEP Phase II (CEP-SAP) which is of relevance to the present study is the project 'Monitoring of Pollution in the Caspian Sea'. This is a four-country study funded by TACIS to the tune of € 1.3 million. In Kazakhstan, KAZHYDROMET will be responsible for implementation of the project, which is now under way.

Another possibly relevant element is a UNEP institutional project to 'strengthen the environmental, legal and policy frameworks operating at regional and national levels, and where necessary, improve implementation and compliance of those frameworks'. UNEP will assist governments with the introduction of appropriate compliance and enforcement monitoring tools, to be applied to monitor the status of enforcement and compliance with the various MEAs (Multilateral Environmental Agreements) and legal frameworks developed under the project. There is no information on whether Kazakhstan will participate in this initiative.

The third phase of the CEP (2007-2017) was agreed in 2006, and will receive an initial $35 million from the GEF; a Caspian Investment Fund will also be established.

In October 2006, the Framework Convention for the Protection of the Marine Environment of the Caspian Sea, which is the first legally binding agreement on environmental protection of the Caspian Sea, was ratified by all five littoral states, and entered into force. The objective of this Convention is the protection of the Caspian environment from all sources of pollution including the protection, preservation, restoration and sustainable and rational use of the biological resources of the Caspian Sea.

Table 6.2.1 Caspian Environment Programme Projects Conducted in Kazakhstan

Project Title	Lead Institution	Start Date	End Date
Fish Parasites in the Caspian Sea in territorial waters of Kazakhstan	Institute of Zoology of the Ministry of Education and Science of the RK	01.01.1995	01.01.1997
Supply of potable water of high quality to the population of the Caspian Region of the RK (Atyrau and Mangistau regions) and treatment of waste waters	Scientific Research Institute for Oil and Water	01.12.2001	30.07.2003
Organisation and conduct of environmental monitoring in the Kazakhstan sector of the Caspian Sea	RGP "Kazhydromet"	01.01.2001	
Biodiversity of land and marine animals in regions affected by human impact. Evaluation of the quality of habitats	Institute of Zoology	01.01.1999	01.01.2002
Project for reclamation of lands close to construction site of the Atyrau terminal of Atyrau region for Kazakhstan branch of Karachanak Petroleum Operating Company	GosNPTSzem	01.04.2001	30.07.2001
Recreational zoning of the coastal territories of the North-Eastern Caspian (within the territory of the RK) taking into consideration data obtained as a result of remote sensing	"EcoBioMedCenter"	01.01.2000	31.12.2001
Setting up CIS for the Republic of Kazakhstan	Institute of Ecology and Sustainable Development	01.01.1996	01.01.2000
Evaluation of the impact of nuclear tests and oil and gas operations on the environmental situation and health of the population of Western Kazakhstan	Kazakh Scientific Research Centre for Oncology and Radiology	01.01.1999	01.01.2002
"Caspian pipeline consortium K" Work project for reclamation	GosNPTSzem	01.04.1999	01.07.1999
Development of the methods for increase of oil production levels and reduction of environmental impact as a result of oil operations in the Western Kazakhstan	D.A. Kunayev Institute of Mining	01.01.1999	31.05.1999
Creating "Environment and natural resources" database for monitoring and control of the environmental situation in the country	Institute of Ecology and Sustainable Development	01.06.2001	01.01.2002
Preparation of a report on the environmental status of the Republic of Kazakhstan in Internet in the framework of GRIDA	Institute of Ecology and Sustainable Development	01.01.1999	31.12.1998
Portfolio of the priority investments	The World Bank	01.07.2000	30.06.2003
Ecotox	Caspian Environment Prog.	01.09.1999	31.05.2002

6.2.2 World Bank

The World Bank has been funding projects in the environment / natural resources field in Kazakhstan for many years. Examples of on-going projects in this sector are as follows:

- Dam for restoration of the northern Aral Sea (increasing level from 39m to 42m).

- Management of pine forests in eastern Kazakhstan (to address illegal logging).
- Dryland management pilot project with GEF (to return to livestock production).
- Irrigation & Drainage Project, IDP (IDP1 $80 million completed; IDP2 $120 million)
- Solid waste management – Astana pilot project under discussion.
- Environmental amelioration in Uskinmagorsk industrial city in eastern Kazakhstan.
- WB-RK matched funds for research; fund currently $4 million.

None of the World Bank funding currently concerns the environment of the Caspian Sea or its pollution by the oil industry. However, the Bank has expressed an interest in maintaining contact with the current JICA initiative and is keen to be involved with activities that might be appropriate.

6.2.3 EBRD

EBRD is also active in Kazakhstan, but it is concerned almost exclusively with investment in major physical projects through the provision of loans or equity (€ 950 million in 13 years). All of its projects are required to comply with EBRD environmental safeguard policies, but none of the projects relates to the field of interest of the present JICA project.

6.2.4 ADB

As the EBRD has moved east into Central Asia, so the Asian Development Bank (ADB) has moved west into the same region, and is currently active in Kazakhstan. ADB currently has three main environment-related activities in Kazakhstan, but none of them is related to the environment of the Caspian Sea or its pollution by the oil industry. The activities are as follows:

- Central Asian Countries Initiative for Land Management (CACILM)
- Capacity Building in Environmental Information Management Systems (EMIS) in Central Asia (TA 6155-REG). This is of relevance to the JICA project because the beneficiary organization in Kazakhstan is KAZHYDROMET, and it has involved training in GIS.
- Environmental Monitoring & Information Management Systems in Southern Kazakhstan (TA 4375-KAZ). This project, which started in August 2006, will be of some relevance to the JICA project because the local beneficiary organisation is MoEP, and the focus is on EMIS.

6.2.5 USAID

USAID has funded various capacity-building initiatives in the oil and gas sector since 1995. These have included environmentally relevant topics such as oil spill prevention and response, the clean-up of oil contaminated land and sectoral HSE requirements. USAID has continued to lobby for clarity and transparency in the fields of permitting, fees/fines and enforcement, and has provided technical support for improvement in this area. Most of the USAID work has been conducted under their Central Asia Natural Resources Management Program (NRMP), which ended in 2005.

Within the NRMP, the U.S. Minerals Management Service (MMS) ran a two-year capacity-building programme in Kazakhstan on environmental and safety management in the offshore oil industry, including EIA, contingency planning and oil spill response. This included training seminars and visits to the USA, and achieved some amendments to Kazakh environmental regulations. At the end of 2003, MMS ran a workshop which introduced Kazakh officials to modern techniques of offshore oil exploration and production, and the internationally recognised methods of inspection and enforcement. Participants at the

workshop included, inter alia, representatives of MoEP. The USAID workshop was a single three-day event in the capital. The experience of NRMP is valuable to the present study.

6.2.6 DFID

The UK's DFID has withdrawn from Kazakhstan, but the UK Foreign & Commonwealth Office (FCO), as represented by the British Embassy, still has a strong interest in the country. It is not funding any projects in relation to environmental management or protection of the Caspian, but it has an interest in the oil industry because of British commercial involvement in that sector.

6.2.7 JICA

In the environmental field, apart from the present study, JICA (Japan International Cooperation Agency) is implementing another project in Karaganda for the monitoring of mercury pollution. JICA also provides some valuable training programs, and last year three Kazakh experts from KAZHYDROMET and MoEP went to Japan for technical training on environmental monitoring. JICA's activities in Kazakhstan are expected to increase in the coming years once the agency's main office is established in Astana.

6.2.8 JBIC

The "Atyrau Refinery Reconstruction Project" aims to modernize the Atyrau Refinery for production of high octane gasoline and low sulfur diesel oil. The project is implemented by Kazakh Oil (KazMunaiGas) using JBIC (Japan Bank for International Cooperation) buyer's credit totalling 25 billion yen for the procurement of equipment from JGC and Marubeni Corporation. The project is co-financed with BNP Paribas and HSBC. Construction of the plant was completed in May 2006, and the plant is preparing to start–up operation.

Table 6.2.2 Capacity of the Reconstructed Atyrau Refinery

Unit	Capacity	Remarks
Naphtha hydro-treatment unit	13,000 barrel/day	–
Naphtha splitter unit	25,000 barrel/day	–
Isomerization unit	5,500 barrel/day	–
Diesel oil desulfurization and dewaxing unit	28,000 barrel/day	–
Hydrogen manufacturing unit	4,000 tonnes/year*	*Hydrogen production
Amine unit	N/A	–
Sour waste stripper	N/A	–
Sulfur recovery unit	26 tonnes/day*	*Sulfur production
Waste water treatment unit	N/A	Active sludge

Source：News release from JGC (2001) etc

The environmental facilities of the project include the sulfur recovery unit (without a tail gas treatment facility) and sulfur will be recovered as granular sulfur and shipped to market. The process water will be treated by a sour water stripper and will have secondary treatment, along with other waste water, by active sludge bio-treatment. The treated water will be reused as make-up water for the cooling tower, and this will halt the discharge of wastewater to the

evaporation pond. These environmental measures are often adopted in similar projects, and the selection of the technologies is appropriate. If the ambient air quality worsens, a tail gas treatment unit may be required.

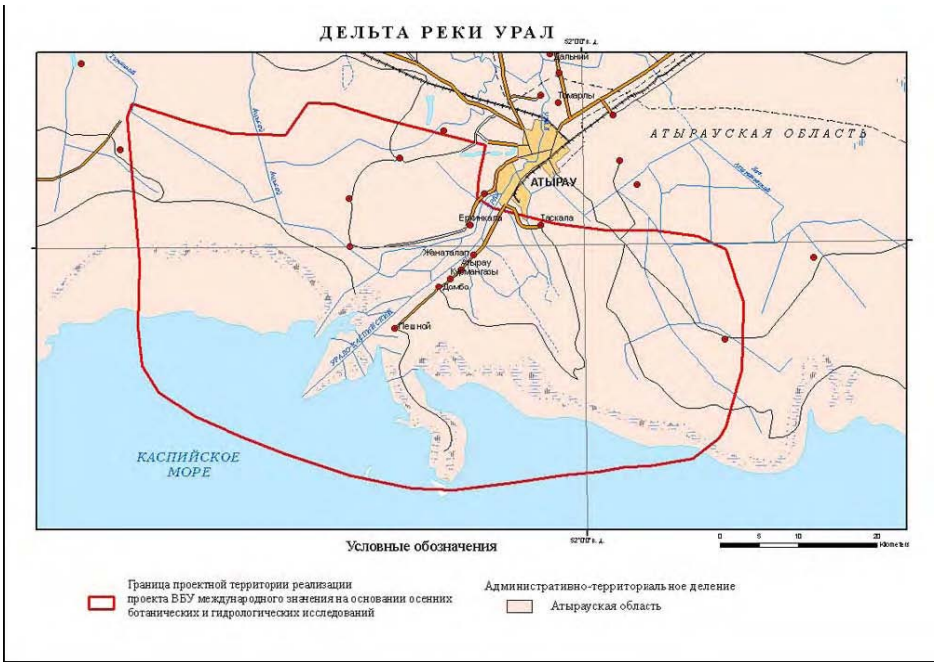
New plant of Atyrau refinery

Waste water outlet in evaporation pond

Figure 6.2.1 Photographs of the Atyrau Refinery and Evaporation Pond

6.2.9 UNDP

The project "Integrated Conservation of Priority Globally Significant Wetlands as the Habitat of Migrating Water Birds: Demonstration on Three Project Sites" started in July 2004. The project started in July 2004 and has a planned duration of 7 years. It is funded by the Global Environmental Facility through UNDP in Kazakhstan. The Forestry and Hunting Committee (FHC) of the Ministry of Agriculture is the implementing organization. The Ural River Delta is one the three sites selected, and the project has been trying to establish a National Nature Reserve (NNR) in the area outlined in red in the figure below (source: http://www.wetlands.kz). This NNR has now been identified as a Specially Protected Natural Area in the new Environmental Code of Kazakhstan, which defines the restrictions on activities within the NNR. In May 2007, the Forest and Hunting Committee has approved the feasibility study for establishment of "Ak-zhaiyk" Nature Reserve.



Source: http://www.wetlands.kz

Figure 6.2.2 Proposed Area for Ural Delta Nature Reserve

6.2.10 OECD/EAP

In November 2006, OECD/EAP carried out a seminar in Atyrau entitled "Improving environmental regulation and control of offshore oil and gas activities". This is a part of the multilateral co-operation within the EAP's framework of "Environment for Europe", and the bilateral co-operation between the Kazakh Committee for Environmental Control and the Norwegian Pollution Control Authority (SFT). The objectives of the seminar were to:

- Introduce international best practice of environmental regulation and control to various stakeholders
- Provide more detail about Norway's experience of environmental regulation and control, in particular as applied to oil and gas extraction enterprises, and
- Discuss some specific requirements of the draft Environmental Code of Kazakhstan

Obviously, this initiative by OECD and the Norwegian government is highly relevant to the present study, and the team has tried to co-ordinate with the OECD/EAP team.

6.2.11 EC-NESSD

This project by European Commission (EC) aims to develop National Environmental Strategies for Sustainable Development (NESSD) for Kazakhstan, Kyrgyzstan and Tajikistan. The main components of the ESSD project are:

- Raise awareness of the need for environmental planning and protection in the target countries;
- Improve the capacity of administrations and other representative bodies to undertake environmental strategy planning and implementation of programmes that deliver sustainable development ;
- Support the beneficiaries to deepen and implement the overall national environmental strategy for sustainable development, taking into account as well the real national economic, social, and environmental conditions ;
- Support environmental strategy planning in one key area in the full administrative cycle extending from the national level out towards the local communities ;
- Build a regional vision of environmental cooperation and the sharing of transboundary resources

In Kazakhstan, NESSD project is providing advices to MoEP on development of National Environmental Programme 2008-2010, and also implementing capacity development in Mangistau oblast (see http://www.nessd.eu).

6.3 Conclusion

Discussions indicated that there is a great deal of goodwill for the present JICA initiative amongst all of the donors consulted. All requested to be kept informed of progress and involved in any relevant workshops or downstream activities. This network of goodwill will help to create a supportive environment for implementation of the recommendations resulting from the study.