
DATA BOOK 4
FINAL DISPOSAL AND
ENVIRONMENTAL STUDY

**THE STUDY ON
SOLID WASTE MANAGEMENT
FOR ALMATY CITY
IN THE REPUBLIC OF KAZAKHSTAN**

DATA BOOK 4

FINAL DISPOSAL AND ENVIRONMENTAL STUDY

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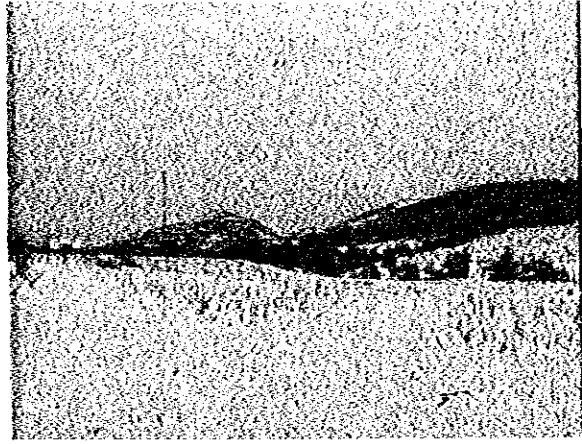
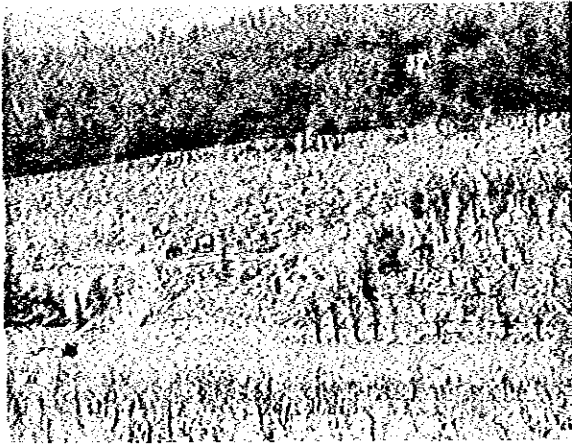
CHAPTER 1
PHOTOGRAPHS OF ILLEGAL DUMPSITES
IN ALMATY CITY



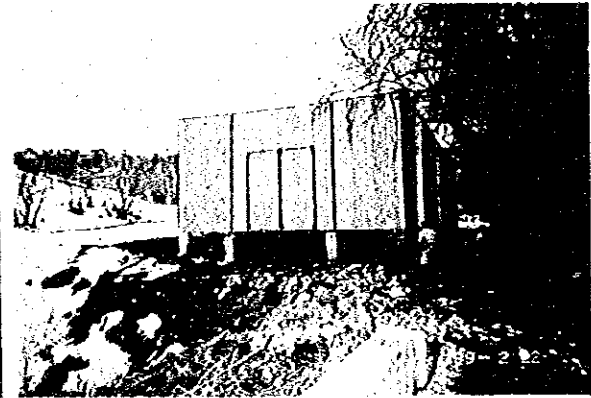
No. 1 Remisovka, south from Al-Farabi Ave., Bostandysky



No. 2 South-west of a botanical garden, south from Al-Farabi Ave.,
Bostandysky



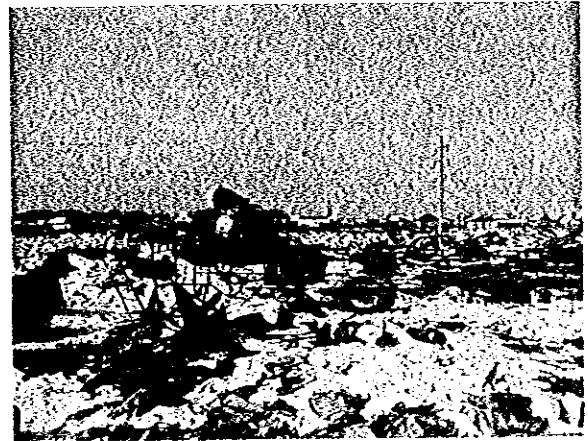
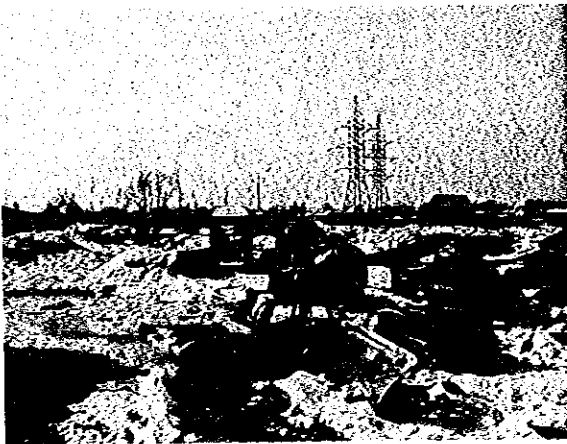
No. 3 South from Kok-Tobe Mountain, 1km west to Dostyk Ave., Medeusky



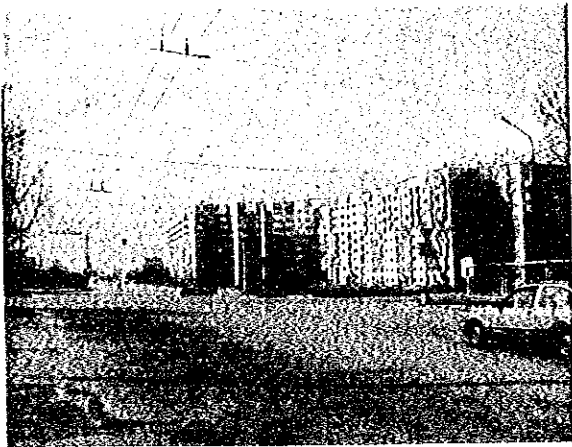
No. 4 A construction lot between "Turksib" Sanatorium and dwelling blocks/dachas, along Gornaya St., Medeusky



No.5 South-west from Zhetysu residential are, north side of Abai Ave.,
Auezovsky



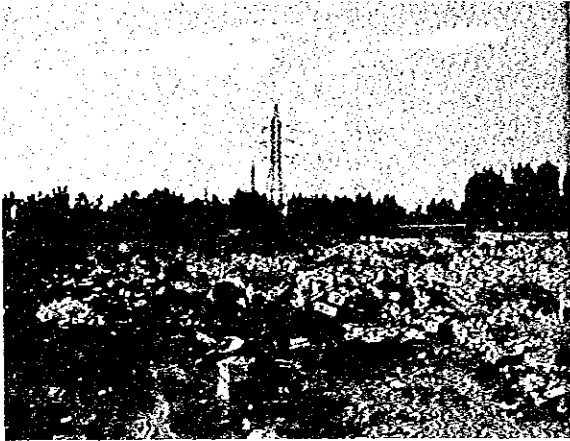
No.6 North of Ryskulov Ave., south edge of Shanyrak AK-4, Auezovsky



No. 7 Zhubanov-Saina St. cross-section, Auezovsky



No. 8 Territory of "Wallihan" KSK between Nurmakov-Ayteke and Bi-Kazaybek St., Almalinsky



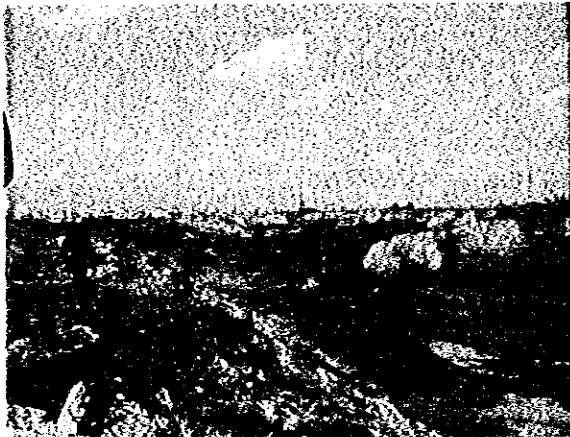
No. 9 North of Raiymbek Ave. west side of the city cemetery, Almalinsky



No. 10 Ten dump sites between railways, and Semipalatinskaya St. and Ryskulov Ave., Zhetysusky



No. 11 South of a sludge retention pond from the water heating station, north of Ryskulov Ave., Zhetysusky



No. 12 Shanyrak-1, along Bolshy Almatinka River, Zhetysusky



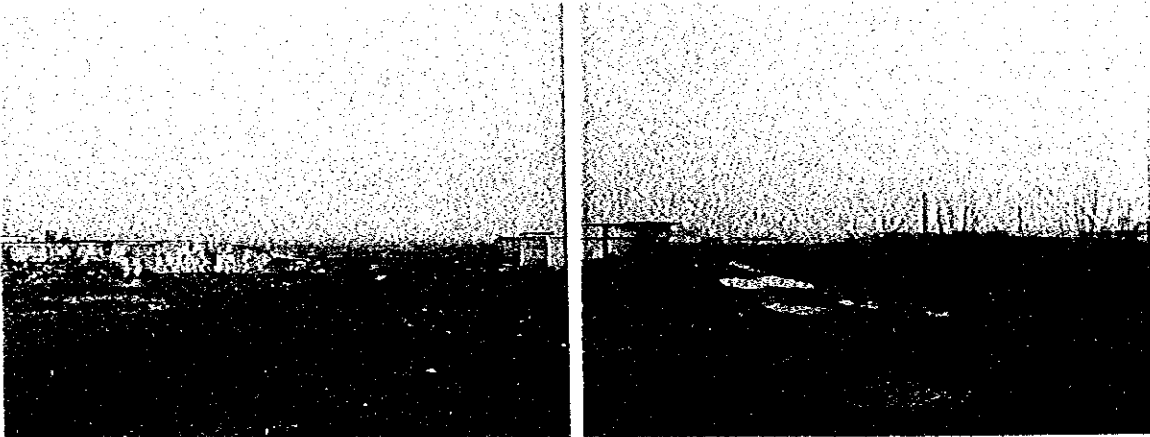
No. 13 North side of Kulagher residential area, close to Sultanka River and a horse race field, Zhetysusky



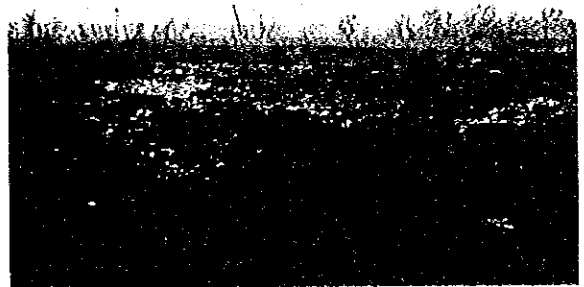
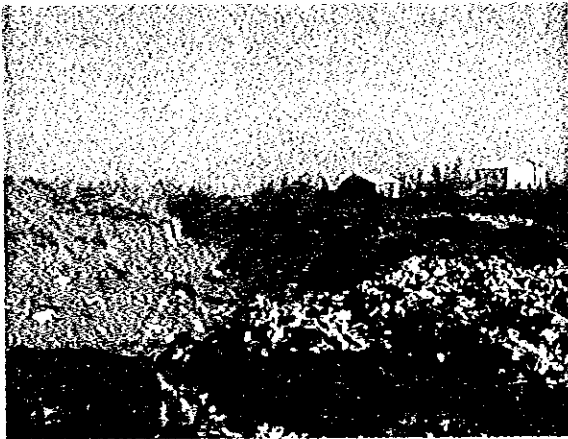
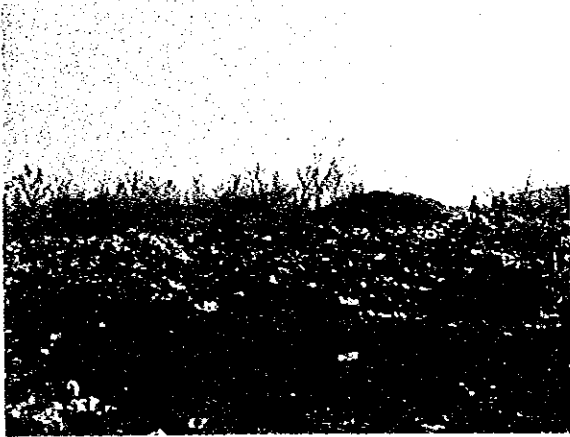
No. 14 Zhansugirov St. along Sultanka River, Zhetysusky



No. 15 70th Raz'ezd, Ostroumov St., neighbouring to the military base, Truksibsky



No. 16 Spasskaya St., north side of residential area between drainage and KNS DKP along the high voltage main, Truksibsky



No. 17 Next to the above No. 15 and KNS DKP, power Supply under the site,
Truksibsky

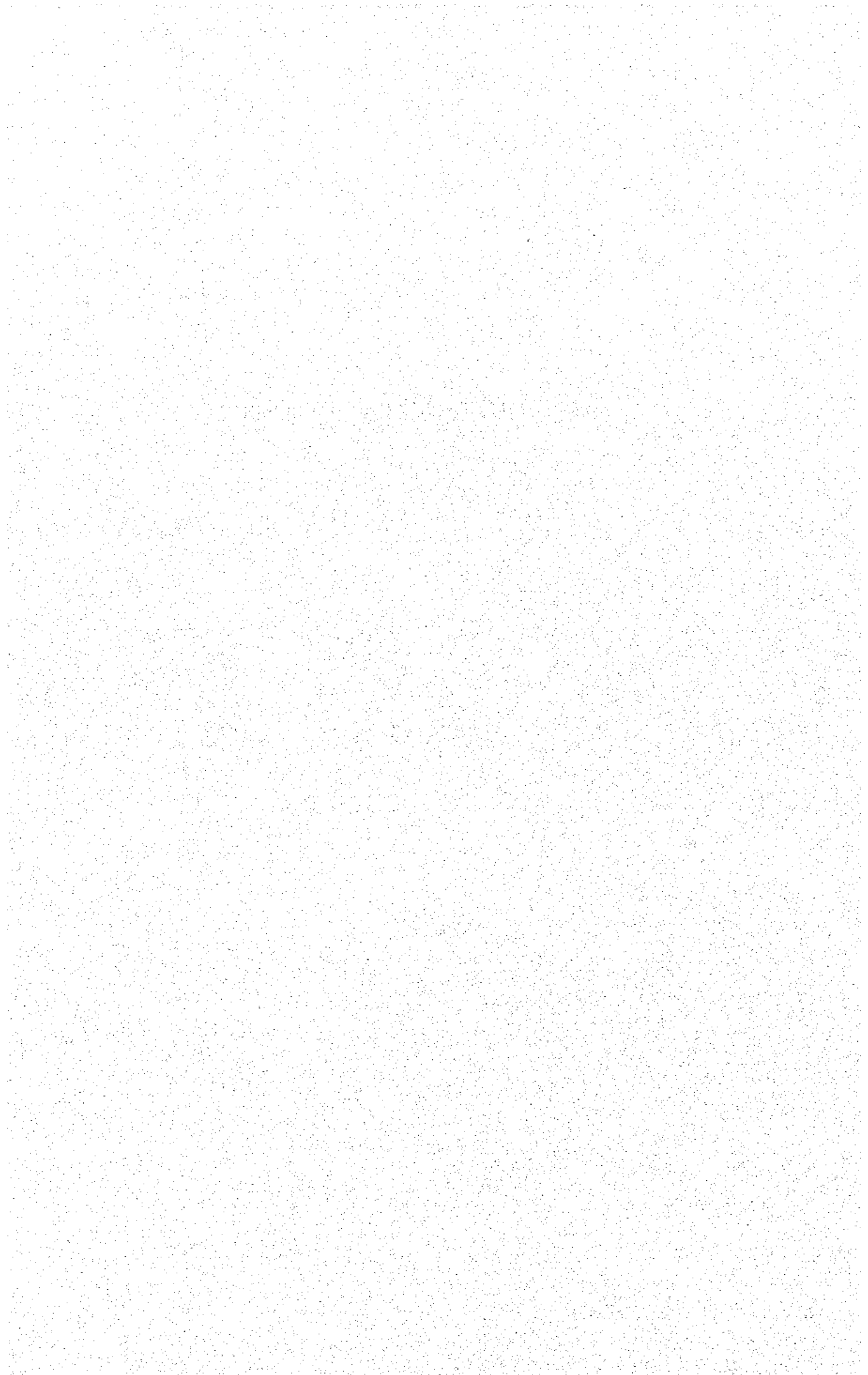


No. 18 From the east to the north-west of Parhach Lake, Turksibsky



No. 19 Roadside of Krasnogvardeiskaya St., along a riverbank of Karasu River, Turksibsky

CHAPTER 2
ENVIRONMENTAL QUALITY
OF
ALMATY CITY



2.1 WATER QUALITY

Table 2.1.1 (1/3) Records of Surface Water Pollution Monitoring in the Malaya Almatinka River

Pollutants & Water Quality Indices	Monitoring Sites for Water Quality in Almaty City															
	2 km upstream of the city boundary						4 km downstream of the city boundary, in Pokrovka						River mouth, 0.5 km downstream of the Radio station No.5			
	6/11/98	17/11/98	1/12/98	16/12/98	6/11/98	17/11/98	1/12/98	16/12/98	6/11/98	17/11/98	1/12/98	16/12/98	6/11/98	17/11/98	1/12/98	16/12/98
Water discharge (m ³ /s)	1.30	0.75	0.69	0.63	1.54	2.48	1.01	1.34	2.48	3.22	4.42	3.28	138.4	19.6	131.2	159.0
Suspended Solids (mg/l)	4.2	0.3	1.4	3.6	79.8	3.7	120.6	8.8	138.4	19.6	131.2	159.0	10.4	5.8	0.6	3.6
Temperature (°C)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Color	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Odor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
pH	7.55	7.57	7.57	7.60	7.60	7.57	7.60	7.57	7.80	7.57	7.60	7.57	7.80	7.57	7.60	7.57
Hardness (mg/3KB)	1.08	1.29	2.08	2.87	2.70	2.18	4.21	3.62	3.47	1.87	4.42	3.79	3.47	1.87	4.42	3.79
Mineral: major ions (mg/l)	113	135	240	305	249	705	369	347	242	527	425	462	242	527	425	462
Dissolved Oxygen (mg/l)	11.7	10.9	11.9	12.1	10.6	10.5	11.2	11.8	10.2	10.3	12.2	10.3	10.2	10.3	12.2	10.3
BOD ₅ (mg/l)	0.99	0.65	0.86	1.14	1.26	0.74	1.16	1.60	1.44	0.85	1.28	1.82	1.44	0.85	1.28	1.82
COD (mg/l)	8.8	18.70	21.1	25.0	11.5	16.7	16.7	20.2	10.4	20.8	16.3	17.3	10.4	20.8	16.3	17.3
CO ₂ (mg/l)	1.0	1.0	1.0	1.0	1.3	1.3	1.3	1.3	1.0	1.0	0.0	1.3	1.0	1.0	0.0	1.3
Ammonium ions (mg/l)	0.03	0.04	0.05	0.04	0.03	0.07	0.08	0.08	0.08	0.09	0.08	0.07	0.08	0.09	0.08	0.07

Table 2.1.1 (2/3) Records of Surface Water Pollution Monitoring in the Malaya Almatinka River (Cont'd)

Pollutants & Water Quality Indices	Monitoring Sites for Water Quality in Almaty City													
	2 km upstream of the city boundary				4 km downstream of the city boundary, in Pokrovka				River mouth, 0.5 km downstream of the Radio station No.5					
	6/11/98	17/11/98	1/12/98	16/12/98	6/11/98	17/11/98	1/12/98	16/12/98	6/11/98	17/11/98	1/12/98	17/11/98	1/12/98	16/12/98
Nitrate (mg/l)	0.34	0.69	0.48	0.83	0.57	0.81	0.48	3.37	3.97	0.81	0.82	0.81	0.82	4.15
Nitrite (mg/l)	0.044	0.006	0.016	0.020	0.068	0.032	0.018	0.026	0.034	0.032	0.022	0.032	0.022	0.034
Fluoride (mg/l)	0.70	0.62	0.75	0.62	0.81	0.81	0.99	1.07	1.31	0.76	1.18	0.76	1.18	1.14
Phosphate (mg/l)	0.006	0.008	0.006	0.007	0.024	0.0011	0.007	0.010	0.024	0.0013	0.010	0.0013	0.010	0.013
Fe (mg/l)	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.10	0.04	0.00	0.00	0.00	0.00	0.11
Fe ₂ (mg/l)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.04
Fe ₃ (mg/l)	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.07	0.04	0.00	0.00	0.00	0.00	0.07
Copper (mg/l)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.002	0.000
Zinc (mg/l)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.004	0.002
Nickel (mg/l)	0.9	1.2	0.9	1.0	1.5	1.7	3.5	1.5	0.0	0.0	2.4	0.0	2.4	0.0
Calcium (mg/l)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0
Lead (mg/l)	0.0	2.0	1.3	2.3	2.1	2.2	2.4	2.4	2.0	2.3	2.7	2.3	2.7	2.6
Phenol Volatile (mg/l)	0.000	0.000	0.000	0.000	0.001	0.002	0.000	0.002	0.001	0.002	0.001	0.002	0.001	0.002

Table 2.1.1 (3/3) Records of Surface Water Pollution Monitoring in the Malaya Almatinka River (Cont'd)

Pollutants & Water Quality Indices	Monitoring Sites for Water Quality in Almaty City													
	2 km upstream of the city boundary				4 km downstream of the city boundary, in Pokrovka				River mouth, 0.5 km downstream of the Radio station No.5					
	6/11/98	17/11/98	1/12/98	16/12/98	6/11/98	17/11/98	1/12/98	16/12/98	6/11/98	17/11/98	1/12/98	16/12/98		
Petroleum Products (mg/l)	0.02	0.02	0.02	0.02	0.05	0.03	0.03	0.03	0.05	0.04	0.04	0.04		
Fat (mg/l)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Organic Chlorine: Pesticide														
П, П' ДДА (mg/l)	NR	0.002	0.000	0.000	NR	0.000	0.000	0.000	NR	0.000	0.000	0.000		
П, П' ДДЗ (mg/l)	NR	0.003	0.000	0.000	NR	0.002	0.000	0.000	NR	0.000	0.000	0.000		
П, П' ДДТ (mg/l)	NR	0.002	0.001	0.000	NR	0.000	0.000	0.000	NR	0.000	0.000	0.003		
α-ГХЦГ (mg/l)	NR	0.001	0.000	0.000	NR	0.000	0.000	0.000	NR	0.000	0.000	0.002		
γ-ГХЦГ (mg/l)	NR	0.001	0.000	0.000	NR	0.000	0.000	0.002	NR	0.000	0.000	0.004		
β-ГХЦГ (mg/l)	NR	0.001	0.000	0.000	NR	0.000	0.000	0.000	NR	0.000	0.000	0.002		
Дикофол (mg/l)	NR	0.006	0.003	0.000	NR	0.002	0.004	0.004	NR	0.003	0.004	0.007		
ГХБ (mg/l)	NR	0.001	0.000	0.000	NR	0.000	0.000	0.000	NR	0.000	0.000	0.000		

Source: Republican State Enterprise Kazhydromet, "Information Bulletin on the State of Environment Pollution in Almaty City," November and December 1998.
 Note: NR stands for "No Records."

Table 2.1.2 (1/3) Records of Surface Water Pollution Monitoring in the Bolshaya Almatinka River

Pollutants & Water Quality Indices	Monitoring Sites for Water Quality in Almaty City															
	9.1 km upstream of the city boundary				0.5 km downstream of AHBK				0.5 km upstream of the city boundary				12 km upstream of the river mouth			
	9/11/98	18/11/98	2/12/98	17/12/98	9/11/98	18/11/98	2/12/98	17/12/98	9/11/98	18/11/98	2/12/98	17/12/98	9/11/98	18/11/98	2/12/98	17/12/98
Water discharge (m ³ /s)	1.22	0.44	0.46	0.46	0.64	0.45	0.54	1.77	0.62	0.26	0.58	0.78	0.62	1.62	4.26	3.55
Suspended Solids (mg/l)	28.8	1.51	2.9	4.8	227.8	33.8	172.5	10.7	214.0	58.5	201.5	43.2	210.9	71.5	307.3	176.6
Temperature (°C)	7.8	4.6	0.4	4.2	9.8	7.8	1.4	5.6	9.6	6.0	0.6	3.4	11.0	5.2	0.8	3.0
Color	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Odor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
pH	7.55	7.57	7.60	7.57	7.55	7.57	7.60	7.60	7.55	7.57	7.57	7.57	7.55	7.57	7.57	7.77
Hardness (mg/3KB)	1.21	1.40	2.42	2.83	1.40	1.94	3.29	2.96	1.68	2.20	3.67	4.04	2.54	2.52	3.75	4.83
Mineral: major ions (mg/l)	137	179	232	300	208	330	385	350	375	440	446	361	267	583	511	414
Dissolved Oxygen (mg/l)	11.9	10.4	11.5	12.0	10.1	9.86	11.2	11.5	9.54	9.82	10.5	10.8	9.22	9.63	10.3	10.4
BOD ₅ (mg/l)	1.01	0.81	0.70	1.14	1.12	0.93	1.14	1.29	1.17	1.08	1.148	1.45	1.22	1.23	1.43	1.53
COD (mg/l)	7.81	17.7	18.3	27.9	13.5	18.7	16.3	21.1	12.5	12.0	16.3	23.1	12.0	14.6	12.5	20.2
CO ₂ (mg/l)	1.0	1.0	1.0	1.0	NR	NR	1.3	1.0	NR	NR	1.3	1.3	1.3	NR	1.3	1.3
Ammonium ions (mg/l)	0.04	0.04	0.04	0.05	0.05	0.14	0.05	0.10	0.06	0.13	0.05	0.11	0.09	0.12	0.07	0.09

Table 2.1.2 (2/3) Records of Surface Water Pollution Monitoring in the Bolshaya Almatinka River (Cont'd)

Pollutants & Water Quality Indices	Monitoring Sites for Water Quality in Almaty City															
	9.1 km upstream of the city boundary				0.5 km downstream of AHBK				0.5 km upstream of the city boundary				12 km upstream of the river mouth			
	9/11/98	18/11/98	2/12/98	17/12/98	9/11/98	18/11/98	2/12/98	17/12/98	9/11/98	18/11/98	2/12/98	17/12/98	9/11/98	18/11/98	2/12/98	17/12/98
Nitrate (mg/l)	0.44	0.75	0.62	0.94	0.20	1.37	1.15	3.64	0.17	2.33	1.67	3.32	2.84	1.47	1.99	3.95
Nitrite (mg/l)	0.060	0.000	0.000	0.018	0.014	0.030	0.010	0.042	0.038	0.028	0.012	0.040	1.320	0.052	0.014	0.054
Fluoride (mg/l)	0.78	0.68	0.92	0.75	0.64	0.86	0.60	0.93	0.47	0.86	0.67	1.00	1.19	0.80	0.56	1.18
Phosphate (mg/l)	0.020	0.028	0.008	0.011	0.030	0.014	0.036	0.013	0.030	0.016	0.048	0.017	0.030	0.018	0.050	0.018
Fe (mg/l)	0.04	0.00	0.00	0.00	0.09	0.20	0.00	0.04	0.11	0.28	0.20	0.07	0.07	0.32	0.28	0.07
Fe ₂ (mg/l)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.00	0.00	0.04	0.04
Fe ₃ (mg/l)	0.04	0.00	0.00	0.00	0.09	0.20	0.00	0.04	0.11	0.28	0.16	0.03	0.07	0.32	0.24	0.03
Copper (mg/l)	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.002	0.000
Zinc (mg/l)	0.000	0.000	0.000	0.000	0.004	0.002	0.000	0.001	0.004	0.003	0.000	0.002	0.000	0.003	0.002	0.002
Nickel (mg/l)	6.0	9.0	2.1	7.1	2.2	3.3	1.8	3.5	2.3	2.8	0.3	3.1	1.8	2.0	1.5	1.8
Calcium (mg/l)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Lead (mg/l)	2.5	3.0	2.4	3.2	2.0	2.4	2.0	2.7	2.5	3.1	2.2	3.5	0.0	0.0	0.85	0.0
Phenol Volatile (mg/l)	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.001	0.002	0.002	0.002

Table 2.1.2 (3/3) Records of Surface Water Pollution Monitoring in the Bolshaya Almatinka River (Cont'd)

Pollutants & Water Quality Indices	Monitoring Sites for Water Quality in Almaty City															
	9.1 km upstream of the city boundary				0.5 km downstream of AHBK				0.5 km upstream of the city boundary				12 km upstream of the river mouth			
	9/11/98	18/11/98	2/12/98	17/12/98	9/11/98	18/11/98	2/12/98	17/12/98	9/11/98	18/11/98	2/12/98	17/12/98	9/11/98	18/11/98	2/12/98	17/12/98
Petroleum Products (mg/l)	0.05	0.02	0.02	0.03	0.09	0.11	0.10	0.11	0.09	0.13	0.13	0.12	0.01	0.11	0.11	0.13
Fat (mg/l)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Organic Chlorine: Pesticide																
П, П' ДДА (mg/l)	NR	0.000	0.000	0.000	NR	0.000	0.000	0.000	NR	0.000	0.000	0.000	NR	0.001	0.000	0.000
П, П' ДДЗ (mg/l)	NR	0.002	0.000	0.000	NR	0.003	0.002	0.004	NR	0.003	0.000	0.000	NR	0.001	0.002	0.000
П, П' ДДТ (mg/l)	NR	0.000	0.000	0.000	NR	0.000	0.003	0.010	NR	0.000	0.000	0.004	NR	0.000	0.005	0.002
α-ГХЦГ (mg/l)	NR	0.000	0.000	0.000	NR	0.000	0.000	0.000	NR	0.000	0.000	0.000	NR	0.001	0.000	0.000
γ-ГХЦГ (mg/l)	NR	0.000	0.000	0.000	NR	0.000	0.000	0.000	NR	0.000	0.000	0.000	NR	0.001	0.000	0.000
β-ГХЦГ (mg/l)	NR	0.000	0.000	0.000	NR	0.000	0.000	0.000	NR	0.000	0.000	0.000	NR	0.000	0.000	0.000
Дикофол (mg/l)	NR	0.000	0.000	0.000	NR	0.002	0.011	0.015	NR	0.003	0.010	0.008	NR	0.001	0.016	0.004
ГХБ (mg/l)	NR	0.000	0.000	0.000	NR	0.000	0.000	0.000	NR	0.000	0.000	0.000	NR	0.000	0.000	0.000

Source: Republican State Enterprise Kazhydromet, "Information Bulletin on the State of Environment Pollution in Almaty City," November and December 1998.
 Note: NR stands for "No Records."

**Table 2.1.3 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Malaya Almatinka River: 2 km upstream of the city boundary**

Parameter	Maximum Allowable Concentration Factor (PDK)*													
	Year	Month												
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.
Discharge (m ³ /s)	1988	-	-	-	-	-	-	-	-	-	-	1.20	-	1.20
	1989	0.83	0.80	-	-	-	1.06	1.83	-	1.53	-	-	-	1.21
	1990	0.81	0.71	0.64	0.66	1.11	1.88	2.50	3.87	2.55	-	-	0.97	1.57
	1991	-	0.67	0.66	0.72	0.84	1.52	-	4.12	2.17	-	0.97	0.88	1.39
	1992	0.76	0.67	0.68	0.65	0.70	1.54	1.76	1.65	3.40	1.53	1.19	0.84	1.28
	1993	-	-	-	-	-	2.34	-	2.65	3.35	2.20	1.39	1.20	2.19
	1994	0.90	0.78	-	-	-	2.12	3.04	-	-	-	-	1.04	1.58
	1995	0.79	0.70	-	0.72	1.70	-	1.81	-	2.26	1.58	1.15	-	1.34
	1998	-	-	-	-	-	-	-	-	-	-	1.03	0.66	0.85
	Average	0.82	0.72	0.66	0.69	1.09	1.74	2.19	3.07	2.54	1.77	0.96	0.93	1.40
Water Temperature (°C)	1988	-	-	-	-	-	-	-	-	-	-	2.6	-	2.6
	1989	1.2	1.4	-	-	-	5.8	5.4	-	5.2	-	-	-	3.8
	1990	1.3	1.6	0.8	1.8	4.2	6.4	6.2	7.2	5.8	-	-	1.8	3.7
	1991	-	1.4	1.6	2.6	2.1	7.4	-	7.2	6.2	-	1.4	1.8	3.5
	1992	1.4	1.8	1.2	2.6	1.8	7.4	6.4	6.4	6.2	2.8	2.3	0.9	3.4
	1993	-	-	-	-	-	5.4	-	6.2	5.2	2.8	1.8	0.9	3.7
	1994	1.1	1.2	-	-	-	8.2	6.8	-	-	-	-	0.1	3.5
	1995	1.4	2.1	-	2.3	5.6	-	7.9	-	7.4	5.9	2.5	-	4.4
	1998	-	-	-	-	-	-	-	-	-	-	4.4	1.8	3.1
	Average	1.3	1.6	1.2	2.3	3.4	6.8	6.5	6.8	6.0	3.8	2.1	1.2	3.5
NH ₄	1988	-	-	-	-	-	-	-	-	-	-	0.0	-	0.0
	1989	0.0	0.0	-	-	-	0.1	0.1	-	0.1	-	-	-	0.1
	1990	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	-	-	0.0	0.0
	1991	-	0.0	0.0	0.0	0.1	0.1	-	0.1	0.05	-	0.0	0.0	0.0
	1992	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
	1993	-	-	-	-	-	0.0	-	0.13	0.0	0.0	0.1	0.08	0.1
	1994	0.10	0.18	-	-	-	0.15	0.18	-	-	-	-	0.00	0.1
	1995	0.05	0.13	-	0.15	0.08	-	0.15	-	0.10	0.15	0.18	-	0.1
	1998	-	-	-	-	-	-	-	-	-	-	0.1	0.1	0.1
	Average	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.1
NO ₂	1988	-	-	-	-	-	-	-	-	-	-	0.0	-	0.0
	1989	0.0	0.0	-	-	-	0.0	0.0	-	0.0	-	-	-	0.0
	1990	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	-	-	0.0	0.1
	1991	-	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	-	0.0	0.3	0.0
	1992	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.4	0.3	0.3	0.0	0.0	0.1
	1993	-	-	-	-	-	0.0	-	0.00	6.0	0.3	1.5	1.5	1.6
	1994	0.0	0.0	-	-	-	0.7	0.9	-	-	-	-	0.0	0.3
	1995	1.2	0.0	-	0.6	0.0	-	0.9	-	0.5	0.6	0.25	-	0.5
	1998	-	-	-	-	-	-	-	-	-	-	0.9	1.3	1.1
	Average	0.2	0.0	0.0	0.2	0.0	0.2	0.6	0.1	1.1	0.4	0.4	0.5	0.4
NO ₃	1988	-	-	-	-	-	-	-	-	-	-	0.1	-	0.1
	1989	0.1	0.1	-	-	-	0.0	0.1	-	0.1	-	-	-	0.1
	1990	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-	-	0.2	0.1
	1991	-	0.4	0.0	0.1	0.1	0.0	-	0.1	0.08	-	0.0	0.1	0.1
	1992	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.1
	1993	-	-	-	-	-	0.1	-	0.09	0.1	0.10	0.10	0.07	0.1
	1994	0.13	0.07	-	-	-	0.03	0.01	-	-	-	-	0.04	0.1
	1995	0.05	0.06	-	0.09	0.01	-	0.05	-	0.03	0.03	0.08	-	0.1
	1998	-	-	-	-	-	-	-	-	-	-	0.1	0.05	0.1
	Average	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1

**Table 2.1.3 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Malaya Almatinka River: 2 km upstream of the city boundary**

Parameter	Maximum Allowable Concentration Factor (PDK)*												
	Year	Month											
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Phenol	1988	-	-	-	-	-	-	-	-	-	0.0	-	0.0
	1989	0.0	0.0	-	-	-	0.0	0.0	-	0.0	-	-	0.0
	1990	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	5.0
	1991	-	0.0	0.0	0.0	1.1	5.0	-	3.0	7.0	-	0.0	0.0
	1992	0.0	5.0	13.0	1.0	0.0	16.0	1.0	0.0	11.0	5.0	8.0	0.0
	1993	-	-	-	-	-	0.0	-	4.0	5.0	1.0	0.0	2.0
	1994	2.0	0.0	-	-	-	1.0	0.0	-	-	-	-	1.0
	1995	2.0	2.0	-	0.0	0.0	-	0.0	-	1.0	1.0	3.0	-
	1998	-	-	-	-	-	-	-	-	-	-	0.0	0.0
	Average	1.0	1.3	4.7	0.3	0.3	3.7	0.2	1.8	4.0	2.3	1.8	1.3
Petroleum Products	1988	-	-	-	-	-	-	-	-	-	-	2.2	-
	1989	0.0	2.0	-	-	-	4.8	1.2	-	1.0	-	-	-
	1990	3.0	1.8	5.6	0.0	3.2	13.4	4.8	0.0	0.6	-	-	1.0
	1991	-	4.0	4.2	3.8	6.6	0.6	-	3.8	4.4	-	3.4	10.0
	1992	2.4	6.0	3.2	3.0	2.8	2.4	3.2	2.6	3.0	2.0	3.6	2.8
	1993	-	-	-	-	-	4.4	-	0.0	0.0	2.0	3.2	4.0
	1994	1.2	3.6	-	-	-	2.4	3.6	-	-	-	-	3.0
	1995	1.2	1.2	-	3.6	32.2	-	3.6	-	3.0	2.0	3.0	-
	1998	-	-	-	-	-	-	-	-	-	-	0.4	0.4
	Average	1.6	3.1	4.3	2.6	11.2	4.7	3.3	1.6	2.0	2.0	2.3	3.5
Fluoride	1988	-	-	-	-	-	-	-	-	-	-	1.1	-
	1989	0.6	-	-	-	-	1.0	-	-	-	-	-	-
	1990	1.3	-	-	0.7	-	0.2	-	0.4	0.9	-	-	-
	1991	-	1.5	-	1.3	-	1.1	-	0.9	0.93	-	1.3	-
	1992	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	0.8	-	1.0	0.5	1.0	0.39	-
	1994	0.39	-	-	-	-	1.60	-	-	-	-	-	-
	1995	0.48	-	-	1.56	-	-	-	-	0.13	-	1.28	-
	1998	-	-	-	-	-	-	-	-	-	-	0.9	0.85
	Average	0.7	1.5	-	1.2	-	0.9	-	0.8	0.6	1.0	0.8	0.9
Copper	1988	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-
	1990	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	-	-	-	-	-
	1992	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	0.0	-	0.00	0.0	3.0	0.0	-
	1994	0.0	-	-	-	-	0.0	0.0	-	-	-	-	-
	1995	1.2	-	-	0.0	-	-	-	-	0.0	-	0.0	-
	1998	-	-	-	-	-	-	-	-	-	-	0.0	0.0
	Average	0.6	-	-	0.0	-	0.0	0.0	0.0	0.0	3.0	0.0	0.0
Zinc	1988	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-
	1990	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	-	-	-	-	-
	1992	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	0.0	-	0.00	0.0	0.3	0.0	-
	1994	0.0	-	-	-	-	0.0	0.0	-	-	-	-	-
	1995	0.0	-	-	0.0	-	-	0.1	-	0.0	-	0.0	-
	1998	-	-	-	-	-	-	-	-	-	-	0.0	0.0
	Average	0.0	-	-	0.0	-	0.0	0.1	0.0	0.0	0.3	0.0	0.0

**Table 2.1.3 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Malaya Almatinka River: 2 km upstream of the city boundary**

Parameter	Maximum Allowable Concentration Factor (PDK)*														
	Year	Month												Av	
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.		
Water Pollution Index	1988	-	-	-	-	-	-	-	-	-	-	-	0.7	-	0.7
	1989	0.30	0.50	-	-	-	1.10	0.28	-	-	-	-	-	-	0.5
	1990	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1994	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1995	-	-	-	-	-	-	2.20	-	1.54	1.55	1.38	-	-	1.6
	1998	-	-	-	-	-	-	-	-	-	-	0.83	0.91	-	0.8
Average	0.3	0.5	-	-	-	1.1	1.2	-	1.5	1.6	0.7	0.9	-	0.9	
Water Classification	1988	-	-	-	-	-	-	-	-	-	-	-	II	-	-
	1989	II	II	-	-	-	III	I	-	-	-	-	-	-	-
	1990	-	-	-	-	-	-	III	III	-	-	-	-	III	-
	1991	-	III	III	III	III	III	-	III	III	-	III	III	III	-
	1992	III	III	V	III	III	VI	V	IV	III	II	III	II	-	-
	1993	-	-	-	-	-	III	-	III	III	III	III	III	III	-
	1994	II	III	-	-	-	V	III	-	-	-	-	-	III	-
	1995	II	III	-	III	IV	-	III	-	III	III	III	III	-	-
	1998	-	-	-	-	-	-	-	-	-	-	-	II	II	-

Source: Republican State Enterprise Kazhydromet, "Information Bulletin on the State of Environment Pollution in Almaty City," November and December 1998.

National Department of Hydrometeorology, Republic of Kazakhstan, "Information Bulletin on the State of Environment Pollution in Almaty City," 1995, 1994 and 1993.

State Committee of USSR on Hydrometeorology, Kazakhstan National Department of Hydrometeorology, "Report on the Pollution of Environment in Almaty City," 1990, 1989 and 1988.

**Table 2.1.4 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Malaya Almatinka River: 0.5 km downstream of a fur manufacturing**

Parameter	Maximum Allowable Concentration Factor (PDK)*													
	Year	Month												Ave.
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
Discharge (m ³ /s)	1988	-	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-
	1990	0.12	0.05	0.08	5.11	1.36	0.19	0.13	0.06	0.23	0.25	-	0.08	0.70
	1991	-	0.07	0.09	0.25	0.18	0.12	0.15	0.35	0.25	0.30	0.20	0.50	0.22
	1992	0.10	0.11	0.13	0.09	0.78	0.12	0.11	0.47	0.22	0.60	0.91	0.80	0.37
	1993	-	-	-	-	-	0.52	0.23	0.24	0.72	0.60	0.49	0.43	0.46
	1994	0.064	0.053	0.12	0.07	-	0.15	0.30	0.39	1.12	-	-	1.05	0.37
	1995	0.80	0.04	0.029	0.02	0.20	0.16	0.28	0.41	0.34	0.41	0.16	-	0.26
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-
	Average	0.27	0.06	0.09	1.11	0.63	0.21	0.20	0.32	0.48	0.43	0.44	0.57	0.40
Water Temperature (°C)	1988	-	-	-	-	-	-	-	-	-	-	-	-	
	1989	-	-	-	-	-	-	-	-	-	-	-	-	
	1990	5.2	6.0	8.2	12.7	12.0	14.2	20.4	12.4	12.0	10.5	-	6.0	10.9
	1991	-	5.7	7.5	6.2	17.0	15.0	20.0	14.6	11.4	13.0	4.2	3.6	10.7
	1992	6.0	7.8	8.0	12.0	11.0	16.0	17.1	13.9	7.7	9.3	8.4	0.4	9.8
	1993	-	-	-	-	-	16.2	14.0	12.2	12.2	7.0	4.2	1.6	9.6
	1994	0.3	6.2	2.8	4.6	-	16.0	12.4	12.0	8.6	-	-	8.4	7.9
	1995	5.4	7.2	4.2	10.2	14.6	13.4	14.4	16.2	10.6	8.4	10.4	-	10.5
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-
	Average	4.2	6.6	6.1	9.1	13.7	15.1	16.4	13.6	10.4	9.6	6.8	4.0	9.9
NH ₄	1988	-	-	-	-	-	-	-	-	-	-	-	-	
	1989	-	-	-	-	-	-	-	-	-	-	-	-	
	1990	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-	0.0	0.0
	1991	-	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.05	0.0	0.1	0.0	0.0
	1992	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.2	0.0	0.1
	1993	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.1	0.13	0.0
	1994	0.05	0.10	0.05	0.10	-	0.18	0.18	0.59	0.05	-	-	0.03	0.1
	1995	0.00	0.08	0.18	0.41	0.10	0.08	0.28	0.36	0.13	0.13	0.08	-	0.2
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-
	Average	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.2	0.0	0.0	0.1	0.0	0.1
NO ₂	1988	-	-	-	-	-	-	-	-	-	-	-	-	
	1989	-	-	-	-	-	-	-	-	-	-	-	-	
	1990	1.7	1.7	3.5	0.8	0.0	4.2	2.4	0.8	1.0	6.9	-	1.5	2.2
	1991	-	9.9	2.5	0.0	6.4	17.4	53.0	9.9	0.33	2.2	0.3	0.5	9.3
	1992	1.2	2.2	2.2	3.3	0.5	0.3	10.5	5.7	0.0	0.5	1.3	0.5	2.4
	1993	-	-	-	-	-	0.7	4.6	0.7	0.7	1.7	0.0	0.5	1.3
	1994	2.0	2.5	2.0	1.5	-	15.0	1.0	0.50	1.20	-	-	1.5	3.0
	1995	2.5	13.3	2.5	3.0	1.1	0.0	1.1	27.8	0.9	2.8	2.1	-	5.2
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-
	Average	1.9	5.9	2.5	1.7	2.0	6.3	12.1	7.6	0.7	2.8	0.9	0.9	3.9
NO ₃	1988	-	-	-	-	-	-	-	-	-	-	-	-	
	1989	-	-	-	-	-	-	-	-	-	-	-	-	
	1990	1.0	0.8	0.6	0.3	0.2	1.1	0.0	0.1	0.2	0.2	-	1.7	0.6
	1991	-	1.0	1.6	0.3	0.6	0.9	0.9	0.2	0.44	0.3	0.4	0.3	0.6
	1992	0.1	0.2	0.2	0.6	0.2	0.4	0.2	0.7	0.1	0.1	0.1	0.1	0.3
	1993	-	-	-	-	-	0.1	0.1	0.09	0.3	0.02	0.07	0.05	0.1
	1994	0.01	0.14	0.06	0.10	-	0.23	0.03	0.03	0.02	-	-	0.08	0.1
	1995	0.30	0.50	2.5	0.46	0.32	0.17	0.59	0.25	0.06	0.18	0.07	-	0.5
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-
	Average	0.4	0.5	1.0	0.4	0.3	0.5	0.3	0.2	0.2	0.2	0.2	0.4	0.4

**Table 2.1.4 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Malaya Almatinka River: 0.5 km downstream of a fur manufacturing**

Parameter	Maximum Allowable Concentration Factor (PDK)*													
	Year	Month												
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.	
Phenol	1988	-	-	-	-	-	-	-	-	-	-	-	-	
	1989	-	-	-	-	-	-	-	-	-	-	-	-	
	1990	0.0	1.0	0.0	2.1	0.0	0.0	0.0	0.0	0.0	28.0	-	0.0	2.8
	1991	-	0.0	0.0	0.0	0.0	1.0	1.0	0.0	1.0	4.0	0.0	2.0	0.8
	1992	2.0	0.0	8.0	1.0	8.0	0.0	0.0	2.0	1.0	0.0	0.0	1.0	1.9
	1993	-	-	-	-	-	0.0	2.0	0.0	7.0	2.0	4.0	0.0	2.1
	1994	0.0	0.0	1.0	2.0	-	0.0	0.0	0.0	0.0	-	-	2.0	0.6
	1995	-	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	1.0	0.0	-	0.7
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	0.7	0.6	1.8	1.0	2.5	0.2	0.5	0.7	1.5	7.0	1.0	1.0	1.5	
Petroleum Products	1988	-	-	-	-	-	-	-	-	-	-	-	-	
	1989	-	-	-	-	-	-	-	-	-	-	-	-	
	1990	3.0	1.8	4.0	1.8	2.2	6.0	3.8	3.6	0.8	1.6	-	9.6	3.5
	1991	-	4.6	2.4	3.6	6.6	1.6	1.2	6.2	3.4	2.4	2.2	5.0	3.6
	1992	2.4	3.8	4.0	2.4	1.2	2.4	5.4	2.0	1.6	2.8	2.4	2.4	2.7
	1993	-	-	-	-	-	5.4	4.8	0.0	2.4	3.0	2.4	0.6	2.7
	1994	3.0	2.0	0.8	5.2	-	1.8	4.8	1.8	3.0	-	-	3.6	2.9
	1995	2.4	1.0	1.2	1.0	3.0	2.0	1.8	1.0	1.8	4.0	3.6	-	2.1
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	2.7	2.6	2.5	2.8	3.3	3.2	3.6	2.4	2.2	2.8	2.7	4.2	2.9	
Fluoride	1988	-	-	-	-	-	-	-	-	-	-	-	-	
	1989	-	-	-	-	-	-	-	-	-	-	-	-	
	1990	0.9	-	-	0.9	-	0.9	-	1.9	1.1	-	-	-	1.1
	1991	-	-	-	0.9	-	1.5	-	0.9	1.12	-	1.1	-	1.1
	1992	-	-	-	-	-	-	-	1.9	1.1	-	-	-	1.5
	1993	-	-	-	-	-	-	0.9	-	1.0	-	0.45	-	0.8
	1994	1.03	-	-	0.17	-	1.52	-	1.12	0.36	-	-	-	0.8
	1995	0.88	-	-	1.64	1.6	1.41	0.84	0.29	0.75	1.84	1.23	-	1.2
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	0.9	-	-	0.9	1.6	1.3	0.9	1.2	0.9	1.8	0.9	-	1.1	
Copper	1988	-	-	-	-	-	-	-	-	-	-	-	-	
	1989	-	-	-	-	-	-	-	-	-	-	-	-	
	1990	-	-	-	-	-	-	-	-	-	-	-	-	
	1991	-	-	-	-	-	-	-	-	-	-	-	-	0.0
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	2.0	-	0.0	-	0.0	-	0.7
	1994	2.0	-	-	-	-	0.0	-	0.0	2.0	-	-	-	1.0
	1995	0.0	-	4.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	-	0.7
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	1.0	-	4.0	0.0	0.0	0.0	1.0	0.0	0.7	3.0	0.0	-	0.6	
Zinc	1988	-	-	-	-	-	-	-	-	-	-	-	-	
	1989	-	-	-	-	-	-	-	-	-	-	-	-	
	1990	-	-	-	-	-	-	-	-	-	-	-	-	
	1991	-	-	-	-	-	-	-	-	-	-	-	-	
	1992	-	-	-	-	-	-	-	-	-	-	-	-	
	1993	-	-	-	-	-	-	0.4	-	0.0	-	0.0	-	0.1
	1994	0.2	-	-	-	-	0.3	-	0.0	0.3	-	-	-	0.2
	1995	0.4	-	0.00	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	-	0.06
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	0.3	-	0.0	0.0	0.0	0.3	0.2	0.0	0.1	0.0	0.0	-	0.1	

**Table 2.1.4 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Malaya Almatinka River: 0.5 km downstream of a fur manufacturing**

Parameter	Maximum Allowable Concentration Factor (PDK)*														
	Year	Month													
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.	
Water Pollution Index	1988	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1990	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1991	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1993	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1994	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1995	-	-	-	-	-	-	-	2.20	-	-	-	-	-	2.20
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	2.2	-	-	-	-	2.2	
Water Classification	1988	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1990	-	-	-	-	-	-	-	-	-	VII	-	-	-	
	1991	-	-	-	-	-	IV	VI	-	-	III	-	-	-	
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1993	-	-	-	-	-	-	III	-	-	-	-	-	-	
	1994	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1995	II	III	II	-	-	-	-	III	-	-	-	-	-	-
1998	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Source: Republican State Enterprise Kazhydromet, "Information Bulletin on the State of Environment Pollution in Almaty City," November and December 1998.

National Department of Hydrometeorology, Republic of Kazakhstan, "Information Bulletin on the State of Environment Pollution in Almaty City," 1995, 1994 and 1993.

State Committee of USSR on Hydrometeorology, Kazakhstan National Department of Hydrometeorology, "Report on the Pollution of Environment in Almaty City," 1991, 1990, 1989 and 1988.

**Table 2.1.5 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Malaya Almatinka River: 4 km downstream of the city boundary, in Pokrovka**

Parameter	Maximum Allowable Concentration Factor (PDK)*													
	Year	Month												
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.
Discharge (m ³ /s)	1988	-	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-
	1990	1.17	1.30	1.98	8.74	-	1.19	0.71	1.22	0.99	0.40	-	0.42	1.81
	1991	-	0.48	0.45	0.42	0.50	0.48	0.42	0.65	0.85	0.65	0.43	1.39	0.61
	1992	0.53	0.58	0.67	0.47	1.48	0.40	0.62	0.89	0.43	0.90	0.85	0.82	0.72
	1993	-	-	-	-	-	0.59	0.47	0.64	2.2	1.87	1.62	1.10	1.21
	1994	1.40	0.64	0.67	0.68	-	0.68	1.05	1.10	0.87	-	-	1.09	0.91
	1995	0.73	1.15	1.40	1.76	2.02	1.90	1.33	2.13	1.86	1.47	1.04	1.66	1.54
	1998	-	-	-	-	-	-	-	-	-	-	2.01	1.18	1.60
Average	0.96	0.83	1.03	2.41	1.33	0.87	0.77	1.11	1.20	1.06	1.19	1.09	1.20	
Water Temperature (°C)	1988	-	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-
	1990	0.7	3.0	6.0	9.6	-	18.0	18.0	16.8	15.2	10.4	-	4.5	10.2
	1991	-	3.3	3.7	8.2	14.0	15.2	23.6	19.8	14.6	15.0	5.1	5.6	11.6
	1992	3.2	6.0	5.4	9.0	14.0	18.0	19.2	18.0	12.4	12.2	7.0	0.4	10.4
	1993	-	-	-	-	-	22.2	26.0	17.2	17.2	10.6	5.4	2.4	14.4
	1994	0.2	3.2	4.2	6.4	-	16.2	19.4	12.4	15.0	-	-	5.8	9.2
	1995	1.8	1.6	3.2	7.0	15.2	15.2	18.2	24.0	13.6	12.1	6.4	7.6	10.5
	1998	-	-	-	-	-	-	-	-	-	-	7.7	2.1	4.9
Average	1.5	3.4	4.5	8.0	14.4	17.5	20.7	18.0	14.7	12.1	6.3	4.1	10.2	
NH ₄	1988	-	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-
	1990	0.0	0.0	0.0	0.1	-	0.0	0.0	0.0	0.0	0.1	-	0.0	0.0
	1991	-	0.0	0.0	0.0	0.1	0.0	0.2	0.1	0.05	0.0	0.2	0.0	0.1
	1992	0.1	0.1	0.1	0.0	0.1	0.0	0.3	0.1	0.3	0.2	0.3	0.0	0.1
	1993	-	-	-	-	-	0.0	0.0	0.03	0.0	0.0	0.1	0.10	0.0
	1994	0.26	0.02	0.18	0.05	-	0.00	0.18	0.05	0.08	-	-	0.00	0.1
	1995	0.00	0.08	0.15	0.46	0.13	0.10	0.26	0.05	0.15	0.15	0.13	0.14	0.2
	1998	-	-	-	-	-	-	-	-	-	-	0.2	0.2	0.2
Average	0.1	0.0	0.1	0.1	0.1	0.0	0.2	0.1	0.1	0.1	0.2	0.1	0.1	
NO ₂	1988	-	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-
	1990	1.2	1.5	1.9	1.9	-	2.6	4.4	0.0	5.5	128	-	2.2	14.9
	1991	-	3.7	1.8	4.8	2.6	0.6	57.5	2.2	1.58	11.0	0.7	1.7	8.0
	1992	1.0	2.3	4.9	2.9	3.4	73.3	28.3	75.0	3.0	1.7	1.5	2.3	16.6
	1993	-	-	-	-	-	1.8	4.1	0.7	2.0	3.0	1.5	6.9	2.9
	1994	2.0	2.4	1.0	11.8	-	62.5	9.3	1.80	3.3	-	-	2.6	10.7
	1995	1.5	1.7	0.6	2.5	23.0	6.8	7.1	7.4	7.6	2.9	2.0	1.6	5.4
	1998	-	-	-	-	-	-	-	-	-	-	2.5	1.1	1.8
Average	1.4	2.3	2.0	4.8	9.7	24.6	18.5	14.5	3.8	29.3	1.6	2.6	8.6	
NO ₃	1988	-	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-
	1990	1.1	0.9	0.7	0.6	-	0.1	0.2	0.1	0.3	0.6	-	1.1	0.6
	1991	-	1.0	1.4	0.1	0.4	0.5	0.8	0.3	0.44	0.5	0.8	0.6	0.6
	1992	0.2	0.1	0.1	0.1	0.5	0.6	0.2	0.5	0.1	0.1	0.1	0.0	0.2
	1993	-	-	-	-	-	0.1	0.0	0.08	0.1	0.03	0.07	0.05	0.1
	1994	0.06	0.12	0.10	0.10	-	0.24	0.10	0.10	0.04	-	-	0.09	0.1
	1995	0.12	0.08	0.05	0.10	0.32	0.28	0.62	0.08	0.12	0.18	0.12	0.15	0.2
	1998	-	-	-	-	-	-	-	-	-	-	0.3	0.25	0.3
Average	0.4	0.4	0.5	0.2	0.4	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.3	

**Table 2.1.5 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Malaya Almatinka River: 4 km downstream of the city boundary, in Pokrovka**

Parameter	Maximum Allowable Concentration Factor (PDK)*													
	Year	Month												
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.
Phenol	1988	-	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-
	1990	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	1.0	-	1.0	0.2
	1991	-	0.0	1.0	0.0	0.0	0.0	2.0	0.0	2.0	3.0	0.0	4.0	1.1
	1992	6.0	0.0	9.0	8.0	13.0	0.0	2.0	1.0	0.0	0.0	1.0	0.0	3.3
	1993	-	-	-	-	-	1.0	0.0	0.0	0.0	1.0	2.0	1.0	0.7
	1994	0.0	0.0	1.0	2.0	-	1.0	0.0	0.0	1.0	-	-	4.0	1.0
	1995	-	0.0	0.0	0.0	2.0	1.0	0.0	0.0	2.0	2.0	0.0	0.67	0.7
	1998	-	-	-	-	-	-	-	-	-	-	1.5	1.0	1.3
Average	2.0	0.0	2.2	2.0	5.0	0.5	0.7	0.2	0.8	1.4	0.9	1.7	1.2	
Petroleum Products	1988	-	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-
	1990	4.0	1.8	4.0	1.8	-	7.0	1.8	4.4	0.4	1.8	-	1.8	2.9
	1991	-	3.8	4.4	3.0	2.4	1.6	2.0	4.8	3.0	3.0	1.8	4.4	3.1
	1992	1.0	2.2	2.2	1.2	2.4	1.8	4.2	2.2	2.8	2.2	2.4	2.8	2.3
	1993	-	-	-	-	-	5.4	1.2	1.2	0.4	3.2	1.2	1.4	2.0
	1994	1.8	3.6	4.8	3.0	-	1.2	2.0	2.0	4.0	-	-	4.0	2.9
	1995	2.4	1.2	2.2	1.8	1.0	1.2	1.8	1.0	1.8	1.8	3.6	2.7	1.9
	1998	-	-	-	-	-	-	-	-	-	-	0.8	0.6	0.7
Average	2.3	2.5	3.5	2.2	1.9	3.0	2.2	2.6	2.1	2.4	2.0	2.5	2.3	
Fluoride	1988	-	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-
	1990	1.7	-	-	1.7	-	1.7	-	2.1	1.3	-	-	-	1.7
	1991	-	-	-	1.1	-	1.3	-	1.5	1.12	-	1.7	-	1.3
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	1.1	-	1.5	-	0.47	-	1.0
	1994	1.47	-	-	0.41	-	0.28	-	1.05	1.40	-	-	-	0.9
	1995	0.65	-	-	0.73	1.57	1.68	0.29	-	0.67	2.60	1.44	2.26	1.3
	1998	-	-	-	-	-	-	-	-	-	-	1.1	1.35	1.2
Average	1.3	-	-	1.0	1.6	1.2	0.7	1.6	1.2	2.6	1.2	1.8	1.3	
Copper	1988	-	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-
	1990	-	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	-	-	-	0.0	-	0.0
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	2.0	-	0.0	-	0.0	-	0.7
	1994	0.0	-	-	-	-	0.0	-	0.0	0.0	-	-	-	0.0
	1995	0.0	-	0.00	0.0	0.0	0.0	0.0	-	2.0	0.0	0.0	0.0	0.2
	1998	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.0
Average	0.0	-	0.0	0.0	0.0	0.0	1.0	0.0	0.7	0.0	0.0	0.0	0.2	
Zinc	1988	-	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-
	1990	-	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	-	-	-	0.0	-	0.0
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	0.4	-	0.0	-	0.0	-	0.1
	1994	0.0	-	-	-	-	0.3	-	0.0	0.0	-	-	-	0.1
	1995	0.6	-	0.00	0.0	0.2	0.0	0.0	-	0.0	0.0	0.0	0.0	0.1
	1998	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.0
Average	0.3	-	0.0	0.0	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.1	

**Table 2.1.5 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Malaya Almatinka River: 4 km downstream of the city boundary, in Pokrovka**

Parameter	Maximum Allowable Concentration Factor (PDK)*													
	Year	Month												
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.
Water Pollution Index	1988	-	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-
	1990	-	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	-	-	-	-	-	-
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	-	-	-	-	-	-	-
	1994	-	-	-	-	-	-	-	-	-	-	-	-	-
	1995	-	-	-	-	-	-	-	-	-	-	-	-	-
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Classification	1988	-	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-
	1990	-	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	-	-	-	-	-	-
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	-	-	-	-	-	-	-
	1994	-	-	-	-	-	-	-	-	-	-	-	-	-
	1995	II	III	II	-	-	-	-	-	-	-	-	-	-
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-

Source: Republican State Enterprise Kazhydromet, "Information Bulletin on the State of Environment Pollution in Almaty City," November and December 1998.

National Department of Hydrometeorology, Republic of Kazakhstan, "Information Bulletin on the State of Environment Pollution in Almaty City," 1995, 1994 and 1993.

State Committee of USSR on Hydrometeorology, Kazakhstan National Department of Hydrometeorology, "Report on the Pollution of Environment in Almaty City," 1991, 1990, 1989 and 1988.

Table 2.1.6 Maximum Allowable Concentration Factor (PDK) of River Water Quality in Almaty City 1988-1998, Malaya Almatinka River: River mouth, 0.5 km downstream of the radio station No. 5

Parameter	Maximum Allowable Concentration Factor (PDK)*													
	Year	Month												
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.
Discharge (m ³ /s)	1988	-	-	-	-	-	-	-	-	-	-	4.32	-	4.32
	1989	5.80	3.90	-	-	-	-	-	-	-	-	-	-	4.85
	1990	-	-	-	-	-	-	-	-	-	2.30	-	2.00	2.15
	1991	-	2.51	3.45	-	-	-	-	1.45	2.25	2.20	3.50	4.06	2.77
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	1.24	0.90	1.20	2.5	2.05	2.00	1.71	1.66
	1994	1.73	1.24	-	1.07	-	1.12	0.84	1.97	2.01	-	-	2.54	1.57
	1995	-	1.34	-	1.83	1.46	-	1.02	1.26	1.33	1.34	1.63	1.56	1.42
	1998	-	-	-	-	-	-	-	-	-	-	2.85	3.85	3.35
	Average	3.77	2.25	3.45	1.45	1.46	1.18	0.92	1.47	2.02	1.97	2.00	2.62	2.76
Water Temperature (°C)	1988	-	-	-	-	-	-	-	-	-	6.6	-	6.6	
	1989	0.8	1.8	-	-	-	-	-	-	-	-	-	1.3	
	1990	-	-	-	-	-	-	-	-	-	14.0	-	4.5	
	1991	-	3.8	4.9	-	-	-	-	29.3	24.6	19.0	7.5	5.2	
	1992	-	-	-	-	-	-	-	-	-	-	-	-	
	1993	-	-	-	-	-	24.6	26.0	16.4	19.0	12.6	5.0	2.2	
	1994	0.0	2.6	-	11.0	-	19.8	23.7	22.0	17.4	-	-	4.8	
	1995	-	2.0	-	9.8	18.8	-	20.6	25.2	15.0	13.4	7.4	7.7	
	1998	-	-	-	-	-	-	-	-	-	-	8.1	2.1	
	Average	0.4	2.6	4.9	10.4	18.8	22.2	23.4	23.2	19.0	14.8	5.6	4.4	
NH ₄	1988	-	-	-	-	-	-	-	-	-	0.0	-	0.0	
	1989	0.0	0.0	-	-	-	-	-	-	-	-	-	0.0	
	1990	-	-	-	-	-	-	-	-	-	0.1	-	0.1	
	1991	-	0.0	0.0	-	-	-	-	0.0	0.05	0.0	0.1	0.0	
	1992	-	-	-	-	-	-	-	-	-	-	-	-	
	1993	-	-	-	-	-	0.0	0.0	0.03	0.0	0.0	0.1	0.13	
	1994	0.10	0.02	-	0.10	-	0.08	0.18	0.05	0.08	-	-	0.00	
	1995	-	0.10	-	0.23	0.15	-	0.31	0.15	0.13	0.08	0.10	0.15	
	1998	-	-	-	-	-	-	-	-	-	-	0.2	0.2	
	Average	0.1	0.0	0.0	0.2	0.2	0.0	0.2	0.1	0.1	0.0	0.1	0.1	
NO ₂	1988	-	-	-	-	-	-	-	-	-	10.0	-	10.0	
	1989	47.5	1.1	-	-	-	-	-	-	-	-	-	24.3	
	1990	-	-	-	-	-	-	-	-	-	92.0	-	46.5	
	1991	-	7.9	3.8	-	-	-	-	1.0	0.50	0.2	0.5	2.1	
	1992	-	-	-	-	-	-	-	-	-	-	-	-	
	1993	-	-	-	-	-	1.0	2.8	1.2	12.3	1.2	3.0	3.8	
	1994	2.0	2.4	-	3.1	-	62.5	2.5	2.5	2.5	-	-	1.8	
	1995	-	0.5	-	1.4	2.0	-	1.1	1.4	2.9	0.6	1.3	1.1	
	1998	-	-	-	-	-	-	-	-	-	-	1.7	1.4	
	Average	24.8	3.0	3.8	2.3	2.0	31.8	2.1	1.5	4.6	23.5	1.3	1.9	
NO ₃	1988	-	-	-	-	-	-	-	-	-	0.4	-	0.4	
	1989	0.5	0.4	-	-	-	-	-	-	-	-	-	0.5	
	1990	-	-	-	-	-	-	-	-	-	0.7	-	0.7	
	1991	-	0.2	0.4	-	-	-	-	0.3	0.38	4.0	0.5	0.6	
	1992	-	-	-	-	-	-	-	-	-	-	-	-	
	1993	-	-	-	-	-	0.0	0.1	0.14	0.5	0.13	0.06	0.09	
	1994	0.02	0.37	-	0.10	-	0.24	0.05	0.06	0.03	-	-	0.05	
	1995	-	0.06	-	0.12	0.13	-	0.31	0.02	0.13	0.15	0.08	0.15	
	1998	-	-	-	-	-	-	-	-	-	-	0.3	0.3	
	Average	0.3	0.3	0.4	0.1	0.1	0.1	0.2	0.1	0.3	1.2	0.2	0.3	

**Table 2.1.6 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Malaya Almatinka River: River mouth, 0.5 km downstream of the radio station No. 5**

Parameter	Maximum Allowable Concentration Factor (PDK)*													
	Year	Month												
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.
Phenol	1988	-	-	-	-	-	-	-	-	-	-	0.0	-	0.0
	1989	0.0	0.0	-	-	-	-	-	-	-	-	-	-	0.0
	1990	-	-	-	-	-	-	-	-	-	0.0	-	0.0	0.0
	1991	-	0.0	0.0	-	-	-	-	2.0	0.0	5.4	2.0	2.0	1.6
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	0.0	0.0	0.0	0.0	1.0	2.0	0.0	0.4
	1994	0.0	0.0	-	1.0	-	0.0	0.0	0.0	1.0	-	-	2.0	0.5
	1995	-	1.0	-	0.0	1.0	-	1.0	0.0	2.0	1.0	2.0	1.3	1.0
	1998	-	-	-	-	-	-	-	-	-	-	1.5	1.5	1.5
	Average	0.0	0.3	0.0	0.5	1.0	0.0	0.3	0.5	0.8	1.9	1.5	1.1	0.6
Petroleum Products	1988	-	-	-	-	-	-	-	-	-	-	2.0	-	2.0
	1989	0.0	-	-	-	-	-	-	-	-	-	-	-	0.0
	1990	-	-	-	-	-	-	-	-	-	1.8	-	1.8	1.8
	1991	-	5.0	2.4	-	-	-	-	2.2	1.8	-	3.6	3.4	2.6
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	4.8	4.8	0.4	0.0	3.6	2.4	0.8	2.4
	1994	1.2	3.0	-	4.0	-	1.4	2.0	3.0	5.6	-	-	6.0	3.3
	1995	-	1.2	-	2.4	2.4	-	2.4	1.2	1.0	3.0	4.0	3.5	2.3
	1998	-	-	-	-	-	-	-	-	-	-	0.9	0.8	0.9
	Average	0.6	3.1	2.4	3.2	2.4	3.1	3.1	1.7	2.1	2.8	2.2	2.7	1.9
Fluoride	1988	-	-	-	-	-	-	-	-	-	-	1.9	-	1.9
	1989	1.8	-	-	-	-	-	-	-	-	-	-	-	1.8
	1990	-	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	2.1	1.69	-	2.1	-	2.0
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	1.8	-	0.3	-	0.29	-	0.8
	1994	0.16	-	-	1.83	-	2.20	-	1.83	1.31	-	-	-	1.5
	1995	-	-	-	0.80	3.53	-	1.41	1.04	1.95	3.07	0.32	1.87	1.75
	1998	-	-	-	-	-	-	-	-	-	-	1.4	1.55	1.5
	Average	1.0	-	-	1.3	3.5	2.2	1.6	1.7	1.3	3.1	0.8	1.7	1.6
Copper	1988	-	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-
	1990	-	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	-	-	-	-	-	-
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	2.0	-	3.0	-	0.0	-	1.7
	1994	0.0	-	-	-	-	0.0	-	0.0	0.0	-	-	-	0.0
	1995	-	-	-	0.0	0.0	-	0.0	0.0	2.0	2.0	0.0	0.67	0.6
	1998	-	-	-	-	-	-	-	-	-	-	0.0	1.0	0.5
	Average	0.0	-	-	0.0	0.0	0.0	1.0	0.0	1.7	2.0	0.0	0.8	0.7
Zinc	1988	-	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-
	1990	-	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	-	-	-	-	-	-
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	0.3	-	0.8	-	0.3	-	0.5
	1994	0.0	-	-	-	-	0.0	-	0.0	0.0	-	-	-	0.0
	1995	-	-	-	0.0	0.0	-	0.2	0.0	0.0	0.0	0.0	0.0	0.0
	1998	-	-	-	-	-	-	-	-	-	-	0.0	0.3	0.2
	Average	-	-	-	0.0	0.0	0.0	0.3	0.0	0.3	0.0	0.1	0.2	0.2

**Table 2.1.6 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Malaya Almatinka River: River mouth, 0.5 km downstream of the radio station No. 5**

Parameter	Maximum Allowable Concentration Factor (PDK)*													
	Year	Month												
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.
Water Pollution Index	1988	-	-	-	-	-	-	-	-	-	-	2.6	-	2.6
	1989	8.80	0.38	-	-	-	-	-	-	-	-	-	-	4.59
	1990	-	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	-	-	-	-	-	-
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	-	-	-	-	-	-	-
	1994	-	-	-	-	-	-	-	-	-	-	-	-	-
	1995	-	-	-	-	-	-	-	-	-	-	-	-	-
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-
	Average	8.8	0.4	-	-	-	-	-	-	-	-	2.6	-	3.6
Water Classification	1988	-	-	-	-	-	-	-	-	-	-	IV	-	
	1989	VII	II	-	-	-	-	-	-	-	-	-	-	
	1990	-	-	-	-	-	-	-	-	-	-	-	-	
	1991	-	-	III	-	-	-	-	-	-	-	-	-	
	1992	-	-	-	-	-	-	-	-	-	-	-	-	
	1993	-	-	-	-	-	-	-	-	-	-	-	-	
	1994	-	-	-	-	-	-	-	-	-	-	-	-	
	1995	-	-	-	-	-	-	-	-	-	-	-	-	
1998	-	-	-	-	-	-	-	-	-	-	-	-		

Source: Republican State Enterprise Kazhydromet, "Information Bulletin on the State of Environment Pollution in Almaty City," November and December 1998.

National Department of Hydrometeorology, Republic of Kazakhstan, "Information Bulletin on the State of Environment Pollution in Almaty City," 1995, 1994 and 1993.

State Committee of USSR on Hydrometeorology, Kazakhstan National Department of Hydrometeorology, "Report on the Pollution of Environment in Almaty City," 1991, 1990, 1989 and 1988.

**Table 2.1.7 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Malaya Almatinka River: 15 km downstream of the city boundary**

Parameter	Maximum Allowable Concentration Factor (PDK)*													
	Year	Month												
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.
Discharge (m ³ /s)	1988	-	-	-	-	-	-	-	-	-	-	2.09	-	2.09
	1989	2.12	2.53	-	-	-	-	-	-	2.80	-	-	-	2.48
	1990	-	-	-	-	-	-	-	-	-	1.95	-	1.80	1.88
	1991	-	2.91	2.60	-	-	-	-	2.10	1.70	1.70	2.40	2.67	2.30
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	0.64	0.76	0.50	2.7	2.80	2.15	1.80	1.62
	1994	1.80	1.07	-	1.43	-	0.64	1.31	1.51	0.69	2.80	2.15	1.10	1.45
	1995	0.83	1.11	1.40	1.79	1.76	1.70	1.46	2.2	1.80	1.56	1.8	-	1.58
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-
	Average	1.58	1.91	2.00	1.61	1.76	0.99	1.18	1.59	1.9	2.16	1.69	1.84	1.91
Water Temperature (°C)	1988	-	-	-	-	-	-	-	-	-	-	6.7	-	6.7
	1989	2.0	0.4	-	-	-	-	5.4	-	13.5	-	-	-	5.3
	1990	-	-	-	-	-	-	-	-	-	13.0	-	5.0	9.0
	1991	-	3.9	4.4	-	-	-	-	19.4	14.8	15.0	6.7	6.0	10.0
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	22.5	20.0	19.8	17.4	11.2	5.8	3.0	14.2
	1994	0.2	3.8	-	7.8	-	16.4	21.0	20.6	17.2	11.2	5.8	4.8	10.9
	1995	1.6	1.4	3.2	8.4	20.4	20.0	25.4	25.2	18.2	13.9	6.8	-	13.1
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-
	Average	1.3	2.4	3.8	8.1	20.4	19.6	18.0	21.3	16.2	12.9	5.0	4.7	9.9
NH ₄	1988	-	-	-	-	-	-	-	-	-	0.0	-	0.0	
	1989	0.0	0.2	-	-	-	-	-	-	0.1	-	-	-	0.1
	1990	-	-	-	-	-	-	-	-	-	0.1	-	0.0	0.1
	1991	-	0.0	0.0	-	-	-	-	0.0	0.10	0.0	0.0	0.0	0.0
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	0.1	0.0	0.0	0.0	0.0	0.0	0.08	0.0
	1994	0.10	0.05	-	0.05	-	0.13	0.15	0.00	0.02	0.0	0.0	0.03	0.1
	1995	0.00	0.08	0.15	0.02	0.15	0.05	0.23	0.08	0.10	0.10	0.10	-	0.1
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-
	Average	0.0	0.1	0.1	0.0	0.2	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0
NO ₂	1988	-	-	-	-	-	-	-	-	-	-	0.0	-	0.0
	1989	4.1	1.5	-	-	-	-	-	-	4.9	-	-	-	3.5
	1990	-	-	-	-	-	-	-	-	-	90.0	-	1.3	45.7
	1991	-	7.7	3.1	-	-	-	-	14.6	0.0	2.2	10.0	15.3	7.6
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	4.6	4.6	0.5	0.5	1.7	3.2	5.2	2.9
	1994	1.5	2.0	-	14.4	-	2.8	7.0	75.0	2.5	1.7	3.2	11.6	12.2
	1995	1.5	2.2	0.6	2.0	1.4	7.9	2.2	3.2	7.1	1.1	2.1	-	2.8
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-
	Average	2.4	3.4	1.9	8.2	1.4	5.1	4.6	23.3	3.0	19.3	3.7	8.4	10.7
NO ₃	1988	-	-	-	-	-	-	-	-	-	-	0.6	-	0.6
	1989	0.6	0.5	-	-	-	-	-	-	0.0	-	-	-	0.4
	1990	-	-	-	-	-	-	-	-	-	0.8	-	1.4	1.1
	1991	-	0.5	0.2	-	-	-	-	0.2	0.47	0.2	0.8	0.6	0.4
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	0.0	0.0	0.03	0.1	0.08	0.06	0.07	0.0
	1994	0.02	0.14	-	0.10	-	0.05	0.10	0.16	0.16	0.08	0.06	0.06	0.1
	1995	0.09	0.06	0.05	0.41	0.04	0.25	0.34	0.01	0.02	0.18	0.10	-	0.1
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-
	Average	0.2	0.3	0.1	0.3	0.0	0.1	0.1	0.1	0.2	0.3	0.2	0.5	0.4

**Table 2.1.7 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Malaya Almatinka River: 15 km downstream of the city boundary**

Parameter	Maximum Allowable Concentration Factor (PDK)*													
	Year	Month											Ave.	
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.		Dec.
Phenol	1988	-	-	-	-	-	-	-	-	-	-	2.0	-	2.0
	1989	0.0	0.0	-	-	-	-	-	-	0.0	-	-	-	0.0
	1990	-	-	-	-	-	-	-	-	-	0.0	-	0.0	0.0
	1991	-	0.0	1.0	-	-	-	-	0.0	1.0	3.0	0.0	0.0	0.7
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	1.0	1.0	0.0	0.0	1.0	4.0	1.0	1.1
	1994	0.0	0.0	-	4.0	-	1.0	0.0	1.0	1.0	1.0	4.0	4.0	1.6
	1995	-	0.0	0.0	0.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0	-	0.3
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-
	Average	0.0	0.0	0.5	2.0	1.0	0.7	0.3	0.3	0.6	1.2	1.6	1.3	0.8
Petroleum Products	1988	-	-	-	-	-	-	-	-	-	2.0	-	2.0	
	1989	0.0	-	-	-	-	-	-	-	2.0	-	-	1.0	
	1990	-	-	-	-	-	-	-	-	-	2.2	-	1.8	
	1991	-	3.2	2.4	-	-	-	-	2.8	3.6	2.6	1.2	1.0	
	1992	-	-	-	-	-	-	-	-	-	-	-	-	
	1993	-	-	-	-	-	9.0	1.2	2.4	0.6	3.6	2.0	2.4	
	1994	1.4	4.8	-	3.0	-	2.4	1.8	2.4	5.0	3.6	2.0	5.0	
	1995	1.8	1.4	2.2	2.0	2.0	1.8	2.0	1.0	1.8	2.0	3.0	-	
	1998	-	-	-	-	-	-	-	-	-	-	-	-	
	Average	1.1	3.1	2.3	2.5	2.0	4.4	1.7	2.2	2.6	2.8	1.6	2.6	
Fluoride	1988	-	-	-	-	-	-	-	-	-	1.4	-	1.4	
	1989	1.4	-	-	-	-	-	-	0.4	-	-	-	0.9	
	1990	-	-	-	-	-	-	-	-	-	-	-	-	
	1991	-	-	-	-	-	-	-	1.5	1.88	-	1.7	1.7	
	1992	-	-	-	-	-	-	-	-	-	-	-	-	
	1993	-	-	-	-	-	-	1.7	-	1.8	-	0.37	1.3	
	1994	0.37	-	-	0.73	-	1.17	-	1.17	2.16	-	0.37	1.0	
	1995	0.68	-	-	1.47	3.24	3.09	1.95	0.45	1.84	2.85	1.73	1.9	
	1998	-	-	-	-	-	-	-	-	-	-	-	-	
	Average	0.8	-	-	1.1	3.2	2.1	1.8	1.0	1.6	2.9	0.8	1.4	
Copper	1988	-	-	-	-	-	-	-	-	-	-	-	-	
	1989	-	-	-	-	-	-	-	-	-	-	-	-	
	1990	-	-	-	-	-	-	-	-	-	-	-	-	
	1991	-	-	-	-	-	-	-	-	-	-	-	-	
	1992	-	-	-	-	-	-	-	-	-	-	-	-	
	1993	-	-	-	-	-	-	2.0	-	0.0	-	5.0	2.3	
	1994	2.0	-	-	-	-	0.0	-	0.0	0.0	-	5.0	1.4	
	1995	0.0	-	0.00	0.0	2.0	0.0	0.0	0.0	2.0	0.0	0.0	0.4	
	1998	-	-	-	-	-	-	-	-	-	-	-	-	
	Average	1.0	-	0.0	0.0	2.0	0.0	1.0	0.0	0.7	0.0	3.3	1.4	
Zinc	1988	-	-	-	-	-	-	-	-	-	-	-	-	
	1989	-	-	-	-	-	-	-	-	-	-	-	-	
	1990	-	-	-	-	-	-	-	-	-	-	-	-	
	1991	-	-	-	-	-	-	-	-	-	-	-	-	
	1992	-	-	-	-	-	-	-	-	-	-	-	-	
	1993	-	-	-	-	-	-	0.4	-	0.0	-	1.4	0.6	
	1994	0.2	-	-	-	-	0.0	-	0.0	0.0	-	1.4	0.3	
	1995	0.4	-	0.00	0.0	0.3	0.4	0.2	0.0	0.0	0.0	0.0	0.1	
	1998	-	-	-	-	-	-	-	-	-	-	-	-	
	Average	0.3	-	0.0	0.0	0.3	0.2	0.3	0.0	0.0	0.0	0.9	0.4	

**Table 2.1.7 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Malaya Almatinka River: 15 km downstream of the city boundary**

Parameter	Maximum Allowable Concentration Factor (PDK)*													Av
	Year	Month												
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
Water Pollution Index	1988	-	-	-	-	-	-	-	-	-	-	1.2	-	1.2
	1989	1.4	0.52	-	-	-	-	-	-	-	-	-	-	0.9
	1990	-	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	-	-	-	-	-	-
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	-	-	-	-	-	-	-
	1994	-	-	-	-	-	-	-	-	-	-	-	-	-
	1995	-	-	-	-	-	-	-	-	-	-	-	-	-
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	1.40	0.52	-	-	-	-	-	-	-	-	-	1.2	-	1.1
Water Classification	1988	-	-	-	-	-	-	-	-	-	-	III	-	-
	1989	III	II	-	-	-	-	-	-	-	-	-	-	-
	1990	-	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	-	-	-	-	-	-
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	-	-	-	-	-	-	-
	1994	-	-	-	-	-	-	-	-	-	-	-	-	-
	1995	II	III	II	-	-	-	-	-	-	-	-	-	-
1998	-	-	-	-	-	-	-	-	-	-	II	II	-	

Source: Republican State Enterprise Kazhydromet, "Information Bulletin on the State of Environment Pollution in Almaty City," November and December 1998.

National Department of Hydrometeorology, Republic of Kazakhstan, "Information Bulletin on the State of Environment Pollution in Almaty City," 1995, 1994 and 1993.

State Committee of USSR on Hydrometeorology, Kazakhstan National Department of Hydrometeorology, "Report on the Pollution of Environment in Almaty City," 1991, 1990, 1989 and 1988.

**Table 2.1.8 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Bolshaya Almatinka River: 9.1 km upstream of the city boundary**

Parameter	Maximum Allowable Concentration Factor (PDK)*														
	Year	Month												Ave.	
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.			
Discharge (m ³ /s)	1988	-	-	-	-	-	-	-	-	-	-	-	0.28	-	0.28
	1989	0.23	0.23	-	-	-	-	0.38	1.7	-	-	-	-	-	0.63
	1990	0.25	-	0.21	0.25	-	0.54	1.51	2.42	1.45	-	-	-	0.35	0.87
	1991	-	0.32	0.34	0.37	0.38	0.38	-	0.26	0.28	0.30	-	-	0.19	0.31
	1992	-	0.26	-	-	0.23	0.26	0.48	1.22	0.74	-	-	-	0.24	0.49
	1993	-	-	-	-	-	3.01	-	2.50	1.0	-	-	-	-	2.17
	1994	0.36	0.35	0.31	0.53	-	0.92	1.87	3.50	-	-	-	-	-	1.12
	1995	0.60	-	-	0.30	0.42	-	0.50	0.27	-	-	-	0.26	-	0.39
	1998	-	-	-	-	-	-	-	-	-	-	-	0.83	0.46	0.65
	Average	0.36	0.29	0.29	0.36	0.34	1.02	0.95	1.69	0.87	0.30	0.36	0.31		0.77
Water Temperature (°C)	1988	-	-	-	-	-	-	-	-	-	-	-	5.6	-	5.6
	1989	1.2	1.8	-	-	-	-	17.0	11.0	-	-	-	-	-	7.8
	1990	2.2	-	3.4	2.6	-	14.6	14.0	11.2	9.0	-	-	-	1.6	7.3
	1991	-	1.0	0.6	6.6	7.2	10.2	-	11.6	12.8	11.2	-	-	1.2	6.9
	1992	-	1.2	-	-	12.4	11.1	27.1	10.2	11.2	-	-	-	2.4	10.8
	1993	-	-	-	-	-	9.1	-	7.6	11.6	-	3.0	4.5	-	7.2
	1994	0.4	1.6	1.6	5.5	-	10.7	10.6	9.6	-	-	-	-	-	5.7
	1995	1.0	-	-	4.0	8.0	-	13.6	10.6	-	-	-	4.2	-	6.9
	1998	-	-	-	-	-	-	-	-	-	-	-	6.2	2.3	4.3
	Average	1.2	1.4	1.9	4.7	9.2	11.1	16.5	10.3	11.2	11.2	3.4	2.4		6.9
NH ₄	1988	-	-	-	-	-	-	-	-	-	-	-	0.0	-	0.0
	1989	0.0	0.0	-	-	-	-	0.1	0.1	-	-	-	-	-	0.1
	1990	0.0	-	0.0	0.0	-	0.0	0.0	0.1	0.0	-	-	-	0.0	0.0
	1991	-	0.1	0.0	0.0	0.1	0.1	-	0.0	0.05	0.2	-	-	0.0	0.1
	1992	-	0.0	-	-	0.1	0.2	0.2	0.3	0.0	-	-	-	0.0	0.1
	1993	-	-	-	-	-	0.0	-	0.03	0.0	-	0.1	0.10	-	0.0
	1994	0.10	0.10	0.05	0.05	-	0.13	0.18	0.03	-	-	-	-	-	0.1
	1995	0.03	-	-	0.00	0.13	-	0.15	0.18	-	-	0.23	-	-	0.1
	1998	-	-	-	-	-	-	-	-	-	-	0.1	0.1	-	0.1
	Average	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.2	0.1	0.0		0.1
NO ₂	1988	-	-	-	-	-	-	-	-	-	-	-	0.0	-	0.0
	1989	0.0	0.0	-	-	-	-	0.0	1.1	-	-	-	-	-	0.3
	1990	0.0	-	0.0	0.5	-	0.0	0.0	0.0	0.0	-	-	-	0.0	0.1
	1991	-	0.0	0.0	0.0	0.4	1.1	-	0.8	0.0	0.0	-	-	0.5	0.3
	1992	-	2.2	-	-	0.5	1.4	1.2	0.4	0.5	-	-	-	0.0	0.9
	1993	-	-	-	-	-	1.2	-	0.0	0.7	-	1.5	0.5	-	0.8
	1994	1.0	0.5	0.0	0.5	-	0.5	2.8	9.3	-	-	-	-	-	2.1
	1995	0.7	-	-	2.0	0.5	-	0.6	0.9	-	-	3.2	-	-	1.3
	1998	-	-	-	-	-	-	-	-	-	-	1.5	0.5	-	1.0
	Average	0.4	0.7	0.0	0.8	0.5	0.8	0.9	1.8	0.3	0.0	1.6	0.3		0.7
NO ₃	1988	-	-	-	-	-	-	-	-	-	-	-	0.1	-	0.1
	1989	0.0	-	-	-	-	-	0.1	0.0	-	-	-	-	-	0.0
	1990	0.1	-	-	0.1	-	0.0	0.1	0.2	0.1	-	-	-	0.1	0.1
	1991	-	0.2	0.1	0.1	0.1	0.1	-	0.1	0.10	0.1	-	-	0.1	0.1
	1992	-	0.1	-	-	0.1	0.1	0.1	0.1	0.0	-	-	-	0.0	0.1
	1993	-	-	-	-	-	0.1	-	0.06	0.1	-	0.06	0.08	-	0.1
	1994	0.02	0.04	0.06	0.03	-	0.02	0.02	0.03	-	-	-	-	-	0.0
	1995	0.09	-	-	0.08	0.04	-	0.07	0.10	-	-	0.08	-	-	0.1
	1998	-	-	-	-	-	-	-	-	-	-	0.1	0.1	-	0.1
	Average	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1		0.1

**Table 2.1.8 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Bolshaya Almatinka River: 9.1 km upstream of the city boundary**

Parameter	Maximum Allowable Concentration Factor (PDK)*														
	Year	Month													
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.	
Phenol	1988	-	-	-	-	-	-	-	-	-	-	-	0.0	-	0.0
	1989	0.0	0.0	-	-	-	-	0.0	7.0	-	-	-	-	-	1.8
	1990	4.0	-	0.0	0.0	-	0.0	0.0	0.0	0.0	-	-	0.0	-	0.5
	1991	-	0.0	0.0	0.0	1.0	9.0	-	0.0	0.0	2.0	-	2.0	-	1.6
	1992	-	5.0	-	-	0.0	0.0	1.0	2.0	16.0	-	-	0.0	-	3.4
	1993	-	-	-	-	-	0.0	-	0.0	0.0	-	0.0	1.0	-	0.2
	1994	1.0	0.0	1.0	1.0	-	1.0	0.0	1.0	-	-	-	-	-	0.7
	1995	-	-	-	1.0	0.0	-	0.0	0.0	-	-	-	1.0	-	0.4
	1998	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.0
	Average	1.7	1.3	0.3	0.5	0.3	2.0	0.2	1.4	4.0	2.0	0.3	0.6	-	0.9
Petroleum Products	1988	-	-	-	-	-	-	-	-	-	-	2.6	-	-	2.6
	1989	0.0	0.0	-	-	-	-	0.8	1.0	-	-	-	-	-	0.5
	1990	2.2	-	3.6	0.0	-	11.4	1.8	3.6	0.6	-	-	1.0	-	3.0
	1991	-	3.6	14.0	2.4	3.8	1.0	-	3.6	6.0	4.4	-	4.4	-	4.8
	1992	-	3.6	-	-	3.8	3.0	3.2	1.4	3.0	-	-	2.0	-	2.9
	1993	-	-	-	-	-	1.8	-	0.6	0.4	-	1.6	3.6	-	1.6
	1994	20.0	18.0	4.0	3.6	-	16.4	6.0	3.6	-	-	-	-	-	10.2
	1995	20.0	-	-	18.0	1.8	-	1.8	4.0	-	-	-	5.0	-	8.4
	1998	-	-	-	-	-	-	-	-	-	-	-	0.3	0.5	0.4
	Average	10.6	6.3	7.2	6.0	3.1	6.7	2.7	2.5	2.5	4.4	1.7	2.3	-	3.8
Fluoride	1988	-	-	-	-	-	-	-	-	-	-	1.1	-	-	1.1
	1989	1.1	-	-	-	-	-	-	0.9	-	-	-	-	-	1.0
	1990	1.3	-	-	4.5	-	0.4	-	0.4	1.3	-	-	-	-	1.6
	1991	-	-	-	1.3	-	0.7	-	1.3	0.93	-	-	-	-	1.1
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	0.8	-	0.0	0.8	-	0.47	-	-	0.5
	1994	0.13	-	-	1.20	-	1.37	-	1.19	-	-	-	-	-	1.0
	1995	0.47	-	-	0.37	-	-	-	1.96	-	-	-	1.68	-	1.1
	1998	-	-	-	-	-	-	-	-	-	-	-	1.0	1.1	1.0
	Average	0.8	-	-	1.8	-	0.8	-	1.0	1.0	-	0.8	1.1	-	1.0
Copper	1988	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1990	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	-	0.0	0.0	-	0.0	-	-	0.0
	1994	0.0	-	-	-	-	0.0	-	0.0	-	-	-	-	-	-
	1995	0.0	-	-	0.0	-	-	-	0.0	-	-	0.0	-	-	0.0
	1998	-	-	-	-	-	-	-	-	-	-	0.0	0.0	-	0.0
	Average	0.0	-	-	0.0	-	-	-	0.0	0.0	-	0.0	0.0	-	0.0
Zinc	1988	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1990	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	-	0.2	0.0	-	0.0	-	-	0.1
	1994	0.0	-	-	-	-	0.0	-	0.0	-	-	-	-	-	0.0
	1995	0.8	-	-	0.0	-	-	-	0.0	-	-	0.0	-	-	0.2
	1998	-	-	-	-	-	-	-	-	-	-	0.0	0.0	-	0.0
	Average	0.4	-	-	0.0	-	0.0	-	0.1	0.0	-	0.0	0.0	-	0.1

**Table 2.1.8 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Bolshaya Almatinka River: 9.1 km upstream of the city boundary**

Parameter	Maximum Allowable Concentration Factor (PDK)*													
	Year	Month												
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.
Water Pollution Index	1988	-	-	-	-	-	-	-	-	-	-	0.8	-	0.8
	1989	0.3	0.20	-	-	-	-	0.20	1.8	-	-	-	-	0.6
	1990	-	-	-	-	-	-	-	-	-	-	-	-	0.00
	1991	-	-	-	-	-	-	-	-	-	-	-	-	-
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	-	-	-	-	-	-	-
	1994	-	-	-	-	-	-	-	-	-	-	-	-	-
	1995	-	-	-	-	-	-	-	1.29	-	-	1.92	-	1.61
	1998	-	-	-	-	-	-	-	-	-	-	2.38	1.08	1.73
		Average	0.3	0.2	-	-	-	-	0.2	1.5	-	-	1.4	1.1
Water Classification	1988	-	-	-	-	-	-	-	-	-	-	II	-	-
	1989	II	I	-	-	-	-	I	III	-	-	-	-	-
	1990	-	-	-	-	-	-	III	-	II	-	-	II	-
	1991	-	-	III	-	II	-	-	-	III	III	-	III	-
	1992	-	III	-	-	III	IV	III	III	III	-	-	-	-
	1993	-	-	-	-	-	III	-	II	II	-	-	II	-
	1994	III	III	III	III	-	III	-	-	-	-	-	-	-
	1995	-	-	-	-	III	-	III	III	-	-	III	-	-
	1998	-	-	-	-	-	-	-	-	-	-	III	III	-

Source: Republican State Enterprise Kazhydromet, "Information Bulletin on the State of Environment Pollution in Almaty City," November and December 1998.

National Department of Hydrometeorology, Republic of Kazakhstan, "Information Bulletin on the State of Environment Pollution in Almaty City," 1995, 1994 and 1993.

State Committee of USSR on Hydrometeorology, Kazakhstan National Department of Hydrometeorology, "Report on the Pollution of Environment in Almaty City," 1991, 1990, 1989 and 1988.

**Table 2.1.9 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Bolshaya Almatinka River: 0.5 km downstream of AHBK**

Parameter	Maximum Allowable Concentration Factor (PDK)*													
	Year	Month												
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.	
Discharge (m ³ /s)	1988	-	-	-	-	-	-	-	-	-	0.78	-	0.78	
	1989	2.53	0.30	-	-	-	4.16	0.7	0.52	0.20	-	-	1.40	
	1990	0.09	0.16	0.15	0.89	1.08	0.73	2.01	0.42	1.05	0.50	-	0.23	0.66
	1991	-	0.43	0.32	0.08	0.12	0.10	0.11	0.22	0.20	0.20	0.57	0.48	0.26
	1992	4.51	4.51	0.34	0.11	1.52	0.18	1.12	0.52	0.21	0.50	0.38	0.30	1.18
	1993	-	-	-	-	-	1.73	2.30	2.55	2.2	0.89	0.88	0.63	1.60
	1994	0.43	0.17	0.28	0.07	-	0.42	1.56	1.26	1.30	-	-	0.34	0.65
	1995	0.07	0.04	0.04	0.01	0.13	0.15	0.18	1.02	1.49	1.41	0.25	0.60	0.45
	1998	-	-	-	-	-	-	-	-	-	-	0.55	1.15	0.85
Average	1.53	0.94	0.23	0.23	0.71	1.07	1.14	0.93	0.95	0.70	0.44	0.53	0.87	
Water Temperature (°C)	1988	-	-	-	-	-	-	-	-	-	5.0	-	5.0	
	1989	1.3	12.8	-	-	-	13.2	22.0	18.0	18.5	-	-	14.3	
	1990	22.5	13.0	21.8	7.2	14.0	20.0	20.8	18.8	15.0	12.3	-	17.0	16.6
	1991	-	10.6	14.1	24.8	24.0	25.2	22.8	23.8	21.2	24.0	2.2	21.0	19.4
	1992	23.2	17.6	24.0	19.2	15.4	26.0	20.1	18.4	12.1	17.5	17.2	15.0	18.8
	1993	-	-	-	-	-	18.0	9.5	13.0	12.4	11.0	6.2	3.8	10.6
	1994	1.0	13.2	11.0	12.4	-	14.2	18.0	17.0	13.4	-	-	10.6	12.3
	1995	11.2	10.0	19.2	16.2	17.4	23.4	23.4	18.6	16.8	13.6	7.0	8.7	15.5
	1998	-	-	-	-	-	-	-	-	-	-	8.8	3.5	6.2
Average	11.8	12.9	18.0	16.0	17.7	20.0	19.5	18.2	15.6	15.7	6.9	11.4	13.2	
NH ₄	1988	-	-	-	-	-	-	-	-	-	0.0	-	0.0	
	1989	0.0	0.0	-	-	-	0.0	0.1	0.0	0.1	-	-	0.0	
	1990	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0
	1991	-	0.0	0.0	0.0	0.1	0.0	0.2	0.1	0.0	0.0	0.0	0.1	0.0
	1992	0.0	0.4	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1
	1993	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.1	0.13	0.0
	1994	0.10	0.21	0.13	0.07	-	0.13	0.21	0.03	0.05	-	-	0.05	0.1
	1995	0.03	0.08	0.13	0.20	0.13	0.10	0.18	0.15	0.15	0.15	0.18	0.20	0.1
	1998	-	-	-	-	-	-	-	-	-	-	0.1	0.15	0.1
Average	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.1	
NO ₂	1988	-	-	-	-	-	-	-	-	-	0.5	-	0.5	
	1989	0.0	2.3	-	-	-	0.5	0.5	6.8	0.4	-	-	1.8	
	1990	1.5	3.0	2.6	1.7	9.8	1.0	1.5	0.0	0.5	1.0	-	2.2	2.3
	1991	-	5.0	6.6	1.3	0.4	1.5	66.0	1.5	0.67	7.5	2.2	5.2	8.9
	1992	15.8	14.2	1.1	48.3	1.8	1.0	1.2	0.6	18.7	1.1	2.5	3.6	9.2
	1993	-	-	-	-	-	0.5	1.8	1.5	0.7	1.2	1.0	1.5	1.2
	1994	1.0	3.8	3.3	6.6	-	0.5	0.7	1.0	1.0	-	-	2.3	2.2
	1995	1.8	8.2	9.2	1.1	2.0	0.0	0.6	1.1	0.6	1.1	1.2	1.1	2.3
	1998	-	-	-	-	-	-	-	-	-	-	1.1	1.3	1.2
Average	4.0	6.1	4.6	11.8	3.5	0.7	10.3	1.8	3.2	2.4	1.3	2.5	3.3	
NO ₃	1988	-	-	-	-	-	-	-	-	-	0.1	-	0.1	
	1989	0.2	0.3	-	-	-	0.1	0.2	0.2	0.2	-	-	0.2	
	1990	0.3	0.5	0.1	0.2	0.3	0.1	0.1	0.1	0.1	0.3	-	0.5	0.2
	1991	-	0.3	0.2	0.5	0.1	0.4	1.08	0.1	0.26	0.2	0.6	0.6	0.4
	1992	0.6	0.2	0.1	0.5	0.2	0.3	0.3	0.2	0.1	0.1	0.1	0.1	0.2
	1993	-	-	-	-	-	0.1	0.1	0.12	0.4	0.04	0.09	0.06	0.1
	1994	0.02	0.34	0.10	0.10	-	0.03	0.02	0.03	0.02	-	-	0.05	0.1
	1995	0.10	0.51	0.08	0.10	0.14	0.15	0.24	0.01	0.01	0.19	0.07	0.14	0.1
	1998	-	-	-	-	-	-	-	-	-	-	0.1	0.25	0.2
Average	0.2	0.4	0.1	0.3	0.2	0.2	0.3	0.1	0.2	0.2	0.2	0.2	0.2	

**Table 2.1.9 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Bolshaya Almatinka River: 0.5 km downstream of AHBK**

Parameter	Maximum Allowable Concentration Factor (PDK)*												
	Year	Month											
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Phenol	1988	-	-	-	-	-	-	-	-	-	0.0	-	0.0
	1989	5.0	0.0	-	-	-	0.0	0.0	6.0	0.0	-	-	1.8
	1990	1.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	2.0	-	0.0
	1991	-	0.0	2.0	0.0	0.0	6.0	16.0	0.0	1.0	7.0	2.0	2.0
	1992	2.0	2.0	2.0	0.0	13.0	0.0	0.0	5.0	1.0	2.0	4.0	1.0
	1993	-	-	-	-	-	0.0	0.0	0.0	0.0	2.0	2.0	0.0
	1994	5.0	0.0	13.0	2.0	-	2.0	0.0	0.0	1.0	-	-	4.0
	1995	-	1.0	0.0	0.0	2.0	0.0	0.0	1.0	3.0	1.0	2.0	1.0
	1998	-	-	-	-	-	-	-	-	-	-	1.0	1.0
Average	3.3	0.5	3.4	1.2	3.8	1.1	2.3	1.7	0.9	2.8	1.8	1.3	
Petroleum Products	1988	-	-	-	-	-	0.0	1.4	7.8	2.0	-	1.8	1.8
	1989	0.0	5.4	-	-	-	0.0	1.4	7.8	2.0	-	-	2.8
	1990	4.0	1.8	8.0	2.8	2.2	4.6	3.2	2.4	0.8	5.2	-	1.0
	1991	-	3.2	6.0	3.2	4.8	1.2	2.8	3.0	2.8	2.0	3.2	5.0
	1992	2.8	1.8	4.0	2.4	0.6	1.8	2.0	1.2	3.6	2.4	1.8	2.8
	1993	-	-	-	-	-	5.4	3.0	0.6	0.4	2.0	3.6	1.2
	1994	4.8	3.0	5.0	3.6	-	4.0	1.8	2.0	3.0	-	-	3.0
	1995	1.8	1.2	1.8	3.0	2.4	1.2	2.0	1.0	2.4	5.0	4.0	3.3
	1998	-	-	-	-	-	-	-	-	-	-	2.0	2.1
Average	2.7	2.7	5.0	3.0	2.5	2.6	2.3	2.6	2.1	3.3	2.4	2.6	
Fluoride	1988	-	-	-	-	-	0.0	0.7	0.9	1.1	-	1.1	1.1
	1989	1.0	-	-	-	-	0.0	0.7	0.9	1.1	-	-	0.7
	1990	1.3	-	-	0.9	-	0.7	-	2.5	0.9	-	-	1.3
	1991	-	-	-	0.9	-	2.3	-	1.3	0.55	-	0.7	1.2
	1992	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	0.5	-	1.4	-	0.22	0.7
	1994	0.17	-	-	0.13	-	1.35	-	0.56	0.64	-	-	0.6
	1995	0.77	-	-	0.43	0.44	0.21	0.76	0.84	0.40	2.23	0.67	1.67
	1998	-	-	-	-	-	-	-	-	-	-	0.95	1.0
Average	0.8	-	-	0.6	0.4	0.9	0.7	1.2	0.8	2.2	0.5	1.3	
Copper	1988	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-
	1990	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	-	-	-	-	-
	1992	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	2.0	-	0.0	-	0.0	0.4
	1994	0.0	-	-	-	-	0.0	-	0.0	2.0	-	-	0.4
	1995	0.0	-	0.00	0.0	0.0	0.0	0.0	0.0	2.0	4.0	0.0	1.33
	1998	-	-	-	-	-	-	-	-	-	-	1.0	1.0
Average	0.0	-	0.0	0.0	0.0	0.0	1.0	0.0	2.0	4.0	0.3	1.2	
Zinc	1988	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-
	1990	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	-	-	-	-	-
	1992	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	0.4	-	0.3	-	0.2	0.3
	1994	0.2	-	-	-	-	0.0	-	0.0	0.2	-	-	0.1
	1995	0.5	-	0.00	0.0	0.0	0.2	0.0	0.2	0.0	0.3	0.0	0.1
	1998	-	-	-	-	-	-	-	-	-	-	0.3	0.15
Average	0.4	-	0.0	0.0	0.0	0.1	0.2	0.1	0.2	0.3	0.2	0.1	

**Table 2.1.9 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Bolshaya Almatinka River: 0.5 km downstream of AHBK**

Parameter	Maximum Allowable Concentration Factor (PDK)*													
	Year	Month												
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.
Water Pollution Index	1988	-	-	-	-	-	-	-	-	-	0.8	-	-	0.8
	1989	1.20	1.48	-	-	-	0.3	0.48	3.6	-	-	-	-	1.4
	1990	-	-	-	-	-	-	-	-	-	-	-	-	0.0
	1991	-	-	-	-	-	-	-	-	-	-	-	-	-
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	-	-	-	-	-	-	-
	1994	-	-	-	-	-	-	-	-	-	-	-	-	-
	1995	-	-	-	-	-	-	-	-	1.1	1.83	-	-	1.5
	1998	-	-	-	-	-	-	-	-	-	-	-	0.91	0.9
	Average	1.2	1.5	-	-	-	0.3	0.5	3.6	1.1	1.8	0.8	0.9	0.9
Water Classification	1988	-	-	-	-	-	-	-	-	-	-	II	-	-
	1989	III	III	-	-	-	I	I	IV	-	-	-	-	-
	1990	-	-	-	-	-	-	III	III	-	-	-	III	-
	1991	-	-	-	-	-	V	VII	-	-	-	-	-	-
	1992	IV	III	III	VI	III	IV	-	-	-	III	III	III	-
	1993	-	-	-	-	-	-	III	-	-	-	-	-	-
	1994	-	-	-	-	-	-	-	-	III	-	-	-	-
	1995	-	III	III	-	-	-	-	-	III	III	-	-	-
	1998	-	-	-	-	-	-	-	-	-	-	-	II	-

Source: Republican State Enterprise Kazhydromet, "Information Bulletin on the State of Environment Pollution in Almaty City," November and December 1998.

National Department of Hydrometeorology, Republic of Kazakhstan, "Information Bulletin on the State of Environment Pollution in Almaty City," 1995, 1994 and 1993.

State Committee of USSR on Hydrometeorology, Kazakhstan National Department of Hydrometeorology, "Report on the Pollution of Environment in Almaty City," 1991, 1990, 1989 and 1988.

**Table 2.1.10 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Bolshaya Almatinka River: 0.5 km upstream of the city boundary**

Parameter	Maximum Allowable Concentration Factor (PDK)*													
	Year	Month											Ave.	
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
Discharge (m ³ /s)	1988	-	-	-	-	-	-	-	-	-	-	0.49	-	0.49
	1989	1.94	0.30	-	-	-	3.00	0.6	0.27	0.19	-	-	-	1.05
	1990	0.17	0.14	0.14	0.71	0.97	1.40	1.92	1.76	0.90	0.55	-	0.25	0.81
	1991	-	0.38	0.36	0.08	0.15	0.60	0.10	0.20	0.20	0.20	0.40	0.46	0.28
	1992	0.48	0.48	0.42	0.25	0.28	0.22	1.21	1.44	0.22	0.50	0.40	0.32	0.52
	1993	-	-	-	-	-	1.77	2.30	1.97	2.5	1.12	0.98	0.60	1.61
	1994	0.36	0.15	0.22	0.08	-	0.86	1.60	1.68	1.32	-	-	0.33	0.73
	1995	0.10	0.05	0.05	0.01	0.11	0.14	0.15	1.47	1.50	1.53	0.24	0.64	0.50
	1998	-	-	-	-	-	-	-	-	-	-	0.44	0.68	0.56
	Average	0.61	0.25	0.24	0.23	0.38	1.14	1.13	1.26	0.98	0.78	0.41	0.47	0.73
Water Temperature (°C)	1988	-	-	-	-	-	-	-	-	-	-	9.0	-	9.0
	1989	2.0	0.8	-	-	-	16.0	26.0	20.0	18.5	-	-	-	13.9
	1990	10.2	6.0	11.6	10.2	18.0	20.5	21.8	18.0	16.5	12.0	-	7.0	13.8
	1991	-	6.9	9.4	20.7	22.0	27.2	23.0	26.2	21.8	20.0	10.0	14.0	18.3
	1992	15.1	12.0	13.4	16.4	17.0	26.0	20.2	17.8	10.7	17.2	0.0	4.0	14.2
	1993	-	-	-	-	-	18.8	10.0	16.0	11.6	9.2	5.0	3.2	10.5
	1994	3.2	7.4	7.8	10.0	-	15.2	18.2	17.4	12.6	-	-	4.4	10.7
	1995	5.0	0.2	3.4	10.2	16.0	24.8	21.6	18.6	16.4	12.9	5.2	7.3	11.8
	1998	-	-	-	-	-	-	-	-	-	-	7.8	2.0	4.9
	Average	7.1	5.6	9.1	13.5	18.3	21.2	20.1	19.1	15.4	14.3	4.7	6.0	11.9
NH ₄	1988	-	-	-	-	-	-	-	-	-	-	0.0	-	0.0
	1989	0.0	0.0	-	-	-	0.1	0.1	0.1	0.1	-	-	-	0.1
	1990	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	-	0.0	0.0
	1991	-	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
	1992	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.6	0.0	0.1
	1993	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.1	0.10	0.0
	1994	0.10	0.08	0.05	0.07	-	0.15	0.31	0.05	0.05	-	-	0.00	0.1
	1995	0.03	0.08	0.10	0.10	0.08	0.08	0.18	0.10	0.10	0.08	0.18	0.15	0.1
	1998	-	-	-	-	-	-	-	-	-	-	0.25	0.2	0.2
	Average	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.2	0.1	0.1
NO ₂	1988	-	-	-	-	-	-	-	-	-	-	0.0	-	0.0
	1989	0.0	0.5	-	-	-	0.0	2.1	9.1	0.4	-	-	-	2.0
	1990	1.5	0.0	1.9	1.7	1.0	1.0	1.7	0.0	0.5	0.7	-	1.0	1.0
	1991	-	0.0	7.6	2.0	0.6	46.5	75.0	6.4	0.92	0.0	2.5	1.7	13.0
	1992	16.5	5.3	0.3	49.2	9.2	0.6	1.1	0.4	0.7	0.5	0.1	3.6	7.3
	1993	-	-	-	-	-	1.0	1.2	0.5	0.5	1.7	0.5	1.0	0.9
	1994	1.0	2.5	3.3	1.0	-	0.5	0.5	5.7	0.5	-	-	0.0	1.7
	1995	9.3	4.7	13.7	2.8	2.0	6.8	0.9	4.2	1.3	0.6	0.9	0.73	4.0
	1998	-	-	-	-	-	-	-	-	-	-	1.65	1.3	1.5
	Average	5.7	2.2	5.4	11.3	3.2	8.1	11.8	3.8	0.7	0.7	0.9	1.3	3.5
NO ₃	1988	-	-	-	-	-	-	-	-	-	-	0.1	-	0.1
	1989	0.1	0.5	-	-	-	0.1	0.1	0.3	0.1	-	-	-	0.2
	1990	0.4	0.1	0.1	0.3	0.2	0.1	0.1	0.1	0.1	0.3	-	0.6	0.2
	1991	-	0.1	0.5	0.5	0.1	0.6	1.0	0.1	0.24	0.3	0.6	0.4	0.4
	1992	0.8	0.2	0.2	0.5	0.2	0.2	0.2	0.1	0.1	0.1	4.0	0.1	0.6
	1993	-	-	-	-	-	0.1	0.0	0.11	0.1	0.07	0.10	0.04	0.1
	1994	0.01	0.36	0.08	0.09	-	0.03	0.02	0.02	0.05	-	-	0.04	0.1
	1995	0.06	0.08	0.06	0.11	0.14	0.03	0.17	0.06	0.02	0.15	0.08	0.13	0.1
	1998	-	-	-	-	-	-	-	-	-	-	0.15	0.3	0.2
	Average	0.3	0.2	0.2	0.3	0.2	0.2	0.2	0.1	0.1	0.2	0.8	0.2	0.2

**Table 2.1.10 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Bolshaya Almatinka River: 0.5 km upstream of the city boundary**

Parameter	Maximum Allowable Concentration Factor (PDK)*													
	Year	Month												Ave.
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
Phenol	1988	-	-	-	-	-	-	-	-	-	-	7.0	-	7.0
	1989	0.0	0.0	-	-	-	0.0	0.0	9.0	1.0	-	-	-	1.7
	1990	1.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	1.0	-	2.0	0.6
	1991	-	0.0	1.0	0.0	0.0	0.0	7.0	2.0	0.0	7.0	4.0	2.0	2.1
	1992	2.0	0.0	0.0	0.0	0.0	1.0	2.0	1.0	0.0	2.0	1.8	0.0	0.8
	1993	-	-	-	-	-	5.0	0.0	0.0	0.0	1.0	5.0	0.0	1.6
	1994	8.0	0.0	0.0	2.0	-	1.0	0.0	0.0	1.0	-	-	0.0	1.3
	1995	-	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	1.0	2.0	1.0	0.5
	1998	-	-	-	-	-	-	-	-	-	-	1.5	2.0	1.8
Average	2.8	0.2	0.2	1.0	0.3	1.0	1.3	1.7	0.3	2.4	2.4	1.0	1.9	
Petroleum Products	1988	-	-	-	-	-	0.0	1.2	7.4	4.0	-	5.8	-	5.8
	1989	0.0	4.2	-	-	-	-	4.0	2.2	0.6	2.2	-	1.8	2.8
	1990	4.2	1.0	3.0	1.2	2.8	4.4	4.0	3.4	2.8	3.0	8.4	3.6	4.4
	1991	-	8.2	2.4	5.8	5.2	1.4	3.8	1.0	3.0	2.6	0.9	3.2	2.4
	1992	3.2	3.6	4.4	2.6	0.1	1.2	2.8	0.4	1.2	2.4	2.0	2.0	2.6
	1993	-	-	-	-	-	5.4	4.8	2.4	4.0	-	-	3.6	4.4
	1994	3.6	5.0	13.6	4.0	-	2.0	1.2	1.0	1.0	4.0	5.0	4.2	2.6
	1995	1.8	1.8	1.8	3.6	3.0	1.8	2.0	-	-	-	2.2	2.5	2.4
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	2.6	4.0	5.0	3.4	2.8	2.3	2.8	2.5	2.4	2.8	3.1	3.0	3.3	
Fluoride	1988	-	-	-	-	-	0.0	0.7	0.9	1.0	-	1.1	-	1.1
	1989	0.8	-	-	-	-	0.7	-	2.5	0.7	-	-	-	0.7
	1990	1.3	-	-	1.1	-	0.7	-	0.5	0.75	-	0.8	-	1.3
	1991	-	-	-	1.1	-	1.3	-	-	-	-	-	-	0.9
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	0.6	-	0.7	-	0.52	-	0.6
	1994	0.92	-	-	1.68	-	1.25	-	0.46	0.72	-	-	-	1.0
	1995	0.33	-	-	0.32	0.89	1.51	0.27	1.41	0.65	2.19	1.19	1.77	1.1
	1998	-	-	-	-	-	-	-	-	-	-	0.85	1.05	1.0
Average	0.8	-	-	1.1	0.9	1.0	0.5	1.2	0.8	2.2	0.7	1.4	0.9	
Copper	1988	-	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-
	1990	-	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	-	-	-	-	-	-
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	2.0	-	0.0	-	0.0	-	0.4
	1994	0.0	-	-	-	-	0.0	-	0.0	2.0	-	-	-	0.4
	1995	2.0	-	0.00	0.0	0.0	0.0	0.0	0.0	2.0	3.0	0.0	1.0	2.0
	1998	-	-	-	-	-	-	-	-	-	-	1.0	0.0	0.5
Average	1.0	-	0.0	0.0	0.0	0.0	1.0	0.0	1.3	3.0	0.3	0.5	0.8	
Zinc	1988	-	-	-	-	-	-	-	-	-	-	-	-	-
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-
	1990	-	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	-	-	-	-	-	-
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	0.4	-	0.0	-	0.2	-	0.2
	1994	0.3	-	-	-	-	0.0	-	0.0	0.0	-	-	-	0.1
	1995	0.0	-	0.00	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	1998	-	-	-	-	-	-	-	-	-	-	0.35	0.1	0.2
Average	0.2	-	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.2	0.1	0.1	

Table 2.1.10 Maximum Allowable Concentration Factor (PDK) of River Water Quality in Almaty City 1988-1998, Bolshaya Almatinka River: 0.5 km upstream of the city boundary

Parameter	Maximum Allowable Concentration Factor (PDK)*												
	Year	Month											
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.
Water Pollution Index	1988	-	-	-	-	-	-	-	-	-	2.4	-	2.4
	1989	0.40	0.97	-	-	-	0.3	0.70	4.7	-	-	-	1.4
	1990	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	-	-	-	-	-
	1992	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	-	-	-	-	-	-
	1994	-	-	-	-	-	-	-	-	-	-	-	-
	1995	-	-	-	-	-	-	-	-	-	-	-	-
	1998	-	-	-	-	-	-	-	-	-	-	-	-
	Average	0.4	1.0	-	-	-	0.3	0.7	4.7	-	-	2.4	-
Water Classification	1988	-	-	-	-	-	-	-	-	-	IV	-	-
	1989	II	II	-	-	-	I	I	V	-	-	-	-
	1990	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	-	-	-	-	-
	1992	-	-	-	-	-	-	III	III	-	-	-	-
	1993	-	-	-	-	-	-	-	-	-	-	-	-
	1994	-	-	-	-	-	-	-	-	-	-	-	-
	1995	-	-	III	-	-	-	-	-	-	-	-	-
1998	-	-	-	-	-	-	-	-	-	-	-	-	

Source: Republican State Enterprise Kazhydromet, "Information Bulletin on the State of Environment Pollution in Almaty City," November and December 1998.

National Department of Hydrometeorology, Republic of Kazakhstan, "Information Bulletin on the State of Environment Pollution in Almaty City," 1995, 1994 and 1993.

State Committee of USSR on Hydrometeorology, Kazakhstan National Department of Hydrometeorology, "Report on the Pollution of Environment in Almaty City," 1991, 1990, 1989 and 1988.

**Table 2.1.11 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Bolshaya Almatinka River: 12 km upstream of river mouth**

Parameter	Maximum Allowable Concentration Factor (PDK)*													
	Year	Month											Ave.	
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.		
Discharge (m ³ /s)	1988	-	-	-	-	-	-	-	-	-	1.59	-	1.59	
	1989	-	-	-	-	-	-	-	-	-	-	-	-	
	1990	-	-	-	-	-	-	-	-	0.75	-	0.81	0.78	
	1991	-	-	0.78	-	-	-	-	0.25	0.60	0.60	0.49	0.48	0.53
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	1.27	1.37	0.98	2.8	2.70	2.60	2.30	2.00
	1994	1.81	1.26	-	1.14	-	1.03	2.09	1.76	2.08	-	-	1.39	1.57
	1995	0.40	-	2.80	1.29	1.14	0.94	0.45	1.02	1.25	1.84	3.29	2.20	1.51
	1998	-	-	-	-	-	-	-	-	-	-	1.64	3.91	2.78
	Average	1.11	1.26	1.79	1.22	1.14	1.08	1.30	1.00	1.68	1.47	1.60	1.85	1.54
Water Temperature (°C)	1988	-	-	-	-	-	-	-	-	-	6.7	-	6.7	
	1989	-	0.0	-	-	-	-	-	-	-	-	-	0.0	
	1990	-	-	-	-	-	-	-	-	-	15.5	-	1.0	
	1991	-	0.1	5.9	-	-	-	-	30.0	23.8	15.0	4.9	6.2	12.3
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	25.0	22.0	20.0	20.6	12.4	5.4	1.4	15.3
	1994	0.0	0.4	-	10.4	-	25.8	22.6	23.4	19.2	-	-	4.8	13.3
	1995	0.0	-	0.2	11.4	23.2	28.2	22.6	23.6	15.8	17.1	8.8	8.3	14.5
	1998	-	-	-	-	-	-	-	-	-	-	8.1	1.9	5.0
	Average	0.0	0.2	3.1	10.9	23.2	26.3	22.4	24.3	19.9	15.0	5.4	3.9	9.4
NH ₄	1988	-	-	-	-	-	-	-	-	-	0.0	-	0.0	
	1989	-	0.0	-	-	-	-	-	-	-	-	-	0.0	
	1990	-	-	-	-	-	-	-	-	-	0.0	-	0.0	
	1991	-	0.0	0.1	-	-	-	-	0.0	0.05	0.0	0.2	0.0	0.1
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.1	0.38	0.1
	1994	0.15	0.15	-	0.07	-	0.26	0.21	0.00	0.08	-	-	0.00	0.1
	1995	0.00	-	0.08	0.31	0.21	0.05	0.28	0.05	0.13	0.15	0.03	0.12	0.1
	1998	-	-	-	-	-	-	-	-	-	-	0.25	0.2	0.2
	Average	0.1	0.1	0.1	0.2	0.2	0.1	0.2	0.0	0.1	0.0	0.1	0.1	0.1
NO ₂	1988	-	-	-	-	-	-	-	-	-	0.0	-	0.0	
	1989	-	12.1	-	-	-	-	-	-	-	-	-	12.1	
	1990	-	-	-	-	-	-	-	-	-	0.3	-	0.2	
	1991	-	0.5	1.4	-	-	-	-	0.0	0.33	0.04	0.9	1.7	0.7
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	0.0	1.5	0.5	0.7	1.2	1.0	1.2	0.9
	1994	2.8	2.8	-	1.5	-	1.8	2.8	38.5	0.0	-	-	2.5	6.6
	1995	2.3	-	1.4	2.5	2.0	2.0	0.6	2.5	4.7	0.9	6.6	2.8	2.6
	1998	-	-	-	-	-	-	-	-	-	-	34.3	1.7	18.0
	Average	2.6	5.1	1.4	2.0	2.0	1.3	1.6	10.4	1.4	0.6	8.6	1.7	5.1
NO ₃	1988	-	-	-	-	-	-	-	-	-	0.3	-	0.3	
	1989	-	0.4	-	-	-	-	-	-	-	-	-	0.4	
	1990	-	-	-	-	-	-	-	-	-	2.0	-	1.3	
	1991	-	0.6	0.6	-	-	-	-	0.1	0.27	0.3	0.5	0.4	
	1992	-	-	-	-	-	-	-	-	-	-	-	-	
	1993	-	-	-	-	-	0.0	0.0	0.03	0.4	0.11	0.06	0.09	0.1
	1994	0.02	0.23	-	0.14	-	0.13	0.04	0.10	0.11	-	-	0.06	0.1
	1995	0.11	-	0.05	0.10	0.13	0.19	0.33	0.01	0.04	0.12	0.14	0.16	0.1
	1998	-	-	-	-	-	-	-	-	-	-	0.25	0.3	0.3
	Average	0.1	0.4	0.3	0.1	0.1	0.1	0.1	0.1	0.2	0.6	0.2	0.3	0.4

**Table 2.1.11 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Bolshaya Almatinka River: 12 km upstream of river mouth**

Parameter	Maximum Allowable Concentration Factor (PDK)*													
	Year	Month												
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.	
Phenol	1988	-	-	-	-	-	-	-	-	-	2.0	-	2.0	
	1989	-	0.0	-	-	-	-	-	-	-	-	-	0.0	
	1990	-	-	-	-	-	-	-	-	0.0	-	0.0	0.0	
	1991	-	0.0	0.0	-	-	-	-	0.0	0.0	4.0	2.0	4.0	1.4
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.4
	1994	2.0	0.0	-	1.0	-	0.0	0.0	0.0	0.0	-	-	0.0	0.4
	1995	-	-	0.0	1.0	1.0	1.0	2.0	0.0	0.0	1.0	2.0	1.0	0.9
	1998	-	-	-	-	-	-	-	-	-	-	1.05	2.0	1.5
	Average	2.0	0.0	0.0	1.0	1.0	0.7	0.7	0.0	0.0	1.5	1.2	1.2	0.8
Petroleum Products	1988	-	-	-	-	-	-	-	-	-	2.0	-	2.0	
	1989	-	1.2	-	-	-	-	-	-	-	-	-	1.2	
	1990	-	-	-	-	-	-	-	-	2.4	-	3.2	2.8	
	1991	-	4.0	6.6	-	-	-	-	4.2	1.8	-	5.2	4.0	4.3
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	6.2	6.0	0.6	0.8	3.0	2.4	2.4	3.1
	1994	3.0	3.0	-	3.0	-	2.0	3.0	3.6	5.0	-	-	4.0	3.3
	1995	2.4	-	2.4	3.6	3.0	2.0	3.0	5.4	1.8	5.0	5.0	4.7	3.5
	1998	-	-	-	-	-	-	-	-	-	-	2.1	2.4	2.3
	Average	2.7	2.7	4.5	3.3	3.0	3.4	4.0	3.5	2.4	3.5	2.9	3.5	2.8
Fluoride	1988	-	-	-	-	-	-	-	-	-	1.4	-	1.4	
	1989	-	-	-	-	-	-	-	-	-	-	-	-	
	1990	-	-	-	-	-	-	-	-	-	-	-	-	
	1991	-	-	-	-	-	-	-	1.6	0.55	-	0.8	-	1.0
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	0.9	-	0.2	0.9	0.75	-	0.7
	1994	0.11	-	-	0.65	-	1.44	-	0.72	1.13	-	-	-	0.8
	1995	0.16	-	-	0.76	2.68	2.76	2.12	0.29	0.75	2.07	0.67	1.55	1.4
	1998	-	-	-	-	-	-	-	-	-	-	1.35	1.15	1.3
	Average	0.1	-	-	0.7	2.7	2.1	1.5	0.9	0.7	1.5	0.7	1.4	1.1
Copper	1988	-	-	-	-	-	-	-	-	-	-	-	-	
	1989	-	-	-	-	-	-	-	-	-	-	-	-	
	1990	-	-	-	-	-	-	-	-	-	-	-	-	
	1991	-	-	-	-	-	-	-	-	-	-	-	-	
	1992	-	-	-	-	-	-	-	-	-	-	-	-	
	1993	-	-	-	-	-	-	0.0	-	0.0	0.0	3.0	-	0.8
	1994	0.0	-	-	-	-	0.0	-	0.0	0.0	-	-	-	0.0
	1995	0.0	-	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	1998	-	-	-	-	-	-	-	-	-	-	0.0	1.0	0.5
	Average	0.0	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.5	0.3
Zinc	1988	-	-	-	-	-	-	-	-	-	-	-	-	
	1989	-	-	-	-	-	-	-	-	-	-	-	-	
	1990	-	-	-	-	-	-	-	-	-	-	-	-	
	1991	-	-	-	-	-	-	-	-	-	-	-	-	
	1992	-	-	-	-	-	-	-	-	-	-	-	-	
	1993	-	-	-	-	-	-	0.0	-	0.0	0.0	0.3	-	0.1
	1994	0.0	-	-	-	-	0.0	-	0.0	0.0	-	-	-	0.0
	1995	0.0	-	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	1998	-	-	-	-	-	-	-	-	-	-	0.15	0.35	0.3
	Average	0.0	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1

**Table 2.1.11 Maximum Allowable Concentration Factor (PDK) of River Water Quality
in Almaty City 1988-1998,
Bolshaya Almatinka River: 12 km upstream of river mouth**

Parameter	Maximum Allowable Concentration Factor (PDK)*													Av
	Year	Month												
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
Water Pollution Index	1988	-	-	-	-	-	-	-	-	-	-	1.4	-	1.4
	1989	-	2.42	-	-	-	-	-	-	-	-	-	-	2.42
	1990	-	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	-	-	-	-	-	-
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	1993	-	-	-	-	-	-	-	-	-	-	-	-	-
	1994	-	-	-	-	-	-	-	-	-	-	-	-	-
	1995	-	-	-	-	-	-	-	-	-	-	-	-	-
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	-	2.4	-	-	-	-	-	-	-	-	-	1.4	-	1.4
Water Classification	1988	-	-	-	-	-	-	-	-	-	-	III	-	-
	1989	-	IV	-	-	-	-	-	-	-	-	-	-	-
	1990	-	-	-	-	-	-	-	-	-	-	-	-	-
	1991	-	-	-	-	-	-	-	-	-	-	-	-	-
	1992	-	-	-	-	-	-	III	III	-	-	-	-	-
	1993	-	-	-	-	-	-	-	-	-	-	-	-	-
	1994	-	-	-	-	-	-	-	-	-	-	-	-	-
	1995	-	-	III	-	-	-	-	-	-	-	-	-	-
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-

Source: Republican State Enterprise Kazhydromet, "Information Bulletin on the State of Environment Pollution in Almaty City," November and December 1998.

National Department of Hydrometeorology, Republic of Kazakhstan, "Information Bulletin on the State of Environment Pollution in Almaty City," 1995, 1994 and 1993.

State Committee of USSR on Hydrometeorology, Kazakhstan National Department of Hydrometeorology, "Report on the Pollution of Environment in Almaty City," 1991, 1990, 1989 and 1988.

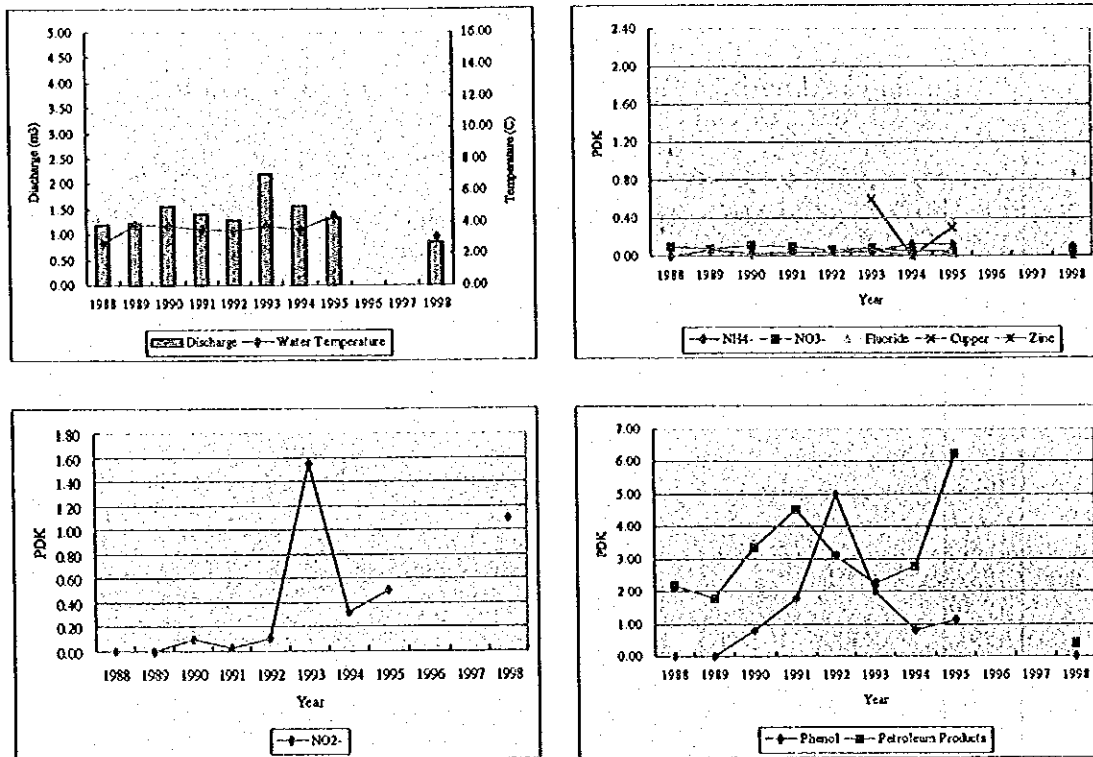


Figure 2.1.1 Average PDK of Water Quality in Malaya Almatinka River (1988-1998),
2 km Upstream of the City Boundary

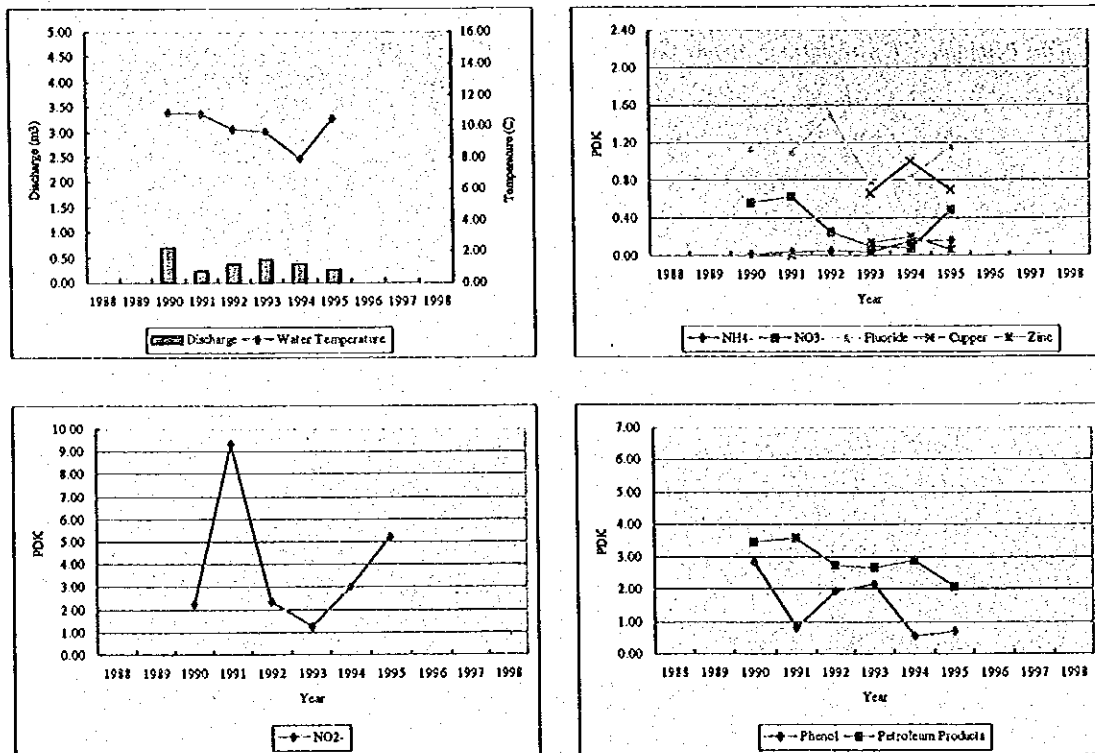


Figure 2.1.2 Average PDK of Water Quality in Malaya Almatinka River (1988-1998),
0.5 km Downstream of a Fur Manufacturing

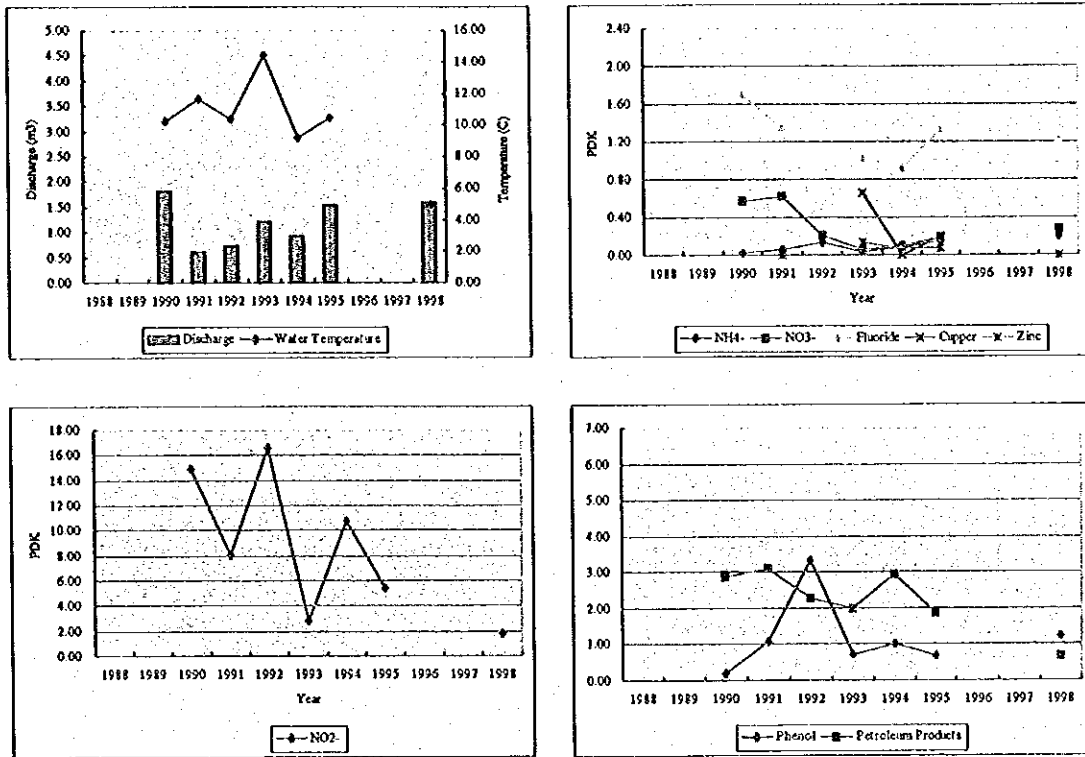


Figure 2.1.3 Average PDK of Water Quality in Malaya Almatinka River (1988-1998), 4 km Downstream of the City Boundary, in Pokrovka

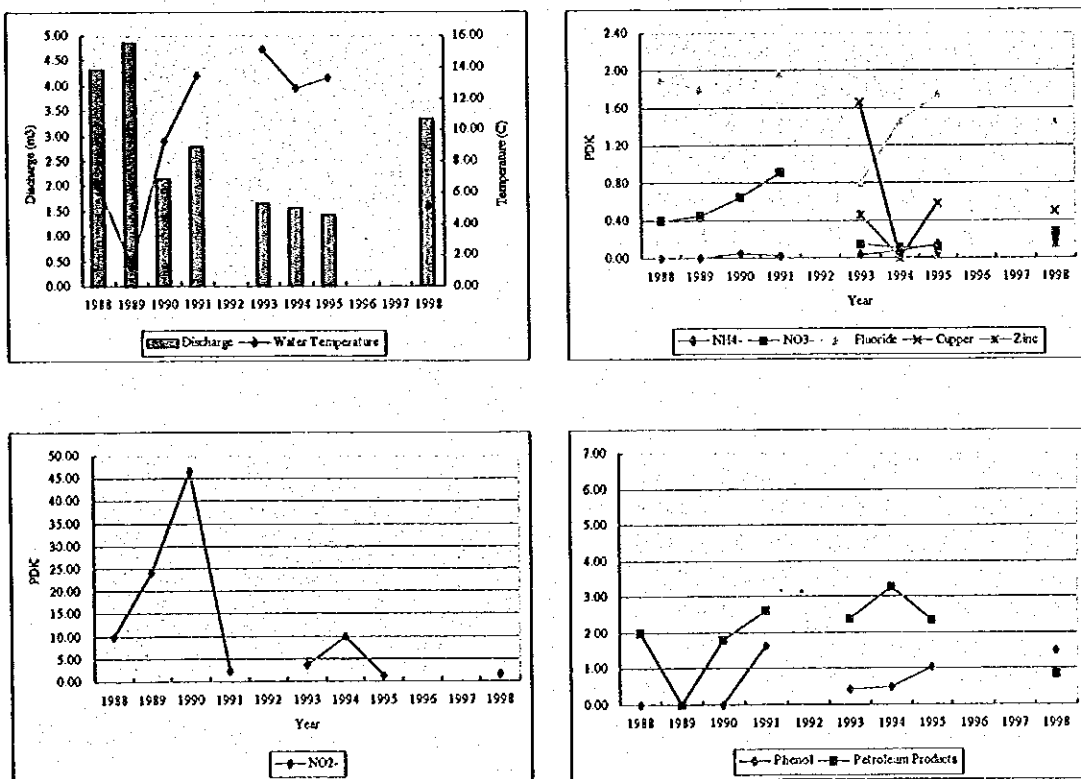


Figure 2.1.4 Average PDK of Water Quality in Malaya Almatinka River (1988-1998), 0.5 km Downstream of the Radio Station No. 5

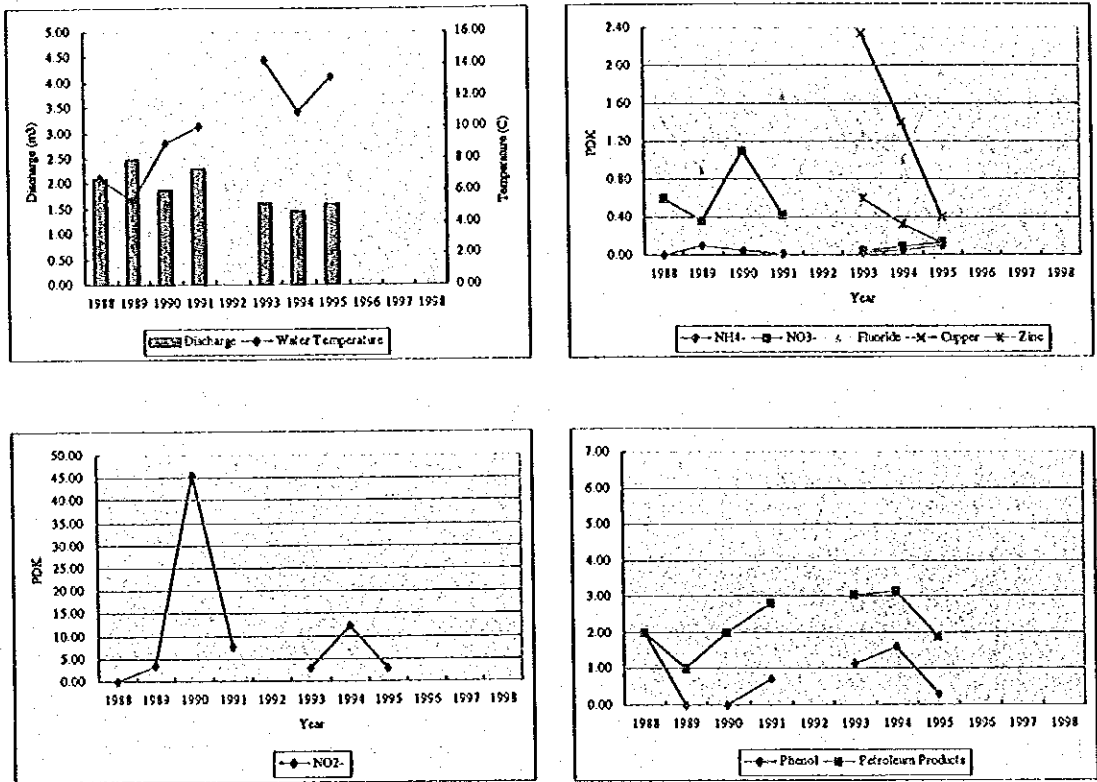


Figure 2.15 Average PDK of Water Quality in Malaya Almatinka River (1988-1998),
15 km Downstream of the City Boundary

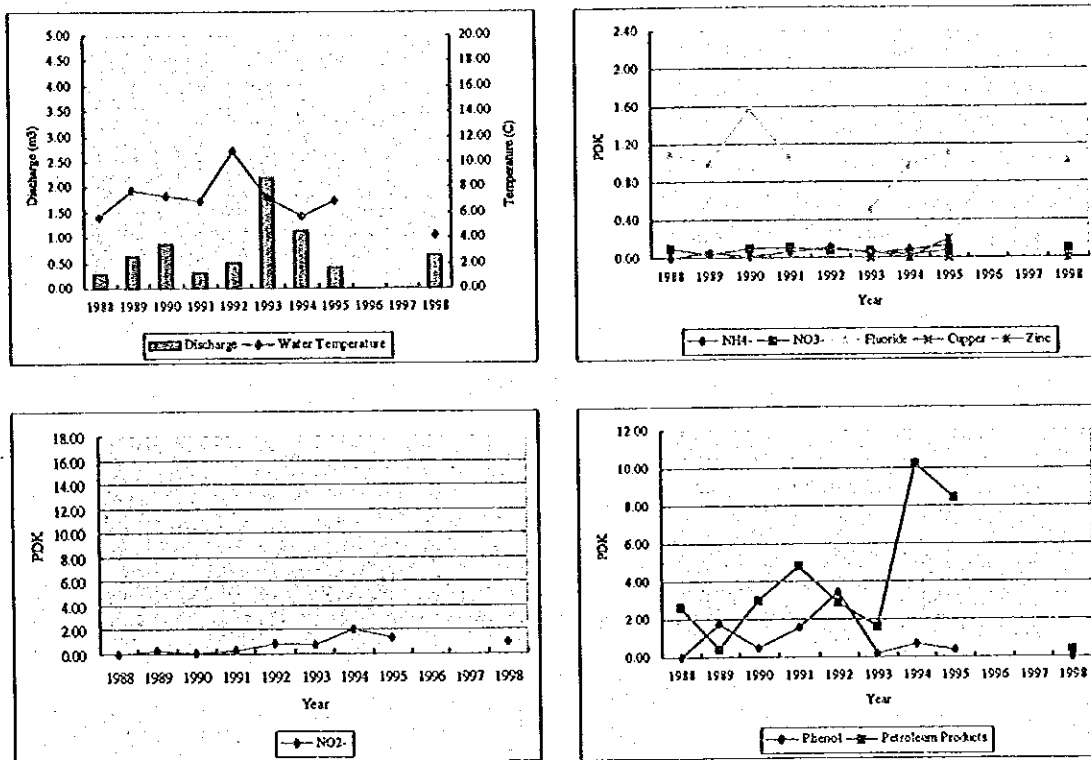


Figure 2.1.6 Average PDK of Water Quality in Bolshaya Almatinka River (1988-1998),
9.1 km Upstream of the City Boundary

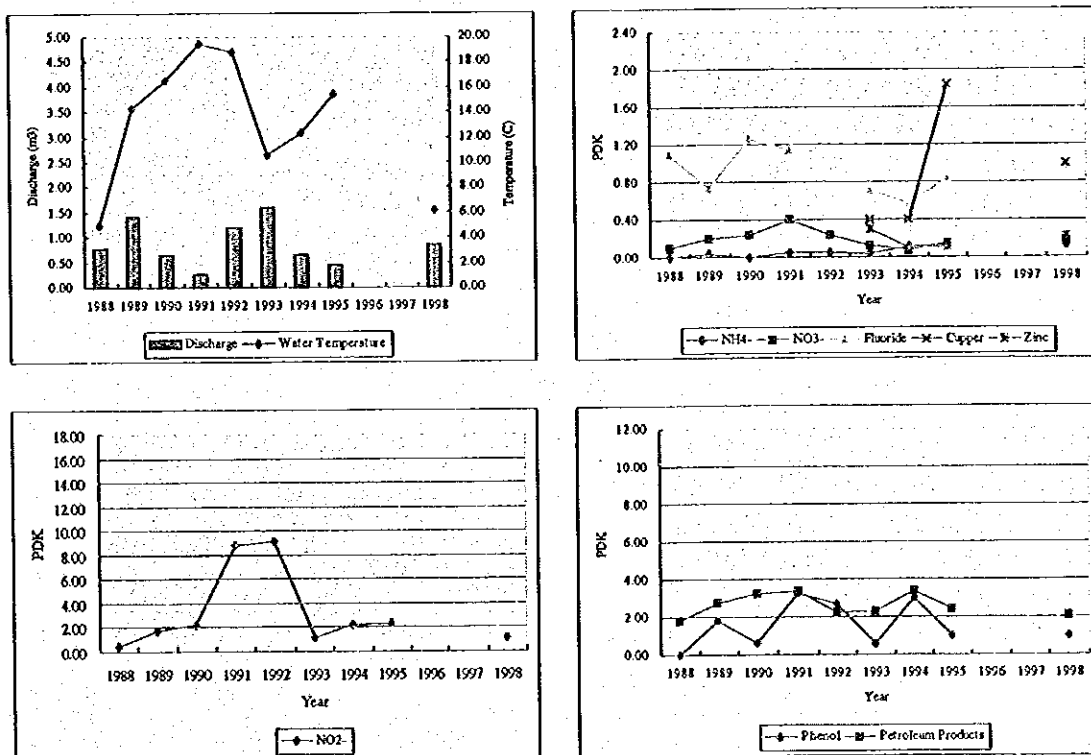


Figure 2.1.7 Average PDK of Water Quality in Bolshaya Almatinka River (1988-1998),
0.5 km Downstream of AHBK

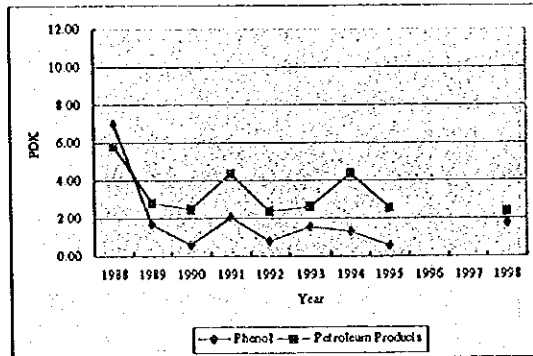
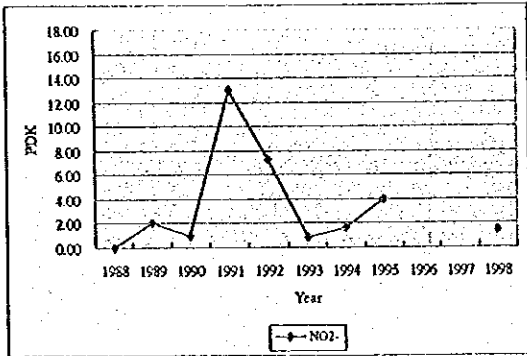
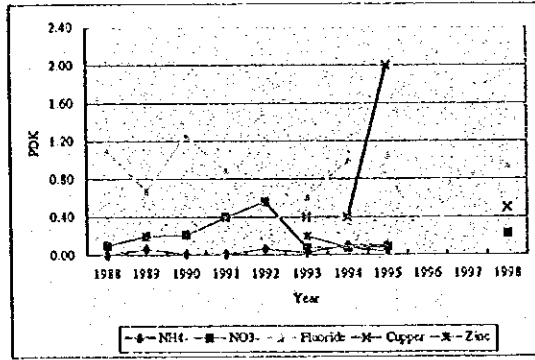
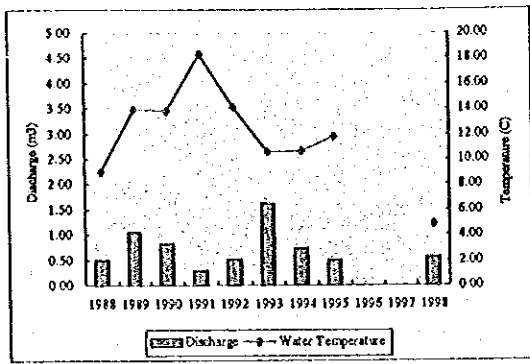


Figure 2.1.8 Average PDK of Water Quality in Bolshaya Almatinka River (1988-1998), 0.5 km Downstream of the City Boundary

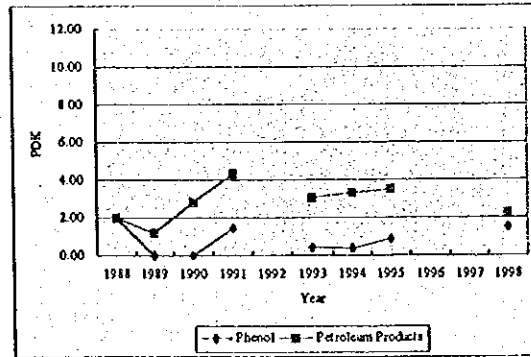
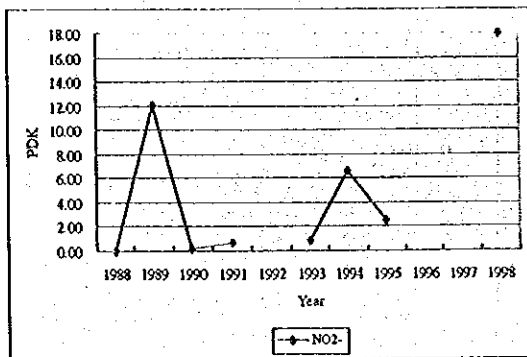
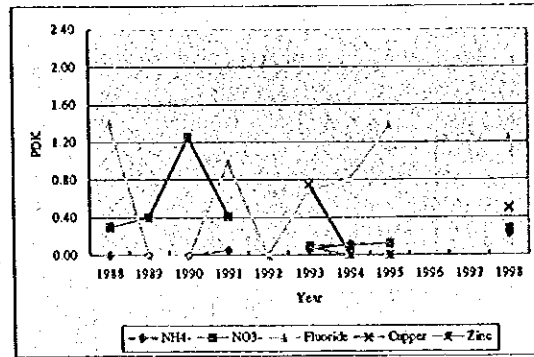
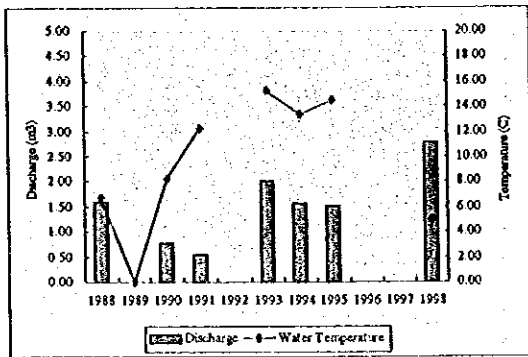


Figure 2.1.9 Average PDK of Water Quality in Bolshaya Almatinka River (1988-1998), 12 km Upstream of the River Mouth

Table 2.1.12 Japanese Water Quality Standards (Receiving Water)

a) Standards relating to Protection of Public Health

Parameter	Permissible value (mg/l)
Cyanide	Not detectable
Alkyl mercury	Not detectable
Organic phosphorus (parathion, methyl parathion, methyl dimeton and EPN only)	Not detectable
Cadmium	<0.01
Lead	<0.1
Hexavalent Chromium	<0.05
Arsenic	<0.05
Total mercury	Not detectable

b) Standards relating to Preservation of the Environment

b1) Rivers

Category	Use	Daily average value				
		pH	BOD (mg/l)	SS (mg/l)	DO (mg/l)	Coliform Bacteria (MPN/100 ml)
M	Water supply: class 1; conservation of the environment and uses of categories A to E	6.5-8.5	<1	<25	>7.5	<50
A	Water supply: class 2, Fishery: class 1; bathing and uses of categories B to E	6.5-8.5	<2	<25	>7.5	<1000
B	Water supply: class 3, Fishery: class 1 and uses of categories C to E	6.5-8.5	<3	<25	>5	<5000
C	Fishery: class 3, Industrial water: class 1, and uses of categories D to E	6.0-8.5	<5	<50	>5	-
D	Industrial water: class 2, Agricultural water *, and uses of category E	6.0-8.5	<8	<100	>2	-
E	Industrial water: class 3, conservation of environment	6.0-8.5	<10	**	>2	-

Note: * For agricultural water, pH shall be between 6.0-7.5 and dissolved oxygen shall not be less than 5 mg/l. (The same value is applied to the standards for lakes).

** Floating matter should not be observed.

Table 2.1.12 Japanese Water Quality Standards (cont'd)

b2) Lakes

Natural lakes, reservoirs, marshes and artificial lakes with more than 10 million m³

Category	Use	Daily average value				
		pH	COD (mg/l)	SS (mg/l)	DO (mg/l)	Coliform Bacteria (MPN/100 ml)
AA	Water supply: class 1; conservation of the environment and uses of categories A to E	6.5-8.5	<1	<1	>7.5	<50
A	Water supply: class 2, Fishery: class 1; bathing and uses of categories B to E	6.5-8.5	<3	<5	>7.5	<1000
B	Water supply: class 3, Fishery: class 1 and uses of categories C to E	6.5-8.5	<5	<15	>5	-
C	Fishery: class 3, Industrial water: class 1, and uses of categories D to E	6.0-8.5	<8	*	>2	-

* Floating matter should not be observed.

b3) Coastal Waters

Category	Use	Daily average value				
		pH	COD (mg/l)	DO (mg/l)	Hexane (mg/l)	Coliform Bacteria (MPN/100 ml)
A	Fishery: class 1; bathing and uses of categories A to C	7.8-8.3	<2	>7.5	not detectable	<1000 *
B	Fishery: class 2; industrial water and uses of category C	7.8-8.3	<3	>5	not detectable	-
C	Conservation of the environment	7.0-8.3	<8	>2	-	-

* For oyster culture this value must be <70.

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Quality Control
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4.3. The epidemic safety of drinking water is assessed for its conformity with the standards by microbiological and parasitic data listed in Table 2.1.13.

Table 2.1.13 Water Standards of Microbiological and Parasitic Data

Parasites	Unit of measurement	Standards
Thermotolerant coliform bacteria	Number of bacteria in 100 ml ₁₎	Absence
General coliform bacteria ₂₎	Number of bacteria in 100 ml ₁₎	Absence
Total bacterium number ₂₎	Number of bacteria forming colonies in 1 ml	Not more than 50
Coliphages ₃₎	Number of patch-forming units (BFU) in 100 ml	Absence
Spores of sulfate-reducing bacteria ₄₎	Number of spores in 20 ml	Absence
Giardia (intestinal worm) cysts ₃₎	Number of cysts in 50 l	Absence

4.4.3. The content of harmful chemicals getting into water supply sources due to business activity of people (Addendum 2).

Table 2.1.14 Water Standards of Harmful Chemicals from Industrial Effluents (1)

Parameters	Unit of measurement	Standards (MPC), not more than	Index of harmfulness ₁₎	Class of danger
General data				
pH value	PH units	Within 6-9		
Total mineralization (dry residue)	mg/l	1000 (1500) ₂₎		
Total hardness	mmol/l	7.0 (10) ₂₎		
Permanganate oxidizability	mg/l	5.0		
Oil products, total	mg/l	0.1		
Surfactants, anion-active	mg/l	0.5		
Phenol index	mg/l	0.25		
Inorganic substances				
Aluminum (Al ³⁺)	mg/l	0.5	Low toxic	2
Barium (Ba ²⁺)	“-	0.1	“-	2

Berillium (Be ²⁺)	-"	0.0002	-"	1
Boron (B, total)	-"	0.5	-"	2
Iron (Fe, total)	-"	0.3 (1.0) ₂ , org.	3	
Cadmium (Cd, total)	-"	0.001	Low toxic	2
Manganese (Mn, total)	-"	0.1 (0.5) ₂	Org.	3
Copper (Cu, total)	-"	1.0	-"	3
Molybdenum (Mo, total)	-"	0.25	Low toxic	2
Arsenic (As, total)	-"	0.05	Low toxic	2
Nickel (Ni, total)	mg/l	0.1	Low toxic	3
Nitrates (for NO ₃)	-"	45	Org.	3
Mercury (Hg, total)	-"	0.0005	Low toxic	1
Lead (Pb, total)	-"	0.03	-"	2
Selenium (Se, total)	-"	0.01	-"	2
Strontium (Sr ²⁺)	-"	7.0	-"	2
Sulfates (SO ₄ ²⁻)	-"	500	Org.	4
Fluorides (F)				
For climatic areas				
- I and II	-"	1.5	Low toxic	2
- III	-"	1.2	-"	2
Chlorides (Cl)	-"	350	Org.	4
Chromium (Cr ⁶⁺)	-"	0.05	Low toxic	3
Cyanides (CN)	-"	0.035	-"	2
Zinc (Zn ²⁺)	-"	5.0	Org.	3
Organic substances				
γ-ГХЦГ (lindane)	-"	0.002	Low toxic	1
ДДТ (sum of isomers)	-"	0.002	-"	2
2,4-Д	-"	0.03	-"	2

Table 2.1.15 Water Standards of Harmful Chemicals from Industrial Effluents (2)

Parameters	Unit of measurement	Standards (MPC), not more than	Index of harmfulness	Class of danger
Chlorine				
- residual free	mg/l	Within 0.3-0.5	Org.	3
-residual fixed	-"	Within 0.8-1.2	-"	3
Chloroform (with chlorination of water)	-"	0.2	Low toxic	2
Residual ozone	-"	0.3	org	
Formaldehyde (with ozonation of water)	-"	0.05	Low toxic	2
Polyacrylamide -"- 2.0	-"	2	-"	2
Activated silicic acid (for Si)	-"	10	-"	2
Polyphosphates (for PO ₄ ³⁻)	-"	3.5	Org.	3
Residual amount of aluminum- and iron-containing coagulants	-"	See data for Aluminum and Iron in Table 2.1.14		

4.5. The favorable organoleptic properties of water are conditioned by its conformity with the norms listed in Table 2.1.16 and with the standards for the content of substances listed in Tables 2.1.14 and 2.1.15 and Addendum 2.

Table 2.1.16 Water Standards of Organoleptic Properties

Parameters	Unit of measurement	Standards, not more than
Odor	points	2
Flavor	-"	2
Chromaticity	degrees	20 (35)
Turbidity	EMΦ (Formazine turbidity unit) or mg/l for kaolin	1.5 (2)

4.6. The radiation safety of water is conditioned by its conformity with the standards for α and β activity listed in Table 2.1.17.

Table 2.1.17 Water Standards of Radiation Safety

Parameters	Unit of measurement	Standards	Index of harmfulness
Total α -radioactivity	Бк/л	0.1	radioactive
Total β -radioactivity	Бк/л	1.0	-"

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GOST 2874-82

Date of introduction: 01.01.85

Table 2.1.18 Microbiological Parameters of Water

Parameters	Standard	Method of testing
Number of microorganisms in 1 cm ³ of water, not more than	100	GOST 18963
Number of coliform bacillus bacteria in 1 dm ³ of water (Coliform index), not more than	3	GOST 18963

Table 2.1.19 Toxicological Parameters of Water

Parameters	Standard	Method of testing
Residual aluminum (Al), mg/dm ³ , not more than	0.5	GOST 18165
Berillium (Be), not more than	0.0002	GOST 18294
Molibdenum (Mo), mg/dm ³ , not more than	0.25	GOST 18308
Arsenic (As), mg/dm ³ , not more than	0.05	GOST 4152
Nitrates (NO ₃), mg/dm ³ , not more than	45.0	GOST 18826
Residual polyacrylamide, mg/dm ³ , not more than	2.0	GOST 19355
Lead (Pb), mg/dm ³ , not more than	0.03	GOST 18293
Selenium (Se), mg/dm ³ , not more than	0.01	GOST 19413
Strontium (Sr), mg/dm ³ , not more than	7.0	GOST 23950
Fluorine (F), mg/dm ³ , not more than, for climatic areas:		
I and II	1.5	
III	1.2	
IV	0.7	

Table 2.1.20 Concentration of Chemicals Affecting Organoleptic Properties of Water

Parameters	Standard	Method of testing
Index of hydrogen, pH	6.0-9.0	Measured by pH meter of any type with a glass electrode, with a measurement uncertainty of not more than 0.1 pH
Iron (Fe), mg/dm ³ , not more than	0.3	GOST 4011
Total hardness, mole/m ³ , not more than	7.0	GOST 4151
Manganese (Mn), mg/dm ³ , not more than	0.1	GOST 4974
Residual polyphosphates (PO ₄ ³⁻), mg/dm ³ , not more than	3.5	GOST 18309
Sulfates (SO ₄ ²⁻), mg/dm ³ , not more than	500	GOST 4389
Dry residue, mg/dm ³ , not more than	1000	GOST 18164
Chlorides (Cl ⁻), mg/dm ³ , not more than	350	GOST 4245
Zink (Zn ²⁺), mg/dm ³ , not more than	5.0	GOST 18293

Notes:

1. The water systems supplying water without special treatment by agreement with the Sanitary Service are allowed to have: dry residue – up to 1500 mg/dm³; total hardness – up to 10 mole/m³; iron – up to 1 mg/dm³; manganese – up to 0.5 mg/dm³.
2. The sum of concentrations of chlorides and sulfates expressed as fractions of maximum permissible concentrations of each individual substance, must not be more than 1.

Table 2.1.21 Organoleptic Properties of Water

Parameters	Standard	Method of testing
Odor at 20° C on heating to 60° C, points, not more than	2	GOST 3351
Taste and flavor at 20° C, points, not more than	2	GOST 3351
Color, degrees, not more than	20	GOST 3351
Turbidity according to the standard scale	1.5	GOST 3351

Note: By agreement with the Sanitary Service, an increase in the water color of up to 35° and the turbidity (during flooding) up to 2 mg/dm³ is allowed.

**Table 2.2.1 Maximum Allowable Concentration Factor (PDK) of Air Pollution
in Almaty City 1988-1998**

Pollutants	Year	Maximum Allowable Concentration Factor (PDK)														
		Month												Ave.		
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.			
Dust	1988	Ave.	-	-	-	-	-	-	-	-	-	-	2.0	-	-	2.0
		Max.	-	-	-	-	-	-	-	-	-	-	3.4	-	-	3.4
	1989	Ave.	1.3	1.3	-	-	-	1.3	1.3	2.0	-	2.0	-	-	-	1.5
		Max.	2.2	2.0	-	-	-	2.8	2.6	3.4	-	3.2	-	-	-	2.7
	1990	Ave.	2.0	1.9	1.6	1.7	1.3	2.0	1.7	1.5	1.8	1.9	-	2.1	-	1.8
		Max.	3.2	3.2	3.6	4.2	2.8	3.0	1.5	1.4	1.7	1.8	-	3.6	-	2.7
	1991	Ave.	1.6	1.8	1.9	1.9	1.9	1.9	1.8	2.6	2.4	3.1	2.2	-	-	1.3
		Max.	2.5	3.0	3.0	4.0	3.0	3.0	2.8	3.2	3.4	2.0	8.7	-	-	2.1
	1992	Ave.	2.1	2.0	2.1	2.2	2.0	1.7	2.1	1.8	2.2	2.3	2.3	1.4	-	2.0
		Max.	2.4	2.4	3.2	3.8	3.0	3.0	6.4	1.0	7.0	2.4	2.8	2.4	-	3.6
	1993	Ave.	-	-	-	-	-	2.0	2.0	1.7	1.7	2.0	1.5	2.0	-	1.8
		Max.	-	-	-	-	-	3.0	2.8	3.4	2.8	3.6	2.6	2.2	-	2.9
	1994	Ave.	1.9	1.3	1.3	1.1	0.9	1.0	1.0	1.3	1.3	-	-	1.3	-	0.6
		Max.	2.8	2.2	2.0	2.2	6.4	2.2	1.4	1.8	2.0	-	-	2.4	-	1.0
	1995	Ave.	1.2	1.2	1.1	1.9	0.8	0.8	0.1	0.7	0.7	0.2	0.2	0.2	-	0.8
		Max.	2.0	1.8	2.2	1.0	1.2	1.0	1.9	0.6	0.6	0.4	0.4	0.4	-	1.1
	1998	Ave.	-	-	-	-	-	-	-	-	-	-	1.4	0.5	-	1.0
		Max.	-	-	-	-	-	-	-	-	-	-	1.5	1.0	-	1.3
SO ₂	1988	Ave.	-	-	-	-	-	-	-	-	-	0.2	-	-	0.2	
		Max.	-	-	-	-	-	-	-	-	-	0.1	-	-	0.1	
	1989	Ave.	0.2	0.2	-	-	-	0.2	0.2	0.2	-	0.2	-	-	-	0.2
		Max.	0.1	0.2	-	-	-	0.1	0.1	0.1	-	0.2	-	-	-	0.1
	1990	Ave.	0.2	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	-	0.4	-	0.2
		Max.	0.2	0.2	0.2	0.2	0.1	0.2	0.1	0.1	0.1	0.1	-	1.6	-	0.3
	1991	Ave.	0.5	0.5	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.6	-	-	0.3
		Max.	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.3	8.2	-	-	0.9
	1992	Ave.	0.5	0.6	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	-	0.4
		Max.	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.4	-	0.2
	1993	Ave.	-	-	-	-	-	0.3	0.4	0.3	0.3	0.3	0.3	0.5	-	0.3
		Max.	-	-	-	-	-	0.2	0.3	0.1	0.2	0.3	0.2	0.3	-	0.2
	1994	Ave.	0.6	0.5	0.4	0.3	0.3	0.3	0.3	0.3	0.3	-	-	0.4	-	0.2
		Max.	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	-	-	0.2	-	0.1
	1995	Ave.	0.5	0.4	0.4	0.5	0.1	0.2	0.01	0.2	0.2	0.1	0.02	0.02	-	0.2
		Max.	0.3	0.2	0.3	0.6	0.2	0.1	0.02	0.06	0.06	0.05	0.06	0.04	-	0.2
	1998	Ave.	-	-	-	-	-	-	-	-	-	-	0.3	0.1	-	0.2
		Max.	-	-	-	-	-	-	-	-	-	-	0.0	0.1	-	0.1
CO	1988	Ave.	-	-	-	-	-	-	-	-	-	1.3	-	-	1.3	
		Max.	-	-	-	-	-	-	-	-	-	4.0	-	-	4.0	
	1989	Ave.	1.3	1.3	-	-	-	0.7	0.7	0.7	-	0.7	-	-	-	0.9
		Max.	3.4	3.8	-	-	-	2.4	3.2	2.8	-	2.8	-	-	-	3.1
	1990	Ave.	1.3	1.2	1.0	0.7	0.7	0.7	0.5	0.5	0.6	0.9	-	1.3	-	0.9
		Max.	3.8	4.0	2.8	2.6	2.4	1.8	1.1	0.8	1.4	1.9	-	4.6	-	2.5
	1991	Ave.	1.4	0.9	0.5	0.6	0.9	0.8	0.8	1.0	1.3	1.6	1.6	-	-	1.0
		Max.	3.4	3.6	2.4	3.0	3.2	2.8	3.2	2.4	3.4	4.6	6.3	-	-	3.5
	1992	Ave.	1.6	1.5	1.2	1.0	0.9	0.9	0.9	1.1	0.8	0.9	1.4	1.5	-	1.2
		Max.	4.8	3.8	3.0	2.8	2.6	3.4	3.2	5.9	2.8	3.0	4.8	3.8	-	4.0
	1993	Ave.	-	-	-	-	-	0.8	0.7	0.7	0.9	1.3	0.9	1.5	-	1.0
		Max.	-	-	-	-	-	2.0	2.2	2.6	3.0	3.6	2.6	5.6	-	3.1
	1994	Ave.	1.5	1.2	1.2	0.9	0.8	0.6	0.8	0.8	0.8	-	-	1.2	-	0.4
		Max.	4.0	3.0	3.8	2.4	2.8	2.0	2.2	2.8	4.3	-	-	2.6	-	1.4
	1995	Ave.	1.1	1.0	1.0	0.7	0.7	0.9	2.5	0.9	0.9	3.1	3.5	3.8	-	1.7
		Max.	3.0	2.8	3.0	1.6	2.0	2.2	5.1	1.2	1.2	7.3	9.4	8.4	-	3.9
	1998	Ave.	-	-	-	-	-	-	-	-	-	-	0.6	0.3	-	0.5
		Max.	-	-	-	-	-	-	-	-	-	-	1.3	1.3	-	1.3

**Table 2.2.1 Maximum Allowable Concentration Factor (PDK) of Air Pollution
in Almaty City 1988-1998**

Pollutants	Year	Maximum Allowable Concentration Factor (PDK)													
		Month													
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.	
NO ₂	1988	Ave.	-	-	-	-	-	-	-	-	-	1.5	-	-	1.5
		Max.	-	-	-	-	-	-	-	-	-	3.2	-	-	3.2
	1989	Ave.	1.5	1.3	-	-	-	1.0	1.0	1.0	-	1.3	-	-	1.2
		Max.	2.6	2.0	-	-	-	1.9	2.5	2.4	-	2.2	-	-	2.3
	1990	Ave.	1.8	1.8	1.5	1.3	1.3	1.3	1.0	1.3	1.2	1.3	-	1.2	1.4
		Max.	2.5	5.4	2.0	2.0	1.8	1.8	1.2	1.4	1.2	1.2	-	1.6	2.0
	1991	Ave.	1.7	1.6	1.4	1.3	1.5	1.6	1.5	1.6	2.0	0.0	2.1	-	1.5
		Max.	2.7	2.5	2.2	2.4	3.3	3.3	3.2	2.8	3.5	0.2	6.0	-	2.9
	1992	Ave.	2.2	2.8	2.0	2.0	1.8	1.4	1.6	1.5	1.5	1.5	1.6	1.7	2.0
		Max.	3.1	3.1	3.1	3.1	3.1	2.9	3.1	1.6	3.4	4.5	3.1	3.5	3.4
	1993	Ave.	-	-	-	-	-	1.9	1.5	1.3	1.4	1.4	1.4	1.8	1.5
		Max.	-	-	-	-	-	4.0	4.4	3.4	2.9	3.2	4.9	3.2	3.7
	1994	Ave.	2.2	2.0	2.0	1.6	1.7	1.8	1.9	1.5	1.4	-	-	1.3	0.8
		Max.	3.4	3.2	2.5	3.5	3.2	3.9	4.1	3.3	2.5	-	-	3.2	1.7
	1995	Ave.	1.5	1.3	1.3	1.1	1.3	1.2	0.05	1.0	1.0	0.04	0.06	0.06	0.8
		Max.	2.8	3.3	3.3	2.8	2.0	2.7	0.14	1.2	1.2	0.10	0.14	0.15	1.7
	1998	Ave.	-	-	-	-	-	-	-	-	-	-	0.8	0.3	0.6
		Max.	-	-	-	-	-	-	-	-	-	-	0.5	1.0	0.8
NO	1988	Ave.	-	-	-	-	-	-	-	-	-	0.3	-	-	0.3
		Max.	-	-	-	-	-	-	-	-	-	0.2	-	-	0.2
	1989	Ave.	0.2	0.2	-	-	-	0.2	0.2	0.2	-	0.3	-	-	0.2
		Max.	0.1	0.1	-	-	-	0.1	0.1	0.1	-	0.2	-	-	0.1
	1990	Ave.	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.2	0.2	0.2	-	0.2	0.2
		Max.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	-	0.1	0.1
	1991	Ave.	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.5	0.3	-	0.3
		Max.	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.7	-	0.2
	1992	Ave.	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.1	0.2	0.2	0.2	0.2
		Max.	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.0	0.1	0.1	0.1	0.2	0.1
	1993	Ave.	-	-	-	-	-	0.6	0.8	0.4	0.4	0.3	0.3	0.5	0.5
		Max.	-	-	-	-	-	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.1
	1994	Ave.	0.5	0.5	0.4	0.5	0.4	0.5	0.5	0.5	0.4	-	-	0.5	0.2
		Max.	0.1	0.2	0.1	0.1	0.1	0.4	0.2	0.2	0.1	-	-	0.2	0.1
	1995	Ave.	0.4	0.3	0.3	0.3	0.3	0.3	0.02	0.3	0.3	0.02	0.02	0.02	0.2
		Max.	0.1	0.1	0.1	0.1	0.1	0.1	0.05	0.1	0.1	0.05	0.05	0.05	0.1
	1998	Ave.	-	-	-	-	-	-	-	-	-	-	-	-	0.0
		Max.	-	-	-	-	-	-	-	-	-	-	-	-	0.0
Formaldehyde	1988	Ave.	-	-	-	-	-	-	-	-	-	2.3	-	-	2.3
		Max.	-	-	-	-	-	-	-	-	-	0.5	-	-	0.5
	1989	Ave.	1.7	1.0	-	-	-	2.3	2.0	4.3	-	5.0	-	-	2.7
		Max.	0.5	0.5	-	-	-	0.8	0.5	1.2	-	1.1	-	-	0.8
	1990	Ave.	3.0	2.7	3.0	2.3	1.7	3.1	3.5	1.6	1.3	2.5	-	3.2	2.5
		Max.	0.7	0.7	0.6	0.6	0.5	0.6	0.6	0.5	0.4	0.5	-	0.6	0.6
	1991	Ave.	4.4	4.8	3.5	3.9	3.4	2.7	4.9	3.5	3.7	5.0	4.2	-	4.0
		Max.	1.5	2.5	1.0	1.0	1.0	0.9	1.0	1.0	0.8	1.1	14.6	-	2.4
	1992	Ave.	4.3	5.8	-	4.4	4.9	6.2	4.8	4.4	4.7	4.6	5.6	3.4	4.8
		Max.	1.3	1.3	-	1.3	1.6	1.6	1.4	0.4	1.4	0.9	1.2	0.9	1.2
	1993	Ave.	-	-	-	-	-	6.4	4.7	6.3	7.1	3.0	4.8	6.6	5.6
		Max.	-	-	-	-	-	1.3	1.3	1.8	1.8	0.8	1.2	1.5	1.4
	1994	Ave.	7.1	4.0	5.3	4.4	5.8	6.4	5.0	4.6	6.4	-	-	5.5	2.8
		Max.	1.8	1.2	1.2	1.1	1.4	1.4	1.5	1.0	1.2	-	-	1.2	0.6
	1995	Ave.	5.4	6.4	6.0	7.0	4.7	1.7	0.005	3.3	3.3	0.02	0.014	0.013	3.2
		Max.	1.2	1.2	1.2	1.3	1.0	1.0	0.039	0.9	0.9	0.03	0.011	0.030	0.7
	1998	Ave.	-	-	-	-	-	-	-	-	-	-	3.5	1.5	2.5
		Max.	-	-	-	-	-	-	-	-	-	-	1.0	0.9	1.0

**Table 2.2.1 Maximum Allowable Concentration Factor (PDK) of Air Pollution
in Almaty City 1988-1998**

Pollutants	Year	Maximum Allowable Concentration Factor (PDK)													
		Month												Ave.	
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.		
Phenol	1988	Ave.	-	-	-	-	-	-	-	-	-	-	-	-	-
		Max.	-	-	-	-	-	-	-	-	-	-	-	-	-
	1989	Ave.	-	-	-	-	-	-	-	-	-	-	-	-	-
		Max.	-	-	-	-	-	-	-	-	-	-	-	-	-
	1990	Ave.	-	-	-	-	-	-	-	-	-	-	-	-	-
		Max.	-	-	-	-	-	-	-	-	-	-	-	-	-
	1991	Ave.	0.7	2.8	1.1	1.2	1.6	1.6	1.3	1.0	1.7	1.6	1.8	-	1.5
		Max.	4.6	1.4	1.4	1.1	1.4	1.4	1.4	1.0	1.2	1.0	4.6	-	1.9
	1992	Ave.	2.3	2.1	1.8	1.6	1.8	1.3	1.7	1.7	1.2	1.6	2.1	1.3	1.7
		Max.	1.6	1.6	1.6	1.6	1.6	1.4	1.4	0.6	1.7	1.4	1.7	1.7	1.5
	1993	Ave.	-	-	-	-	-	1.5	1.7	1.4	1.2	2.1	1.5	2.6	1.7
		Max.	-	-	-	-	-	1.7	1.7	3.8	1.7	2.3	1.7	3.4	2.3
	1994	Ave.	2.7	2.6	2.1	2.3	1.6	0.6	1.8	1.6	1.9	-	-	2.1	0.8
		Max.	2.5	2.2	1.7	1.7	1.4	4.9	2.2	1.7	1.7	-	-	2.2	1.3
	1995	Ave.	2.0	1.6	1.7	1.7	1.3	1.3	0.004	1.3	1.3	0.004	0.004	0.005	1.0
		Max.	2.0	1.7	2.0	1.4	1.4	1.4	0.012	1.0	1.0	0.009	0.011	0.013	1.0
1998	Ave.	-	-	-	-	-	-	-	-	-	-	0.5	0.5	0.5	
	Max.	-	-	-	-	-	-	-	-	-	-	0.2	0.7	0.5	

Source: Republican State Enterprise Kazhydromet, "Information Bulletin on the State of Environment Pollution in Almaty City," November and December 1998.

National Department of Hydrometeorology, Republic of Kazakhstan, "Information Bulletin on the State of Environment Pollution in Almaty City," 1995, 1994 and 1993.

State Committee of USSR on Hydrometeorology, Kazakhstan National Department of Hydrometeorology, "Report on the Pollution of Environment in Almaty City," 1991, 1990, 1989 and 1988.

2.3 POSSIBLE SPECIES LIVING IN ALMATY AREA LISTED IN THE RED BOOK

<u>Name</u>	<u>Status</u>
Balkhash Perch	Vulnerable (Category II)
Asiatic Frog	Vulnerable (Category II)
Whooper Swan	Vulnerable (Category II)
Short-toed Snake-eagle	Endangered (Category II)
Golden Eagle	Rare (Category III)
Lammergeier	Rare (Category III)
Egyptian Vulture	Rare (Category III)
Saker Falcon	Endangered (Category I)
Barbary Falcon	Endangered (Category I)
Peregrine Falcon	Endangered (Category I)
Demoiselle Crane	Out of Danger (Category V)
Blue Whistling-thrush	Out of Danger (Category V)
Asiatic Wild Dog	Endangered (Category I)
Tian Shan Red Bear	Rare (Category III)
Pine Marten	Rare (Category III)
Turkestan Lynx	Rare (Category III)
Tian Shan Argali	Vulnerable (Category II)