Annex VIII-4 (7/18) Water Quality for SW-7 in 1997

Item No.	Item	Unit	SW-7			Mongolian Standard	WHO	
			23-Jun-97	16-Jul-97	23-Jul-97		(health)	(complain)
1	pH		8.5	8.1	8.1	6.5-8.5		
2	Temperature	℃	-3.5	2	3.5			
3	Odor	dilution factor	-		1	≦2		
4	Taste	dilution factor	-			≦2		
5	Color	mg/l Pt scale						≦15
6	Turbidity	kaolin (JIS)	15	3	3			
7	Conductivity	mS/m(at 25℃)	71.7	282	524			
8	Hardness###	mgCaCO$_3$/l				≦350		
9	Dry Residue###	mg/l				≦1000		≦1000
10	COD(KMn0$_4$, alkali)	mg O$_2$/l	2	6.7	3.5			
11	Nitrite	mg NO$_2$/l	0.17	0.01	<0.01		≦3	
12	Nitrate	mg NO$_3$/l	5.8	4	6	≦44.3	≦50	
13	Ammonium	mg NH$_4$/l	0.35	0.28	0.45			≦1.5
14	Orthophosphate	mg P0$_4$/l	0.38	0.2	0.18	≦3.5		
15	Bicarbonate	mg HCO$_3$/l	403	738	1007			
16	Carbonate	mg CO$_3$/l	3.20	2.33	3.18			
17	Chloride*	mg Cl/l	214	57	236	≦350		≦250
18	Sulfate#	mg SO$_4$/l				≦500		≦250
19	Sodium***	mg Na/l	53.6	53.3	53.1			
20	Potassium*	mg K/l	31	19.4	21.4			
21	Calcium	mg Ca/l	27	28	42	≦100		
22	Magnesium##	mg Mg/l				≦30		
23	Copper*	mg Cu/l	0.08	0.05	<0.07	≦1	≦2	≦1
24	Iron	mg Fe/l	0.03	0.1	0.07	≦0.3		≦0.3
25	Manganese*	mg Mn/l		<0.04	0.06	≦0.1	≦0.5	≦0.1
26	Zinc*	mg Zn/l	0.48	0.24	0.23	≦5		≦5
27	Lead**	mg Pb/l			0.01	≦0.03	≦0.01	
28	Chromium(VI)	mg Cr(VI)/l		0.02	0.01			
	Chromium**	mg Cr/l			0.03	≦0.05	≦0.05	
29	Cadmium**	mg Cd/l			0.01	≦0.01	≦0.003	
30	Arsenic**	mg As/l			0.02	≦0.05	≦0.01	
31	Cyanide	mg CN/l		0.05	0.01	≦0.1	≦0.07	
32	Mercury**	mg Hg/l					≦0.001	
33	Fluoride	mg F/l	0.7	<0.01	0.01	0.7-1.5	≦1.5	
34	Silica	mg SiO$_2$/l	11	11	5.2			
35	Molybdenum**	mg Mo/l	0.03	0.03	0.028	≦0.25	≦0.07	
36	Beryllium**	mg Be/l			<0.001			
37	Aluminum	mg Al/l	0.11	<0.01	<0.01	≦0.5		≦0.2
38	Total Coliforms	No. in 1l				(<3 in 1l)	(<1 in 100 ml)	
43	Acidity	mg CaCO$_3$/l	205	105	70			
44	Alkalinity	mg CaCO$_3$/l	330	605	825			
	Nickel*	mg Ni/l	0.12	<0.02	0.05		≦0.02	
	Selenium*	mg Se/l	<0.055	<0.03	<0.04	≦0.001	≦0.01	
	Strontium*	mg Sr/l	0.43	0.5	0.57	≦2		
	Bromine*	mg Br/l	0.56	0.8	1.81			

* ED-TRXRF
** Colorimetry in Ulaanbaatar
*** Flame emission spectrometric method
# Calculated from the correlation between results from gravimetric method and from ED-TRXRF method
Calculated from charge balance
Calculated value

Annex VIII-4 (7/18) Water Quality for SW-7 in 1997

Item No.	Item	Unit	SW-7			Mongolian	WHO	
			23-Jun-97	16-Jul-97	23-Jul-97	Standard	(health)	(complain)
1	pH		8.5	8.1	8.1	6.5-8.5		
2	Temperature	°C	-3.5	2	3.5			
3	Odor	dilution factor	-		1	≦2		
4	Taste	dilution factor	-			≦2		
5	Color	mg/l Pt scale	20	20	20			≦15
6	Turbidity	kaolin (JIS)	15	3	3			
7	Conductivity	mS/m(at 25°C)	71.7	282	524			
8	Hardness###	mg$CaCO_3$/l	1210	1110	1790	≦350		
9	Dry Residue###	mg/l	1487	1296	1981	≦1000		≦1000
10	COD($KMnO_4$, alkali)	mg O_2/l	2	6.7	3.5			
11	Nitrite	mg NO_2/l	0.17	0.01	<0.01		≦3	
12	Nitrate	mg NO_3/l	5.8	4	6	≦44.3	≦50	
13	Ammonium	mg NH_4/l	0.35	0.28	0.45			≦1.5
14	Orthophosphate	mg PO_4/l	0.38	0.2	0.18	≦3.5		
15	Bicarbonate	mg HCO_3/l	403	738	1007			
16	Carbonate	mg CO_3/l	3.20	2.33	3.18			
17	Chloride*	mg Cl/l	214	57	236	≦350		≦250
18	Sulfate#	mg SO_4/l	680	520	720	≦500		≦250
19	Sodium***	mg Na/l	53.6	53.3	53.1			
20	Potassium*	mg K/l	31	19.4	21.4			
21	Calcium	mg Ca/l	27	28	42	≦100		
22	Magnesium##	mg Mg/l	274	249	405	≦30		
23	Copper*	mg Cu/l	0.08	0.05	<0.07	≦1	≦2	≦1
24	Iron	mg Fe/l	0.03	0.1	0.07	≦0.3		≦0.3
25	Manganese*	mg Mn/l	0.14	<0.04	0.06	≦0.1	≦0.5	≦0.1
26	Zinc*	mg Zn/l	0.48	0.24	0.23	≦5		≦5
27	Lead**	mg Pb/l			0.01	≦0.03	≦0.01	
28	Chromium(VI)	mg Cr(VI)/l		0.02	0.01			
	Chromium**	mg Cr/l			0.03	≦0.05	≦0.05	
29	Cadmium**	mg Cd/l			0.01	≦0.01	≦0.003	
30	Arsenic**	mg As/l			0.02	≦0.05	≦0.01	
31	Cyanide	mg CN/l		0.05	0.01	≦0.1	≦0.07	
32	Mercury**	mg Hg/l			0.003		≦0.001	
33	Fluoride	mg F/l	0.7	<0.01	0.01	0.7-1.5	≦1.5	
34	Silica	mg SiO_2/l	11	11	5.2			
35	Molybdenum**	mg Mo/l	0.03	0.03	0.028	≦0.25	≦0.07	
36	Beryllium**	mg Be/l			<0.001			
37	Aluminum	mg Al/l	0.11	<0.01	<0.01	≦0.5		≦0.2
38	Total Coliforms	No. in 1l	23	230	960	(<3 in 1l)	(<1 in 100 ml)	
43	Acidity	mg $CaCO_3$/l	205	105	70			
44	Alkalinity	mg $CaCO_3$/l	330	605	825			
	Nickel*	mg Ni/l	0.12	<0.02	0.05		≦0.02	
	Selenium*	mg Se/l	<0.055	<0.03	<0.04	≦0.001	≦0.01	
	Strontium*	mg Sr/l	0.43	0.5	0.57	≦2		
	Bromine*	mg Br/l	0.56	0.8	1.81			

* ED-TRXRF
** Colorimetry in Ulaanbaatar
*** Flame emission spectrometric method
# Calculated from the correlation between results from gravimetric method and from ED-TRXRF method
Calculated from charge balance
Calculated value

Annex VIII-4 (8/18) Water Quality for SW-8 in 1997

Item No.	Item	Unit	SW-8			Mongolian Standard	WHO (health)	WHO (complain)
			23-Jun-97	16-Jul-97	23-Jul-97			
1	pH		7.9	7.7	7.6	6.5-8.5		
2	Temperature	℃	4	8	5.5			
3	Odor	dilution factor	-		<1	≦2		
4	Taste	dilution factor	-			≦2		
5	Color	mg/l Pt scale	10	20	5			≦15
6	Turbidity	kaolin (JIS)	5	5	0.5			
7	Conductivity	mS/m(at 25℃)	84.1	83	134.7			
8	Hardness###	mg$CaCO_3$/l	410	380	340	≦350		
9	Dry Residue###	mg/l	563	495	496	≦1000		≦1000
10	COD($KMnO_4$, alkali)	mg O_2/l	4	4.6	8			
11	Nitrite	mg NO_2/l	0.028	2	0.03		≦3	
12	Nitrate	mg NO_3/l	0.21	0.6	0.5	≦44.3	≦50	
13	Ammonium	mg NH_4/l	1.29	1.6	1.2			≦1.5
14	Orthophosphate	mg PO_4/l	0.12	0.4	0.41	≦3.5		
15	Bicarbonate	mg HCO_3/l	433	470	397			
16	Carbonate	mg CO_3/l	0.86	0.74	0.40			
17	Chloride*	mg Cl/l	35	22	17	≦350		≦250
18	Sulfate#	mg SO_4/l	130	80	110	≦500		≦250
19	Sodium***	mg Na/l	52	52.1	52.2			
20	Potassium*	mg K/l	17	6.7	7			
21	Calcium	mg Ca/l	38	25	80	≦100		
22	Magnesium##	mg Mg/l	76	77	34	≦30		
23	Copper*	mg Cu/l	0.24	<0.02	0.04	≦1	≦2	≦1
24	Iron	mg Fe/l	0.32	1.3	0.51	≦0.3		≦0.3
25	Manganese*	mg Mn/l	0.73	0.8	0.84	≦0.1	≦0.5	≦0.1
26	Zinc*	mg Zn/l	1.15	0.7	1.25	≦5		≦5
27	Lead**	mg Pb/l			0.02	≦0.03	≦0.01	
28	Chromium(VI)	mg Cr(VI)/l		0.01	<0.01			
	Chromium**	mg Cr/l			0.02	≦0.05	≦0.05	
29	Cadmium**	mg Cd/l			0.02	≦0.01	≦0.003	
30	Arsenic**	mg As/l			0.01	≦0.05	≦0.01	
31	Cyanide	mg CN/l		0.08	0.06	≦0.1	≦0.07	
32	Mercury**	mg Hg/l			0.001		≦0.001	
33	Fluoride	mg F/l	0.62	<0.01	<0.01	0.7-1.5	≦1.5	
34	Silica	mg SiO_2/l	12	15	2.7			
35	Molybdenum**	mg Mo/l	0.03	0.03	0.028	≦0.25	≦0.07	
36	Beryllium**	mg Be/l			0.0042			
37	Aluminum	mg Al/l	<0.01	0.02	0.01	≦0.5		≦0.2
38	Total Coliforms	No. in 1l	960	960	10	(<3 in 1l)	(<1 in 100 ml)	
43	Acidity	mg $CaCO_3$/l	160	100	90			
44	Alkalinity	mg $CaCO_3$/l	355	385	325			
	Nickel*	mg Ni/l	0.08	<0.03	<0.04		≦0.02	
	Selenium*	mg Se/l	<0.015	<0.03	<0.04	≦0.001	≦0.01	
	Strontium*	mg Sr/l	0.53	0.6	0.69	≦2		
	Bromine*	mg Br/l	0.12	0.16	0.42			

* ED-TRXRF
** Colorimetry in Ulaanbaatar
*** Flame emission spectrometric method
# Calculated from the correlation between results from gravimetric method and from ED-TRXRF method
Calculated from charge balance
Calculated value

Annex VIII-4 (8/18) Water Quality for SW-8 in 1997

Item No.	Item	Unit	SW-8			Mongolian Standard	WHO (health)	WHO (complain)
			23-Jun-97	16-Jul-97	23-Jul-97			
1	pH		7.9	7.7	7.6	6.5-8.5		
2	Temperature	°C	4	8	5.5			
3	Odor	dilution factor	-		<1	≦2		
4	Taste	dilution factor	-			≦2		
5	Color	mg/l Pt scale	10	20	5			≦15
6	Turbidity	kaolin (JIS)	5	5	0.5			
7	Conductivity	mS/m(at 25°C)	84.1	83	134.7			
8	Hardness###	$mgCaCO_3/l$	410	380	340	≦350		
9	Dry Residue###	mg/l	563	495	496	≦1000		≦1000
10	COD($KMnO_4$, alkali)	mg O_2/l	4	4.6	8			
11	Nitrite	mg NO_2/l	0.028	2	0.03		≦3	
12	Nitrate	mg NO_3/l	0.21	0.6	0.5	≦44.3	≦50	
13	Ammonium	mg NH_4/l	1.29	1.6	1.2			≦1.5
14	Orthophosphate	mg PO_4/l	0.12	0.4	0.41	≦3.5		
15	Bicarbonate	mg HCO_3/l	433	470	397			
16	Carbonate	mg CO_3/l	0.86	0.74	0.40			
17	Chloride*	mg Cl/l	35	22	17	≦350		≦250
18	Sulfate#	mg SO_4/l	130	80	110	≦500		≦250
19	Sodium***	mg Na/l	52	52.1	52.2			
20	Potassium*	mg K/l	17	6.7	7			
21	Calcium	mg Ca/l	38	25	80	≦100		
22	Magnesium##	mg Mg/l	76	77	34	≦30		
23	Copper*	mg Cu/l	0.24	<0.02	0.04	≦1	≦2	≦1
24	Iron	mg Fe/l	0.32	1.3	0.51	≦0.3		≦0.3
25	Manganese*	mg Mn/l	0.73	0.8	0.84	≦0.1	≦0.5	≦0.1
26	Zinc*	mg Zn/l	1.15	0.7	1.25	≦5		≦5
27	Lead**	mg Pb/l			0.02	≦0.03	≦0.01	
28	Chromium(VI)	mg Cr(VI)/l		0.01	<0.01			
	Chromium**	mg Cr/l			0.02	≦0.05	≦0.05	
29	Cadmium**	mg Cd/l			0.02	≦0.01	≦0.003	
30	Arsenic**	mg As/l			0.01	≦0.05	≦0.01	
31	Cyanide	mg CN/l		0.06	0.06	≦0.1	≦0.07	
32	Mercury**	mg Hg/l			0.001		≦0.001	
33	Fluoride	mg F/l	0.62	<0.01	<0.01	0.7-1.5	≦1.5	
34	Silica	mg SiO_2/l	12	15	2.7			
35	Molybdenum**	mg Mo/l	0.03	0.03	0.028	≦0.25	≦0.07	
36	Beryllium**	mg Be/l			0.0042			
37	Aluminum	mg Al/l	<0.01	0.02	0.01	≦0.5		≦0.2
38	Total Coliforms	No. in 1l	960	960	10	(<3 in 1l)	(<1 in 100 ml)	
43	Acidity	mg $CaCO_3$/l	160	100	90			
44	Alkalinity	mg $CaCO_3$/l	355	385	325			
	Nickel*	mg Ni/l	0.08	<0.03	<0.04		≦0.02	
	Selenium*	mg Se/l	<0.015	<0.03	<0.04	≦0.001	≦0.01	
	Strontium*	mg Sr/l	0.53	0.6	0.69	≦2		
	Bromine*	mg Br/l	0.12	0.16	0.42			

* ED-TRXRF
** Colorimetry in Ulaanbaatar
*** Flame emission spectrometric method
# Calculated from the correlation between results from gravimetric method and from ED-TRXRF method
Calculated from charge balance
Calculated value

Annex VIII-4 (9/18) Analysis for Water Quality of New Test Well in Altai City in 1998

	Parameter	Unit	Mongolian	A1	A2	A3	A4	B1	B2	B3	B4	B5	B6
	Sampling date		Standard	8th Sep	6th Aug	3th Oct	5th Oct.	17th Se	5th Au	6th July	2nd July	9th Jul	4th Sep.
1	pH			7.7	7.2	7.2	6.5	8.1	7.8	7.56	7.8	8	8.36
2	Temparature	Deg. C		4.2	9.1	2.2	1.8	4.2	7.2	7.8	4	3.5	2.2
3	Odor		2	1	4	1	1	1	1	2	2	1	1
4	Taste		2	2	2	1	1	2	2	2	2	1	1
5	Colour	Pt-unit	15#			2	2	2	2			2	1.5
6	Turbidity	NTU	5#	0.5	1.5	1	0.5	0.5	1.5	1	1	1.5	0.5
7	Conductivity	ms/m		213	470	164.3	350	159.2	214	156.7	(58)	44.3	59.9
8	Dry Residue	mg/l	1000									400	800
9	COD			-	-	-	-	-	-	-	-	-	-
10	Nitrite Ion	mg/l		0.03	0.003	0.006	0.008	0.05	0.007	0.003	0.005	0.002	0.005
11	Nitrate Ion	mg/l	44.3	0.3	10	8	0.1	0.8	0.1	1.5	6	4	0.1
12	Ammonium Ion	mg/l		1.5	0.7	0.6	0.3	1	0.7	0.2	0.15	0.3	1.2
13	Orthophosphate	mg/l	3.5	0.05	0	0.3	0.06	0.6	0.75	0.2	0.05	0.2	0.25
14	Cyanide	mg/l	0.1	0.008	0.01	0.01	0.02	nd	0.15	0.04	1	nd	nd
15	Biocarbonate Ion	mg/l		134	420	232	265	135	200	135	160	147	200
16	Carbonate Ion	mg/l		0.3	0.3	0.2	0.0	0.9	0.6	0.2	0.5	0.7	0.2
17	Hardness	mg $CaCO_3$/l	350									225	257.5
18	Chloride Ion*	mg/l	350	200		240		235				110	95
19	Sulfate Ion*	mg/l	500	316		336	331	303				42.5	59
20	Sodium Ion**	mg/l		68.9	69	83.1	75.3	69.1	71.2	68.3	57.3	59.5	55.9
21	Potassium Ion**	mg/l		6	2.8	6.5	7	4.5	6.8	7	6	1.7	4
22	Calcium Ion	mg/l	100	20		24	80	60	40			12	6
23	Magnesium Ion	mg/l	30										
24	Copper***	mg/l	1	0.02	0.01	0.01	0.01	0.1	0.2	0.002	0.001	0.1	nd
25	Iron	mg/l	0.3	0.3		0.1	0.25	0.05	0.2	0.03	0.15	0.05	0.2
26	Manganese***	mg/l	0.1	nd		nd	nd	nd	nd		nd	nd	nd
27	Zinc***	mg/l	5	0.37	0.59	0.32	0.73	0.18	0.63	1.45	0.32	0.13	nd
28	Lead****	mg/l	0.03	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
29	Chromium(VI)	mg/l		0.04	0.03	0.02	0.04	0.03	0.01	0.04	0.004	0.01	0.03
30	Cadmium****	mg/l	0.01	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
31	Arsenic**	mg/l	0.05	0.012	0.035	0.01	0.012	0.02	0.015	0.01	0.01	0.015	0.021
32	Mercury			-	-	-	-	-	-	-	-	-	-
33	Fluoride	mg/l	0.7-1.5			0.8		0.7		0.75			0.8
34	Silica	mg/l		2.9	3	2.2	2.5	2	3	2.9	3	2.7	0.5
35	Molybdenum**	mg/l	0.25	0.035	0.024	0.03	0.038	0.029	0.03	0.02	0.04	0.03	0.02
36	Beryllium**	mg/l	0.0002	<0.005	<0.003	<0.003	<0.004	<0.005	<0.004	<0.003	<0.003	<0.003	<0.004
37	Aluminum	mg/l	0.5	nd	0.03	0.01	0.01	0.02	nd	0.01	nd	0.25	nd
38	Total Coliforms	no/l	3										
39	General Bacteria			-	-	-	-	-	-	-	-	-	-
40	Residual Chlorine	mg/l		nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
41	BOD			-	-	-	-	-	-	-	-	-	-
42	SS			-	-	-	-	-	-	-	-	-	-
43	Acidity	mg $CaCO_3$/l		275	250	225	240	175	155	960	27	210	225
44	Alkalinity	mg $CaCO_3$/l		100	325	175	200	100	150	100	120	110	150

nd: not detected

#: WHO guideline

*: Central Laboratory of Drinking Water and Food Products

**: Institute Chemistry and Chemical Technology of Mongolian Academy of Science

***: Nuclear Physic Research Center

****: Central Laboratory of Geology

Annex VIII-4 (9/18) Analysis for Water Quality of New Test Well in Altai City in 1998

	Parameter	Unit	Mongolian	A1	A2	A3	A4	B1	B2	B3	B4	B5	B6
	Sampling date		Standard	8th Sep	6th Aug	3th Oct	5th Oct	17th Se	5th Au	6th July	2nd July	9th Jul	4th Sep.
1	pH			7.7	7.2	7.2	6.5	8.1	7.8	7.56	7.8	8	8.36
2	Temparature	Deg. C		4.2	9.1	2.2	1.8	4.2	7.2	7.8	4	3.5	2.2
3	Odor		2	1	4	1	1	1	1	2	2	1	1
4	Taste		2	2	2	1	1	2	2	2	2	1	1
5	Colour	Pt-unit	15#	20	50	2	2	2	2	50	50	2	1.5
6	Turbidity	NTU	5#	0.5	1.5	1	0.5	0.5	1.5	1	1	1.5	0.5
7	Conductivity	ms/m		213	470	164.3	350	159.2	214	156.7	(58)	44.3	59.9
8	Dry Residue	mg/l	1000	2000	7600	1200	2400	1400	2100	2800	2400	400	800
9	COD			-	-	-	-	-	-	-	-	-	-
10	Nitrite Ion	mg/l		0.03	0.003	0.006	0.008	0.05	0.007	0.003	0.005	0.002	0.005
11	Nitrate Ion	mg/l	44.3	0.3	10	8	0.1	0.8	0.1	1.5	6	4	0.1
12	Ammonium Ion	mg/l		1.5	0.7	0.6	0.3	1	0.7	0.2	0.15	0.3	1.2
13	Orthophosphate	mg/l	3.5	0.05	0	0.3	0.06	0.6	0.75	0.2	0.05	0.2	0.25
14	Cyanide	mg/l	0.1	0.008	0.01	0.01	0.02	nd	0.15	0.04	1	nd	nd
15	Biocarbonate Ion	mg/l		134	420	232	265	135	200	135	160	147	200
16	Carbonate Ion	mg/l		0.3	0.3	0.2	0.0	0.9	0.6	0.2	0.5	0.7	0.2
17	Hardness	mg $CaCO_3$/l	350	1000	3725	862.5	1875	875	845	1950	900	225	257.5
18	Chloride Ion*	mg/l	350	200	2200	240	475	235	1000	1750	1500	110	95
19	Sulfate Ion*	mg/l	500	316	2813	336	331	303	1350	3062	919	42.5	59
20	Sodium Ion**	mg/l		68.9	69	83.1	75.3	69.1	71.2	68.3	57.3	59.5	55.9
21	Potassium Ion**	mg/l		6	2.8	6.5	7	4.5	6.8	7	6	1.7	4
22	Calcium Ion	mg/l	100	20	272	24	80	60	40	385	100	12	6
23	Magnesium Ion	mg/l	30	228	730	73	402	174	179	237	156	47	58
24	Copper***	mg/l	1	0.02	0.01	0.01	0.01	0.1	0.2	0.002	0.001	0.1	nd
25	Iron	mg/l	0.3	0.3	5.6	0.1	0.25	0.05	0.2	0.03	0.15	0.05	0.2
26	Manganese***	mg/l	0.1	nd	0.36	nd	nd	nd	nd	0.61	nd	nd	nd
27	Zinc***	mg/l	5	0.37	0.59	0.32	0.73	0.18	0.63	1.45	0.32	0.13	nd
28	Lead***	mg/l	0.03	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
29	Chromium(VI)	mg/l		0.04	0.03	0.02	0.04	0.03	0.01	0.04	0.004	0.01	0.03
30	Cadmium****	mg/l	0.01	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
31	Arsenic**	mg/l	0.05	0.012	0.035	0.01	0.012	0.02	0.015	0.01	0.01	0.015	0.021
32	Mercury			-	-	-	-	-	-	-	-	-	-
33	Fluoride	mg/l	0.7-1.5	1.7	1.7	0.8	1.2	0.7	0.8	0.75	0.8	1.5	0.8
34	Silica	mg/l		2.9	3	2.2	2.5	2	3	2.9	3	2.7	0.5
35	Molybdenum**	mg/l	0.25	0.035	0.024	0.03	0.038	0.029	0.03	0.02	0.04	0.03	0.02
36	Beryllium**	mg/l	0.0002	<0.005	<0.003	<0.003	<0.004	<0.005	<0.004	<0.003	<0.003	<0.003	<0.004
37	Aluminum	mg/l	0.5	nd	0.03	0.01	0.01	0.02	nd	0.01	nd	0.25	nd
38	Total Coliforms	no/l	3	92	23	2	10	2	2	160	90	2	10
39	General Bacteria			-	-	-	-	-	-	-	-	-	-
40	Residual Chlorine	mg/l		nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
41	BOD			-	-	-	-	-	-	-	-	-	-
42	SS			-	-	-	-	-	-	-	-	-	-
43	Acidity	mg $CaCO_3$/l		275	250	225	240	175	155	960	27	210	225
44	Alkalinity	mg $CaCO_3$/l		100	325	175	200	100	150	100	120	110	150

nd: not detected

#: WHO guideline

*: Central Laboratory of Drinking Water and Food Products

**: Institute Chemistry and Chemical Technology of Mongolian Academy of Science

***: Nuclear Physic Research Center

****: Central Laboratory of Geology

Annex VIII-4 (10/18) Average Concentrations of Major Ions and Average Physical Parameters for the Water Supply System in 1997

Item No.	Item	Unit	Average	Mongolian Standard	WHO (health)	WHO (complain)
7	Conductivity	mS/m(at 25°C)	63.5			
8	Hardness#	mg$CaCO_3$/l	199	≦350		
9	Dry Residue#	mg/l	344	≦1000		≦1000
12	Nitrate	mg NO_3/l	5.4	≦44.3	≦50	
15	Bicarbonate	mg HCO_3/l	247			
16	Carbonate	mg CO_3/l	1.65			
17	Chloride*	mg Cl/l	29	≦350		≦250
18	Sulfate**	mg SO_4/l	68	≦500		≦250
19	Sodium***	mg Na/l	56			
20	Potassium****	mg K/l	3.3			
21	Calcium	mg Ca/l	28	≦100		
22	Magnesium##	mg Mg/l	31	≦30		

* Titration method
** Gravimetric method
*** Flame emission spectrometric method (using data from SW-6)
**** ED-TRXRF method
# Calculated from calcium and magnesium concentration
Calculated from the charge balance

Annex VIII-4 (11/18) Water Quality for DR-1 and DR-2 in 1997

Item No.	Item	Unit	DR-1				DR-2				Mongolian Standard	WHO (health)	WHO (complain)
			25-Jun-97	17-Jul-97	24-Jul-97	25-Jul-97	26-Jun-97	17-Jul-97	24-Jul-97	25-Jul-97			
1	pH		8.2	8.2	8.3		8.3	8.3	8.2		6.5-8.5		
2	Temperature	°C	3	5	4.5	5.2	4.5	5	4	5.2			
3	Odor	dilution factor			<1				<1		≦2		
4	Taste	dilution factor			<1				<1		≦2		
5	Color	mg/l Pt scale	<1	4	4		<1	3	4				≦15
6	Turbidity	kaolin (JIS)	<1	<1	2		<1	<1	<1				
10	COD($KMnO_4$, alkali)	mg O_2/l	<1	<1	2		<1	<1	<1				
11	Nitrite	mg NO_2/l	<0.01	<0.01	<0.01		<0.01	<0.01	<0.01			≦3	
12	Nitrate	mg NO_3/l	4	5	7.4		3.1	4.5	8.6		≦44.3	≦50	
13	Ammonium	mg NH_4/l			0.2				0.2				≦1.5
23	Copper*	mg Cu/l	0.04	0.05	0.14		<0.06	0.04	0.13		≦1	≦2	≦1
24	Iron	mg Fe/l	0.12	0.1	0.09		0.15	0.14	0.1		≦0.3		≦0.3
25	Manganese*	mg Mn/l	<0.04	<0.06	<0.03		0.1	0.2	<0.1		≦0.1	≦0.5	≦0.1
26	Zinc*	mg Zn/l	0.11	0.11	0.48		0.17	0.14	0.27		≦5		≦5
27	Lead**	mg Pb/l					0.04		0.005		≦0.03	≦0.01	
28	Chromium(VI)	mg Cr(VI)/l	0.01	0.03	0.04		0.02	0.03	0.03				
	Chromium**	mg Cr/l							0.01		≦0.05	≦0.05	
29	Cadmium**	mg Cd/l					0.003		0.003		≦0.01	≦0.003	
30	Arsenic**	mg As/l					0.033		0.03		≦0.05	≦0.01	
31	Cyanide	mg CN/l	0.05	0.06	0.04		0.05	0.03	0.03		≦0.1	≦0.07	
32	Mercury**	mg Hg/l					0.01		0.01			≦0.001	
33	Fluoride	mg F/l	0.2	0.1	<0.05		0.05	<0.05	<0.05		0.7-1.5	≦1.5	
38	Total Coliforms	No. in 1l	1	1	1		1	1	1	1	(<3 in 1l)	(<1 in 100 ml)	
39	General Bacteria	No. in 1 ml	300	143	1000	220	700	250	150	102			
40	Residual Chlorine	mg ClO/l	<0.02	<0.02	0.1	0.7	<0.02	<0.02	0.2	0.1			
43	Acidity	mg $CaCO_3$/l	65	60	35		45	50	35				
44	Alkalinity	mg $CaCO_3$/l	178	185	200		205	190	205				
	Nickel*	mg Ni/l	<0.06	0.03	0.05		0.05	<0.03	<0.05			≦0.02	
	Selenium*	mg Se/l	<0.03	<0.02	<0.03		<0.06	<0.02	<0.04		≦0.001	≦0.01	
	Strontium*	mg Sr/l	0.55	0.54	0.61		0.59	0.58	0.53		≦2		
	Bromine*	mg Br/l	0.12	0.14	0.15		0.14	0.23	0.18				

* ED-TRXRF
** Colorimetry in Ulaanbaatar

Annex VIII-4 (11/18) Water Quality for DR-1 and DR-2 in 1997

Item No.	Item	Unit	DR-1				DR-2				Mongolian Standard	WHO (health)	WHO (complain)
			25-Jun-97	17-Jul-97	24-Jul-97	25-Jul-97	26-Jun-97	17-Jul-97	24-Jul-97	25-Jul-97			
1	pH		8.2	8.2	8.3		8.3	8.3	8.2		6.5-8.5		
2	Temperature	℃	3	5	4.5	5.2	4.5	5	4	5.2			
3	Odor	dilution factor			<1				<1		≦2		
4	Taste	dilution factor			<1				<1		≦2		
5	Color	mg/l Pt scale	<1	4	4		<1	3	4				≦15
6	Turbidity	kaolin (JIS)	<1	<1	2		<1	<1	<1				
10	COD($KMnO_4$, alkali)	mg O_2/l	<1	<1	2		<1	<1	<1				
11	Nitrite	mg NO_2/l	<0.01	<0.01	<0.01		<0.01	<0.01	<0.01			≦3	
12	Nitrate	mg NO_3/l	4	5	7.4		3.1	4.5	8.6		≦44.3	≦50	
13	Ammonium	mg NH_4/l			0.2				0.2				≦1.5
23	Copper*	mg Cu/l	0.04	0.05	0.14		<0.06	0.04	0.13		≦1	≦2	≦1
24	Iron	mg Fe/l	0.12	0.1	0.09		0.15	0.14	0.1		≦0.3		≦0.3
25	Manganese*	mg Mn/l	<0.04	<0.06	<0.03		0.1	0.2	<0.1		≦0.1	≦0.5	≦0.1
26	Zinc*	mg Zn/l	0.11	0.11	0.48		0.17	0.14	0.27		≦5		≦5
27	Lead**	mg Pb/l					0.05		0.05		≦0.03	≦0.01	
28	Chromium(VI)	mg Cr(VI)/l	0.01	0.03	0.04		0.02	0.03	0.03				
	Chromium**	mg Cr/l							0.1		≦0.05	≦0.05	
29	Cadmium**	mg Cd/l					0.039		0.03		≦0.01	≦0.003	
30	Arsenic**	mg As/l					0.033		0.03		≦0.05	≦0.01	
31	Cyanide	mg CN/l	0.05	0.06	0.04		0.05	0.03	0.03		≦0.1	≦0.07	
32	Mercury**	mg Hg/l					0.01		0.01			≦0.001	
33	Fluoride	mg F/l	0.2	0.1	<0.05		0.05	<0.05	<0.05		0.7-1.5	≦1.5	
38	Total Coliforms	No. in 1l	7	7	39	7	7	21	9	4	(<3 in 1l)	(<1 in 100 ml)	
39	General Bacteria	No. in 1 ml	300	143	1000	220	700	250	150	102			
40	Residual Chlorine	mg ClO/l	<0.02	<0.02	0.1	0.7	<0.02	<0.02	0.2	0.1			
43	Acidity	mg $CaCO_3$/l	65	60	35		45	50	35				
44	Alkalinity	mg $CaCO_3$/l	178	185	200		205	190	205				
	Nickel*	mg Ni/l	<0.06	0.03	0.05		0.05	<0.03	<0.05			≦0.02	
	Selenium*	mg Se/l	<0.03	<0.02	<0.03		<0.06	<0.02	<0.04		≦0.001	≦0.01	
	Strontium*	mg Sr/l	0.55	0.54	0.61		0.59	0.58	0.53		≦2		
	Bromine*	mg Br/l	0.12	0.14	0.15		0.14	0.23	0.18				

* ED-TRXRF
** Colorimetry in Ulaanbaatar

Annex VIII-4 (12/18) Water Quality for DT-1, DT-2, DT-3, DT-4 and DT-5 in 1997

Item No.	Item	Unit	DT-1				DT-2			DT-3				DT-4			DT-5				Mongolian Standard	WHO (health)	WHO (complain)
			25-Jun-97	17-Jul-97	24-Jul-97	25-Jul-97	25-Jun-97	17-Jul-97	24-Jul-97	26-Jun-97	17-Jul-97	24-Jul-97	25-Jul-97	25-Jun-97	17-Jul-97	24-Jul-97	25-Jun-97	17-Jul-97	24-Jul-97	25-Jul-97			
1	pH		8.3	8.2	8.1		8.4	8.2	8.2	7.9	8.2	8.1		8	8.1	8.1	8.2	8.2	8.2		6.5-8.5		
2	Temperature	℃	17.5	20	12	16.4	17	20	5	18	15	7	7	9	10	10	9	14.5	8.5	5.7			
3	Odor	dilution factor			<1				<1			<1				<1			<1		≦2		
4	Taste	dilution factor			<1				<1			<1				<1			<1		≦2		
5	Color	mg/l Pt scale	2	<1	2		<1	6	2	<1	<1	2		20	<1	4	<1	2	2				≦15
6	Turbidity	kaolin (JIS)	<1	<1	<1		<1	1	<1	<1	<1	<1		5	<1	2	6	<1	<1				
10	COD($KMnO_4$, alkali)	mg O_2/l	1	2	2		1	1	2	<1	3	1.5		2	<1	2	1	<1	1.5				
11	Nitrite	mg NO_2/l	<0.01	0.01	0.03		<0.01	0.13	<0.01	<0.01	0.01	<0.01		<0.01	<0.01	<0.01	<0.01	0.02	<0.01			≦3	
12	Nitrate	mg NO_3/l	4.9	0.4	7		4.6	5	7	4.7	5	8		4.5	0.4	9	4.1	5	8.2		≦44.3	≦50	
13	Ammonium	mg NH_4/l														0.2			0.2				≦1.5
23	Copper*	mg Cu/l	0.2	0.06	0.06		0.4	0.12	0.05		<0.04	0.05			0.05	0.09			<0.03		≦1	≦2	≦1
24	Iron	mg Fe/l	0.08	0.1	0.1		0.12	0.1	0.11	0.06	0.25	0.1		0.05	0.1	0.09	0.04	0.1	0.09		≦0.3		≦0.3
25	Manganese*	mg Mn/l	<0.07	<0.04	<0.03		0.03	<0.05	<0.04		<0.04	<0.04			<0.02	0.04		<0.06	<0.06		≦0.1	≦0.5	≦0.1
26	Zinc*	mg Zn/l	0.28	0.22	0.21		1.28	0.41	0.2		0.43	0.28			0.21	0.7		0.37	0.1		≦5		≦5
27	Lead**	mg Pb/l					[illegible]		[illegible]												≦0.03	≦0.01	
28	Chromium(VI)	mg Cr(VI)/l	0.02	0.03	0.02		0.02	0.01	0.02	0.05	0.02	0.03		0.02	0.03	0.03	0.03	0.03	0.02				
	Chromium**	mg Cr/l							0.008												≦0.05	≦0.05	
29	Cadmium**	mg Cd/l					[illegible]		[illegible]												≦0.01	≦0.003	
30	Arsenic**	mg As/l					0.035		0.03						<0.03	<0.06			<0.02		≦0.05	≦0.01	
31	Cyanide	mg CN/l	0.05	0.04	0.03		0.06	0.04	0.03	0.05	0.04	0.03		0.04	0.06	0.03	0.05	0.03	0.03		≦0.1	≦0.07	
32	Mercury**	mg Hg/l					[illegible]		[illegible]													≦0.001	
33	Fluoride	mg F/l	0.54	<0.05	<0.05		0.52	<0.05	<0.05	0.82	<0.05	<0.05		0.88		<0.05	0.62	<0.05	<0.05		0.7-1.5	≦1.5	
38	Total Coliforms	No. in 1l	[illegible]	[illegible]	[illegible]	<3	<3	[illegible]		-			[illegible]	-	<3	[illegible]	-		[illegible]	[illegible]	(<3 in 1l)	1 in 100 ml)	
39	General Bacteria	No. in 1 ml	500	500	400	42	580	250		-			30	-	300	350	-		150	22			
40	Residual Chlorine	mg ClO/l	<0.02	<0.02	<0.1	<0.1	<0.02	<0.02	<0.1	<0.02	<0.02	<0.1	<0.1	<0.02	<0.02	0.1	<0.02	<0.02	<0.1	0.1			
43	Acidity	mg $CaCO_3$/l	100	35	38		85	55	28	78	70	43		85	65	63	100	35	65				
44	Alkalinity	mg $CaCO_3$/l	175	225	205		205	190	200	200	180	200		180	215	200	200	145	225				
	Nickel*	mg Ni/l	<0.09	0.04	<0.03		0.05	0.03	<0.04		<0.03	<0.04			<0.03	<0.05		<0.03	<0.03			≦0.02	
	Selenium*	mg Se/l	<0.05	<0.02	<0.03		<0.02	<0.02	<0.03		<0.03	<0.03			<0.02	<0.04			<0.02		≦0.001	≦0.01	
	Strontium*	mg Sr/l	0.58	0.52	0.55		0.52	0.53	0.55		0.62	0.63			0.42	0.58		0.54	0.51		≦2		
	Bromine*	mg Br/l	0.34	0.06	0.14		0.09	0.1	0.14		0.3	0.14			0.1	0.17		0.11	0.17				

* ED-TRXRF
** Colorimetry in Ulaanbaatar

Annex VIII-4 (12/18) Water Quality for DT-1, DT-2, DT-3, DT-4 and DT-5 in 1997

Item No.	Item	Unit	DT-1				DT-2			DT-3				DT-4			DT-5				Mongolian Standard	WHO (health)	WHO (complain)
			25-Jun-97	17-Jul-97	24-Jul-97	25-Jul-97	25-Jun-97	17-Jul-97	24-Jul-97	26-Jun-97	17-Jul-97	24-Jul-97	25-Jul-97	25-Jun-97	17-Jul-97	24-Jul-97	25-Jun-97	17-Jul-97	24-Jul-97	25-Jul-97			
1	pH		8.3	8.2	8.1		8.4	8.2	8.2	7.9	8.2	8.1		8	8.1	8.1	8.2	8.2	8.2		6.5-8.5		
2	Temperature	℃	17.5	20	12	16.4	17	20	5	18	15	7	7	9	10	10	9	14.5	8.5	5.7			
3	Odor	dilution factor			<1				<1			<1				<1			<1		≦2		
4	Taste	dilution factor			<1				<1			<1				<1			<1		≦2		
5	Color	mg/l Pt scale	2	<1	2		<1	6	2	<1	<1	2		20	<1	4	<1	2	2				≦15
6	Turbidity	kaolin (JIS)	<1	<1	<1		<1	1	<1	<1	<1	<1		5	<1	2	6	<1	<1				
10	COD(KMnO_4, alkali)	mg O_2/l	1	2	2		1	1	2	<1	3	1.5		2	<1	2	1	<1	1.5				
11	Nitrite	mg NO_2/l	<0.01	0.01	0.03		<0.01	0.13	<0.01	<0.01	0.01	<0.01		<0.01	<0.01	<0.01	<0.01	0.02	<0.01			≦3	
12	Nitrate	mg NO_3/l	4.9	0.4	7		4.6	5	7	4.7	5	8		4.5	0.4	9	4.1	5	8.2		≦44.3	≦50	
13	Ammonium	mg NH_4/l														0.2			0.2				≦1.5
23	Copper*	mg Cu/l	0.2	0.06	0.06		0.4	0.12	0.05		<0.04	0.05			0.05	0.09			<0.03		≦1	≦2	≦1
24	Iron	mg Fe/l	0.08	0.1	0.1		0.12	0.1	0.11	0.06	0.25	0.1		0.05	0.1	0.09	0.04	0.1	0.09		≦0.3		≦0.3
25	Manganese*	mg Mn/l	<0.07	<0.04	<0.03		0.03	<0.05	<0.04		<0.04	<0.04			<0.02	0.04		<0.06	<0.06		≦0.1	≦0.5	≦0.1
26	Zinc*	mg Zn/l	0.28	0.22	0.21		1.28	0.41	0.2		0.43	0.29			0.21	0.7		0.37	0.1		≦5		≦5
27	Lead**	mg Pb/l					0.036		0.04												≦0.03	≦0.01	
28	Chromium(VI)	mg Cr(VI)/l	0.02	0.03	0.02		0.02	0.01	0.02	0.05	0.02	0.03		0.02	0.03	0.03	0.03	0.03	0.02				
	Chromium**	mg Cr/l							0.008												≦0.05	≦0.05	
29	Cadmium**	mg Cd/l					0.028		0.03												≦0.01	≦0.003	
30	Arsenic**	mg As/l					0.035		0.03						<0.03	<0.06			<0.02		≦0.05	≦0.01	
31	Cyanide	mg CN/l	0.05	0.04	0.03		0.06	0.04	0.03	0.05	0.04	0.03		0.04	0.06	0.03	0.05	0.03	0.03		≦0.1	≦0.07	
32	Mercury**	mg Hg/l					0.01		0.01													≦0.001	
33	Fluoride	mg F/l	0.54	<0.05	<0.05		0.52	<0.05	<0.05	0.82	<0.05	<0.05		0.88		<0.05	0.62	<0.05	<0.05		0.7-1.5	≦1.5	
38	Total Coliforms	No. in 1l	4	7	3	<3	<3	4		-			3	-	<3	4	-		4	4	(<3 in 1l)	1 in 100 ml)	
39	General Bacteria	No. in 1 ml	500	500	400	42	580	250		-			30	-	300	350	-		150	22			
40	Residual Chlorine	mg ClO/l	<0.02	<0.02	<0.1	<0.1	<0.02	<0.02	<0.1	<0.02	<0.02	<0.1	<0.1	<0.02	<0.02	0.1	<0.02	<0.02	<0.1	0.1			
43	Acidity	mg $CaCO_3$/l	100	35	38		85	55	28	78	70	43		85	65	63	100	35	65				
44	Alkalinity	mg $CaCO_3$/l	175	225	205		205	190	200	200	180	200		180	215	200	200	145	225				
	Nickel*	mg Ni/l	<0.09	0.04	<0.03		0.05	0.03	<0.04		<0.03	<0.04			<0.03	<0.05		<0.03	<0.03			≦0.02	
	Selenium*	mg Se/l	<0.05	<0.02	<0.03		<0.02	<0.02	<0.03		<0.03	<0.03			<0.02	<0.04			<0.02		≦0.001	≦0.01	
	Strontium*	mg Sr/l	0.58	0.52	0.55		0.52	0.53	0.55		0.62	0.63			0.42	0.56		0.54	0.51		≦2		
	Bromine*	mg Br/l	0.34	0.08	0.14		0.09	0.1	0.14		0.3	0.14			0.1	0.17		0.11	0.17				

* ED-TRXRF
** Colorimetry in Ulaanbaatar

Annex VIII-4 (13/18) Water Quality for DW-1 and DW-2 in 1997

Item No.	Item	Unit	DW-1			DW-2			Mongolian Standard	WHO (health)	WHO (complain)
			25-Jun-97	17-Jul-97	24-Jul-97	26-Jun-97	17-Jul-97	24-Jul-97			
1	pH		8.4	8.2	9.1	8.4	8.3	8.5	6.5-8.5		
2	Temperature	℃	9	6	5	9	7	7			
3	Odor	dilution factor			<1			<1	≦2		
4	Taste	dilution factor			<1			<1	≦2		
5	Color	mg/l Pt scale	2	5	2	<1	2	4			≦15
6	Turbidity	kaolin (JIS)	<1	<1	<1	<1	<1	<1			
10	COD($KMn0_4$, alkali)	mg O_2/l	<1	<1	2.2	1	<1	2			
11	Nitrite	mg NO_2/l	<0.01	0.01	<0.01	<0.01	0.01	<0.01		≦3	
12	Nitrate	mg NO_3/l	4.2	4.9	9.2	3	5	4	≦44.3	≦50	
13	Ammonium	mg NH_4/l						0.2			≦1.5
23	Copper*	mg Cu/l	0.16	0.1	<0.04		<0.04	<0.06	≦1	≦2	≦1
24	Iron	mg Fe/l	0.06	0.13	0.1	0.03	0.11	0.1	≦0.3		≦0.3
25	Manganese*	mg Mn/l	<0.02	<0.02	<0.04		<0.02		≦0.1	≦0.5	≦0.1
26	Zinc*	mg Zn/l	0.43	0.3	0.25		0.21	0.11	≦5		≦5
28	Chromium(VI)	mg Cr(VI)/l	0.02	0.03	0.02	0.01	0.02	0.02			
31	Cyanide	mg CN/l	0.05	0.03	0.03	0.05	0.06	0.03	≦0.1	≦0.07	
33	Fluoride	mg F/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.7-1.5	≦1.5	
38	Total Coliforms	No. in 1l	[illegible]	[illegible]	[illegible]	-		[illegible]	(<3 in 1l)	(<1 in 100 ml)	
39	General Bacteria	No. in 1 ml	720	200	250	-		300			
40	Residual Chlorine	mg ClO/l		0.03	0.1		<0.02	0.1			
43	Acidity	mg $CaCO_3$/l	60	80	30	80	60	35			
44	Alkalinity	mg $CaCO_3$/l	200	225	300	200	175	220			
	Nickel*	mg Ni/l	0.03	<0.02	<0.02		<0.04	<0.05		≦0.02	
	Selenium*	mg Se/l	<0.04	<0.02	<0.02		<0.07	<0.05	≦0.001	≦0.01	
	Strontium*	mg Sr/l	0.58	0.6	0.6		0.53	0.64	≦2		
	Bromine*	mg Br/l	0.11	0.11	0.25		0.12				

* ED-TRXRF

Annex VIII-4 (13/18) Water Quality for DW-1 and DW-2 in 1997

Item No.	Item	Unit	DW-1			DW-2			Mongolian Standard	WHO (health)	WHO (complain)
			25-Jun-97	17-Jul-97	24-Jul-97	26-Jun-97	17-Jul-97	24-Jul-97			
1	pH		8.4	8.2	9.1	8.4	8.3	8.5	6.5-8.5		
2	Temperature	℃	9	6	5	9	7	7			
3	Odor	dilution factor			<1			<1	≦2		
4	Taste	dilution factor			<1			<1	≦2		
5	Color	mg/l Pt scale	2	5	2	<1	2	4			≦15
6	Turbidity	kaolin (JIS)	<1	<1	<1	<1	<1	<1			
10	COD($KMn0_4$, alkali)	mg O_2/l	<1	<1	2.2	1	<1	2			
11	Nitrite	mg NO_2/l	<0.01	0.01	<0.01	<0.01	0.01	<0.01		≦3	
12	Nitrate	mg NO_3/l	4.2	4.9	9.2	3	5	4	≦44.3	≦50	
13	Ammonium	mg NH_4/l						0.2			≦1.5
23	Copper*	mg Cu/l	0.16	0.1	<0.04		<0.04	<0.06	≦1	≦2	≦1
24	Iron	mg Fe/l	0.06	0.13	0.1	0.03	0.91	0.1	≦0.3		≦0.3
25	Manganese*	mg Mn/l	<0.02	<0.02	<0.04		<0.02		≦0.1	≦0.5	≦0.1
26	Zinc*	mg Zn/l	0.43	0.3	0.25		0.21	0.11	≦5		≦5
28	Chromium(VI)	mg Cr(VI)/l	0.02	0.03	0.02	0.01	0.02	0.02			
31	Cyanide	mg CN/l	0.05	0.03	0.03	0.05	0.06	0.03	≦0.1	≦0.07	
33	Fluoride	mg F/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.7-1.5	≦1.5	
38	Total Coliforms	No. in 1l	7	11	4	-		11	(<3 in 1l)	(<1 in 100 ml)	
39	General Bacteria	No. in 1 ml	720	200	250	-		300			
40	Residual Chlorine	mg ClO/l		0.03	0.1		<0.02	0.1			
43	Acidity	mg $CaCO_3$/l	60	80	30	80	60	35			
44	Alkalinity	mg $CaCO_3$/l	200	225	300	200	175	220			
	Nickel*	mg Ni/l	0.03	<0.02	<0.02		<0.04	<0.05		≦0.02	
	Selenium*	mg Se/l	<0.04	<0.02	<0.02		<0.07	<0.05	≦0.001	≦0.01	
	Strontium*	mg Sr/l	0.58	0.6	0.6		0.53	0.64	≦2		
	Bromine*	mg Br/l	0.11	0.11	0.25		0.12				

* ED-TRXRF

Annex VIII-4 (14/18) Water Quality for DG-1, DG-2, DG-3, DG-4 and DG-5 in 1997

Item No.	Item	Unit	DG-1				DG-2				DG-3				DG-4				DG-5				Mongolian Standard	WHO (health)	WHO (complain)
			25-Jun-97	17-Jul-97	24-Jul-97	25-Jul-97	25-Jun-97	17-Jul-97	24-Jul-97	25-Jul-97	26-Jun-97	17-Jul-97	24-Jul-97	25-Jul-97	25-Jun-97	17-Jul-97	24-Jul-97	25-Jul-97	25-Jun-97	17-Jul-97	24-Jul-97	25-Jul-97			
1	pH		8.2	8.2	8.2		8	8.3	8.3		8.3	7.8	8.2		8.3	8.3	8.3		8.3	8.3	8.3		6.5-8.5		
2	Temperature	℃	19	12	8	9.9	19.4	15	18	9.4	19.7	16	16.5	11.9	19.7	15	9.8	15.3	19.4	18	16	16.5			
3	Odor	dilution factor			<1				1				1				1				1		≤2		
4	Taste	dilution factor			<1				1				1				1				<1		≤2		
5	Color	mg/l Pt scale	2	2	4		4	2	4		<1	5	4		<1	20	2		<1	<1	2				≤15
6	Turbidity	baslin (JIS)	2	2	<1		2	<1	<1		<1	1	1		<1	3	<1		<1	<1	<1				
10	COD(KMnO$_4$, alkali)	mg O$_2$/l	3	<1	2		3	<1	<1		<1	<1	2		2.8	1	3.5		1.4	<1	2.8				
11	Nitrite	mg NO$_2$/l	0.02	0.02	<0.01		0.01	<0.01	<0.01		<0.01	0.5	<0.01		<0.01	0.25	0.03		<0.01	0.01	<0.01			≤3	
12	Nitrate	mg NO$_3$/l	4.2	4	8		4.1	4	8.2		4.1	9	9.4		4.9	5	7		2	5	9		≤44.3	≤50	
13	Ammonium	mg NH$_4$/l																							≤1.5
23	Copper*	mg Cu/l	<0.05	0.07	0.08		<0.03	<0.03	0.05		0.05	0.04	0.05		0.08	0.05	0.03		0.09	<0.05	0.31		≤1	≤2	≤1
24	Iron	mg Fe/l	0.03	0.2	0.1		0.05	0.21	0.06		0.04	0.3	0.05		0.03	0.3	0.01		0.02	0.1	0.01		≤0.3		≤0.3
25	Manganese*	mg Mn/l	<0.05	<0.03	<0.06		0.06	<0.04	<0.04		<0.04	<0.05	<0.05		<0.04	<0.02	<0.06		0.04	<0.04	<0.02		≤0.1	≤0.5	≤0.1
26	Zinc*	mg Zn/l	0.18	0.17	0.35		0.08	0.07	0.26		0.12	0.13	0.57		0.28	0.41	0.23		0.28	0.07	0.14		≤5		≤5
27	Lead**	mg Pb/l					[illegible]																≤0.03	≤0.01	
28	Chromium(VI)	mg Cr(VI)/l	0.04	0.02	0.02		0.02	0.03	0.02		0.02	0.01	0.01		0.02		0.02		0.01	0.04	0.02				
29	Cadmium**	mg Cd/l					0.026																≤0.01	≤0.003	
30	Arsenic**	mg As/l					0.024																≤0.05	≤0.01	
31	Cyanide	mg CN/l	[illegible]	0.04	0.02		0.05	0.05	0.03		0.05	0.05	0.03		0.05	0.08	0.04		0.05	0.04	0.02		≤0.1	≤0.07	
32	Mercury**	mg Hg/l					[illegible]																	≤0.001	
33	Fluoride	mg F/l	0.74	<0.05	<0.05		0.7	0.1	<0.05		0.69	<0.05	<0.05		0.61	<0.05	<0.05		<0.05	<0.05	<0.05		0.7-1.5	≤1.5	
36	Total Coliforms	No. in 1l	[illegible]				[illegible]																(<3 in 10	(<1 in 100 ml)	
39	General Bacteria	No. in 1 ml	290	300	300	102	1000	250	500	240	950	430	100	533	780	700	700	345	850	143	500	496			
40	Residual Chlorine	mg ClO/l	<0.02	<0.02	0.1	<0.1	<0.02	<0.02	0.2	0.15		<0.02	0.2	0.1	<0.02	<0.02	0.2	0.1	<0.02	<0.02	0.2	0.15			
43	Acidity	mg CaCO$_3$/l	85	30	35		60	55	50		53	40	65		55	50	60		53	60	30				
44	Alkalinity	mg CaCO$_3$/l	195	225	210		183	175	210		185	250	210		180	205	225		175	225	200				
	Nickel*	mg Ni/l	<0.05	<0.02	<0.05		0.03	<0.04	<0.04		<0.03	<0.03	<0.05		<0.04	<0.03	<0.03		0.03		<0.02			≤0.02	
	Selenium*	mg Se/l	<0.05	<0.02	<0.07		<0.02	<0.04	<0.05		<0.03	<0.02	<0.04		<0.05	<0.02	<0.04		<0.03	<0.04	<0.02		≤0.001	≤0.01	
	Strontium*	mg Sr/l	0.58	0.58	0.61		0.19	0.54	0.63		0.58	0.27	0.5		0.59	0.45	0.58		0.59	0.42	0.63		≤2		
	Bromine*	mg Br/l	0.3	0.13	0.22		0.12	0.12	0.14		0.15		0.13		0.12	0.07	0.12		0.28	0.07	0.18				

* ED-TRXRF
** Colorimetry

Annex VIII-4 (14/18) Water Quality for DG-1, DG-2, DG-3, DG-4 and DG-5 in 1997

Item No.	Item	Unit	DG-1				DG-2				DG-3				DG-4				DG-5				Mongolian Standard	WHO (health)	WHO (complain)
			25-Jun-97	17-Jul-97	24-Jul-97	25-Jul-97	25-Jun-97	17-Jul-97	24-Jul-97	25-Jul-97	26-Jun-97	17-Jul-97	24-Jul-97	25-Jul-97	25-Jun-97	17-Jul-97	24-Jul-97	25-Jul-97	25-Jun-97	17-Jul-97	24-Jul-97	25-Jul-97			
1	pH		8.2	8.2	8.2		8	8.3	8.3		8.3	7.8	8.2		8.3	8.3	8.3		8.3	8.3	8.3		6.5-8.5		
2	Temperature	°C	19	12	8	9.9	19.4	15	18	9.4	19.7	16	16.5	11.6	19.7	15	9.8	15.3	18.4	16	16	16.5			
3	Odor	dilution factor			<1				1				1				1				<1		≤2		
4	Taste	dilution factor			<1				1				1				1				2		≤2		≤15
5	Color	mg/l Pt scale	2	2	4		4	2	4		<1	5	4		<1	20	2		<1	<1	2				
6	Turbidity	kaolin (JIS)	2	2	<1		2	<1	<1		<1	1	1		<1	3	<1		<1	<1	<1				
10	COD($KMnO_4$, alkali)	mg O_2/l	3	<1	2		3	<1	<1		<1	<1	2		2.8	1	3.5		1.4	<1	2.8			≤3	
11	Nitrite	mg NO_2/l	0.02	0.02	<0.01		0.01	<0.01	<0.01		<0.01	0.5	<0.01		<0.01	0.25	0.03		<0.01	0.01	<0.01		≤44.3	≤50	
12	Nitrate	mg NO_3/l	4.2	4	8		4.1	4	8.2		4.1	9	9.4		4.9	5	7		2	5	9				≤15
13	Ammonium	mg NH_4/l																							
23	Copper*	mg Cu/l	<0.05	0.07	0.08		<0.03	<0.03	0.05		0.05	0.04	0.05		0.06	0.05	0.03		0.09	<0.05	0.31		≤1	≤2	≤1
24	Iron	mg Fe/l	0.03	0.2	0.1		0.05	0.21	0.06		0.04	0.3	0.05		0.03	0.3	0.01		0.02	0.1	0.01		≤0.3		≤0.3
25	Manganese*	mg Mn/l	<0.05	<0.03	<0.06		0.06	<0.04	<0.04		<0.04	<0.05	<0.05		<0.04	<0.02	<0.06		0.04	<0.04	<0.02		≤0.1	≤0.5	≤0.1
26	Zinc*	mg Zn/l	0.18	0.17	0.35		0.06	0.07	0.26		0.12	0.13	0.57		0.26	0.41	0.23		0.26	0.07	0.14		≤5		≤5
27	Lead**	mg Pb/l					0.041																≤0.03	≤0.01	
28	Chromium(VI)	mg Cr(VI)/l	0.04	0.02	0.02		0.02	0.03	0.02		0.02	0.01	0.01		0.02		0.02		0.01	0.04	0.02				
29	Cadmium**	mg Cd/l					0.026																≤0.01	≤0.003	
30	Arsenic**	mg As/l					0.024																≤0.05	≤0.01	
31	Cyanide	mg CN/l	0.76	0.04	0.02		0.05	0.05	0.03		0.05	0.05	0.03		0.05	0.06	0.04		0.05	0.04	0.02		≤0.1	≤0.07	
32	Mercury**	mg Hg/l					0.01																	≤0.001	
33	Flyoride	mg F/l	0.74	<0.05	<0.05		0.7	0.1	<0.05		0.89	<0.05	<0.05		0.61	<0.05	<0.05		<0.05	<0.05	<0.05		0.7-1.5	≤1.5	
38	Total Coliforms	No. in 1l	11	11	4		28	21	7	4	11	11	180	7	8	4	15	21	3	7	43	2	(<3 in 1l)	(<1 in 100 ml)	
39	General Bacteria	No. in 1 ml	290	300	300	102	1000	250	500	240	950	430	100	533	780	700	700	345	850	143	500	486			
40	Residual Chlorine	mg ClO/l	<0.02	<0.02	0.1	<0.1	<0.02	<0.02	0.2	0.15		<0.02	0.2	0.1	<0.02	<0.02	0.2	0.1	<0.02	<0.02	0.2	0.15			
43	Acidity	mg $CaCO_3$/l	65	30	35		60	55	50		53	40	65		55	50	60		53	60	30				
44	Alkalinity	mg $CaCO_3$/l	195	225	210		180	175	210		185	250	210		180	205	225		175	225	200				
	Nickel*	mg Ni/l	<0.05	<0.02	<0.05		0.03	<0.04	<0.04		<0.03	<0.03	<0.05		<0.04	<0.03	<0.03		0.03		<0.02			≤0.02	
	Selenium*	mg Se/l	<0.05	<0.02	<0.07		<0.02	<0.04	<0.05		<0.03	<0.02	<0.04		<0.05	<0.02	<0.04		<0.03	<0.04	<0.02		≤0.001	≤0.01	
	Strontium*	mg Sr/l	0.58	0.58	0.61		0.19	0.54	0.63		0.58	0.27	0.5		0.59	0.45	0.58		0.59	0.42	0.63		≤7		
	Bromine*	mg Br/l	0.3	0.13	0.22		0.12	0.12	0.14		0.15		0.13		0.12	0.07	0.12		0.28	0.07	0.18				

* ED-TRXRF
** Colorimetry

Annex VIII-4 (15/18) Classification of Samples by the Number of Total Coliform in 1997

Sampling Site	Total Sample Number	Total Number of Coliforms in 1 litter			
		0 - <3	3 - <10	10 - <100	100 -
		Sample Number			
Reservoir	8	0	6	2	0
Water Wagon	4	0	1	3	0
Tap Water	11	3	8	0	0
Ger	20	0	10	9	1
SW-1	3	0	0	0	3
SW-2	3	0	0	0	3
SW-3	3	0	0	0	3
SW-4	3	0	0	1	2
SW-5	2	0	0	1	1
SW-6	3	0	2	1	0
SW-7	3	0	0	0	3
SW-8	3	0	0	1	2

Annex VIII-4 (16/18) Evaluation of Water Quality for Water of Wells and Water Supply Facilities

Item	Existing Wells								New Test Wells										Water Supply System			
	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8	A1	A2	A3	A4	B1	B2	B3	B4	B5	B6	DR	DT	DW	DG
Color*	OX	O	O	OX	OX	OX	X	OX	X	XX	O	O	O	O	XX	XX	O	O	O	O	O	O
Hardness	XX	X	XX	XX	X	O	XX	OX	XX	XX	OX	XX	XX	XX	XX	XX	O	O	O			
Dry Residue	X	O	X	X	O	O	X	O	XX	XX	X	XX	X	XX	XX	XX	O	O	O			
Chloride	O	O	O	O	O	O	O	O	O	XX	O	X	O	XX	XX	XX	O	O	O			
Sulfate	XX	O	X	X	O	O	X	O	O	XX	O	O	O	XX	XX	X	O	O	O			
Calcium	X	O	OX	O	O	O	O	O	O	XX	O	O	O	O	XX	OX	O	O	O			
Magnesium	XX	XX	XX	XX	XX	OX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	X	X	X	X	X	X
Strontium	X	O	XX	X	O	O	O	O	O	XX	O	O	O	OX	XX	XX	O	O	O	O	O	O
Iron	O	O	O	OX	O	O	O	O	OX	XX	O	O	O	O	O	O	O	O	O	O	O	O
Manganese	OX	O	O	O	XX	XX	OX	XX	O	XX	O	O	O	O	XX	O	O	O	O	O	O	O
Lead	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	?
Chromium	O	?	?	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Cadmium	?	?	?	?	?	O	?	O	O	O	O	O	O	O	O	O	O	O	O	O	O	?
Arsenic	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Total coliform**	XX	XX	XX	XX	XX	X	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	X	OX	X	XX

* WHO guidelines

** Guidelines

O: good,

OX: near the standard

X: exceed the standard

XX: exceed twice the standard

?: inconclusive

Annex VIII-4 (17/18) Water Quality of Rivers in 1997

Item No.	Item	Unit	R-1			R-3	R-4		
			26-Jun-97	17-Jul-97	23-Jul-97	26-Jun-97	26-Jun-97	17-Jul-97	23-Jul-97
1	pH		8.4	8.9	8.7	8.6	9.3	8.7	8.1
2	Temperature	℃	14	15	22	12.5	2	10	8.5
3	Odor	dilution factor			<1				1
5	Color	mg/l Pt scale	20	20	5	10		5	6
6	Turbidity	kaolin (JIS)	10	5	<1	<1	10	1	1
7	Conductivity	mS/m(at 25℃)	1999	1830	1746	528	128	102	141
8	Hardness	mg$CaCO_3$/l	300	6875	8195	445	450	410	425
10	COD($KMnO_4$,alkali)	mg O_2/l	–	–	–	4	–	–	–
11	Nitrite	mg NO_2/l	0.01	0.02	<0.01	0.01	<0.01	0.01	<0.01
12	Nitrate	mg NO_3/l	0.2	0.5	0.7	0.3	0.2	5.6	9.6
13	Ammonium	mg NH_4/l			0.4		0.34		0.23
15	Bicarbonate	mg HCO_3/l	345	329	238	1098		403	458
16	Carbonate	mg CO_3/l	3.45	10.41	4.73	13.82		6.38	1.82
17	Chloride*	mg Cl/l	10100	5420	4770	1120	303	160	152
18	Sulfate*	mg SO_4/l	5350-10700	2865-5730	2660-5320	1110-2220	206-412	158-316	143-286
20	Potassium*	mg K/l	29	17	17	20	17	7.3	8.6
21	Calcium*	mg Ca/l	548	312	305	58	48	49	48
22	Magnesium	mg Mg/l	72	1650	1789	95	92	85	67
23	Copper*	mg Cu/l	<0.15	<0.13	<0.12	<0.09	0.06	0.05	<0.05
24	Iron	mg Fe/l	0.19	0.13	0.09	0.06	0.05	0.42	0.07
25	Manganese*	mg Mn/l	<0.31	<0.17	<0.14	<0.08	0.1	<0.05	<0.07
26	Zinc	mg Zn/l	<0.23	0.43	<0.13	0.12	0.15	0.17	0.18
28	Chromium(VI)	mg Cr(VI)/l	0.01	0.03	0.02	0.01		0.01	0.001
31	Cyanide	mg CN/l	0.06	0.5	0.8	0.09	0.8	0.05	0.01
33	Fluolide	mg F/l	0.22	<0.05	0.05	0.19		0.05	0.04
38	Total Coliforms	No. in 1l	960	2380	2380	>2380		960	>2380
43	Acidity	mg $CaCO_3$/l	40	95	80	750		160	78
44	Alkalinity	mg $CaCO_3$/l	283	270	195	900		330	375
	Nickel*	mg Ni/l	<0.14	<0.11	<0.13		<0.05	<0.03	<0.06
	Seleni8m*	mg Se/l	<0.3	<0.2	<0.17		<0.04	<0.03	<0.04
	Strontium*	mg St/l	27.8	19.2	16.7		1.25	0.93	0.87
	Bromine*	mg Br/l	5.85	3.3	3		0.53	0.21	0.21

* ED-TRXRF

Annex VIII-4 (18/18) Water Quality of Sewerage System in 1997

Item No.	Item	Unit	S-1			S-2			S-3			Maxmum Quality limit (in Oman)#
			26-Jun-97	18-Jul-97	24-Jul-97	26-Jun-97	18-Jul-97	24-Jul-97	26-Jun-97	18-Jul-97	24-Jul-97	
1	pH		8.4	8.4	8.6	8.3	8.1	9	8.9	8.7	9.3	
2	Temperature	℃	5.5	7	7	9	11	15	15	12.5	16	
3	Odor	dilution factor			16			4			4	
5	Color	mg/l Pt scale	60	60	50	20	20	100	20	40	140	
6	Turbidity	kaolin (JIS)	30	10	40	5	10	80	20	10	80	
7	Conductivity	mS/m(at 25℃)	130	109	155	102	80	114	100	84	108	270
8	Hardness	mg$CaCO_3$/l	170	270	475	163	270	350	175	270	425	
9	Dry Residue	mg/l	1486		2800	4120		3200	412		2000	2000
10	COD($K_2Cr_2O_7$)	mg O_2/l	161.4	102.7	163	112.2	113.8	115	138	139.9	144	200
11	Nitrite	mg NO_2/l	0.02	0.01	0.01	0.38	0.35	0.3	0.07	0.3	0.28	
12	Nitrate	mg NO_3/l	0.07	0.2	<0.1	2.6	3.8	2.8	0.08	2.4	2.1	50
13	Ammonium	mg NH_4/l										10
14	Orthophosphate	mg $P0_4$/l			1.55			1.8			1.7	
17	Chloride*	mg Cl/l	261	265	195	228	160	197	212	173	195	650
20	Potassium*	mg K/l	18	16	11.3	20	8.1	12.5	20	7.6	9.1	
21	Calcium	mg Ca/l	28	33	48	34	27	37	37	30	40	
	Calcium*	mg Ca/l	40	41	39	43	33	36	43	30	40	
22	Magnesium	mg Mg/l	24	45	85	18.6	49	62	19.8	47	78	
23	Copper*	mg Cu/l	<0.05	0.11	0.17	0.05	0.05	<0.05	0.04	0.04	0.08	1
24	Iron	mg Fe/l	0.25	0.36	0.15	0.29	0.25	0.21	0.34	0.26	0.17	5
25	Manganese*	mg Mn/l	0.08	<0.07	0.04	0.09	0.07	<0.08	0.09	<0.03	<0.06	
26	Zinc	mg Zn/l	0.13	0.19	0.54	0.14	0.1	0.23	0.17	0.12	0.27	5
27	Lead	mg Pb/l	<0.05	<0.09	<0.09	<0.09	<0.05	<0.07	<0.07	<0.05	0.12	0.2
28	Chromium(VI)	mg Cr(VI)/l	0.01	0.03	0.03	0.01	<0.01	0.03	0.03	<0.01	0.01	total 0.05
31	Cyanide	mg CN/l	0.08	0.28	0.06	0.07	0.07	0.05	0.09	0.09	0.05	0.1
33	Fluolide	mg F/l	0.2		0.04	0.16		0.03	0.18		0.03	2
38	Total Coliforms	No. in 1l	100000	1000000	1000000	100000	1000000	1000000	10000	100000	100000	Fecal 1000
39	General Bacteria	No. in 1 ml	600000			200000			60000			
41	BOD	mg O_2/l	20	20.5	21	21.4	22.8	23.5	20.5	22.3	2.5	20
42	SS	mg SS/l	708	247	211	572	283	444	424	255	171	30
43	Acidity	mg $CaCO_3$/l	140	180		170	75		210	105		
44	Alkalinity	mg $CaCO_3$/l	270	400		355	250		330	325		
	Nickel*	mg Ni/l	<0.03	<0.04	<0.06	<0.04	<0.03	0.04	<0.04	<0.04	<0.05	
	Selenium*	mg Se/l	<0.04	<0.03	<0.05	<0.03	<0.03	<0.05	<0.03	<0.02	<0.05	
	Strontium*	mg St/l	0.83	0.7	0.79	0.82	0.52	0.64	0.94	0.53	0.71	
	Bromine*	mg Br/l	0.3	0.12	0.27	0.12	0.12	0.22	0.15	0.07	0.28	

*ED-TRXRF

Donald R. Rowe and Isam Mohammed Abdel-Magid, Handbook of Wastewater Reclamation and Reuse (1995), CRC Press Inc.

Supplementary Explanation of Analysis Methods and the Result

1) Electric Neutrality

In the natural water system, carbonate, bicarbonate, chloride, sulfate, sodium, potassium, calcium, and magnesium are dominate ion species. In addition, nitrate ion is also considered. The concentration of ions is shown in molar (mol/l): m{nitrate}, m{carbonate}, m{bicarbonate}, m{chloride}, m{sulfate}, m{sodium}, m{potassium}, m{calcium}, and m{magnesium}. These quantities must approximately fulfill the following equation (charge balance equation):

$$m\{nitrate\}+m\{carbonate\} + 2m\{bicarbonate\} + m\{chloride\} +2\, m\{sulfate\} = m\{sodium\} + m\{potassium\} + 2m\{calcium\} + 2m\{magnesium\}$$

In order to verify this relationship for samples from wells, the sum of major anions' equivalent and that of major cations' equivalent are calculated (in Table (1/9) of Annex VI-5) from the results obtained with the speedy water analyzer (Annex VI-1 Table (1/15) to (3/15)) except sodium ion, which was analyzed with the flame emission spectrometric method. The sum of major cations' equivalent is much larger than that of major anions' equivalent for the majority of the samples.

This result indicates a great systematic error for this water quality analyses. The Methods used for analyses on bicarbonate, carbonate, calcium, chloride, sodium, potassium, and sulfate are shown in Table (2/9) of Annex VI-5. The comparison among some analysis methods is shown in Table (3/9) of Annex VI-5 for wells. This comparison indicates that:

a) calcium concentration obtained with the titration method is comparatively consistent with that obtained with the energy dispersive total X-ray fluorescence (ED-TRXRF) technique;
b) potassium concentration obtained from the turbidimetric method is comparatively consistent with that obtained with ED-TRXRF technique in the low concentration range;
c) there are relatively large discrepancy among three method for chloride; and
d) there are very large discrepancy between three methods for sulfate.

Causes for the discrepancy of chloride analyses are:

a) the element chlorine is measured with ED-TRXRF, but the chloride ion is measured with the turbidimetric and titration methods; and
b) the turbidimetric method generally have lower values in the high concentration range of chloride.

The causes for the discrepancy of sulfate analyses are:

a) the element sulfur is measured with ED-TRXRF, but the sulfate ion is measured with the turbidimetric and gravimetric methods;
b) the turbidimetric method needs the constant stirring during suspension formation;
c) other species containing sulfur atom may exist (for example, sulfide compounds).

In conclusion, the discrepancy between the sum of equivalnt for major anions and that for major cations is mainly due to the erroneous measurement for chloride and sulfate with the speedy water analyzer. For chloride measurement the ED-TRXRF and titration methods are generally more reliable than turbidity methods. The ED-TRXRF results for chloride concentration are chosen at least for well samples, because these samples are not influenced from the chlorination. Sulfate concentration is calculated from the charge balance and calculation results are shown in Table (4/9) of Annex VI-5 for wells.

2) Residual Solid and Electric Conductivity

The values for dry residual and electrical conductivity of natural water are normally correlated. But the measured residual solid doesn't show such a tendency with the electrical conductivity (in Figure. (8/9) of Annex VI-5). Dry residuals were probably not measured in correct.

So the theoretical residual solid is calculated from major ions' concentration shown in Table (4/9) of Annex VI-5. During the process of drying, bicarbonate ion breaks down as expressed the following equation:

$$2HCO_3^- \rightarrow CO_2 + CO_3^{2-} + H_2O$$

If other ions don't change during drying, the theoretical dry residual can be calculated

and this result is shown in Table (5/9) of Annex VI-5 with the electrical conductivity. This relation between theoretical dry residual and electrical conductivity is shown in Figure. 1 of Annex VI-5. Some samples also show the large discrepancy from the correlation curve, especially for SW-1, SW-4, SW-7, and SW-8. It is concluded that there is another erroneous factor which produces dispersive relationship between the theoretical dry residual and electrical conductivity.

The following supposition is considered:

a) sulfate concentrations were measured accurately with the titration method and are linearly related with S element concentrations obtained from ED-TRXRF.
b) magnesium concentrations were not accurately measured with titration, because high magnesium concentration demanded the consumption of a lot of titrant which made the end point unclear in this study.

Sulfate concentrations are calculated from the linear relationship between sulfate concentration measured with the titration method and S element concentration obtained from ED-TRXRF (Figure 2 of Annex VI-5). Magnesium concentrations are calculated from the charge balance. Major ions' concentrations obtained from these above process are shown in Table (6/9) of Annex VI-5, and the theoretical dry residual is calculated and is also shown in Table (7/9) of Annex VI-5 with the electrical conductivity.

The relationship between the theoretical dry residual and electrical conductivity is shown in Figure (9/9) of Annex VI-5. The correlation between them is comparatively well. It is concluded that the concentrations shown in Table (6/9) of Annex VI-5 are more reasonable ones of major ions for well samples than in Table (1/9) or Table (4/9)

Annex VIII-5 (1/9)

Electric Charge Balance among Major Ions for Well Samples in the case of using chloride and potassium concentration obtained from the speedy water analyzer

(a) Phase 1

Item No.	Item	Equivalent weight	Unit	23-Jun-97 SW-1	23-Jun-97 SW-2	23-Jun-97 SW-3	23-Jun-97 SW-4	26-Jun-97 SW-5	23-Jun-97 SW-6	23-Jun-97 SW-7	23-Jun-97 SW-8
12	Nitrate	62	mg NO_3/l	5.5	9.8	4.1	3.9	0.5	2	5.8	0.21
15	Bicarbonate	61	mg HCO_3/l	306	256	262	342	292	208	402	534
16	Carbonate	30	mg CO_3/l	0.60	0.16	0.52	1.08	0.30	2.08	3.20	0.86
17	Chloride	35.5	mg Cl/l	2	19.9	0.8	14	18	16	1.9	1.4
18	Sulfate	48	mg SO_4/l	140	47	95	45	4	22	150	36
19	Sodium*	23	mg Na/l	49.3	47.4	54.6	52	54.8	56.2	53.6	52
20	Potassium	39.1	mg K/l	9.5	4.1	7	9	10	1.7	12	6.1
21	Calcium	20	mg Ca/l	100	46	47	33	22	22	27	38
22	Magnesium	12.16	mg Mg/l	540	74	138	146	29	37	174	53

Item No.	Item	Equivalent weight	Unit	23-Jun-97 W-1	23-Jun-97 W-2	23-Jun-97 W-3	23-Jun-97 W-4	26-Jun-97 W-5	23-Jun-97 W-6	23-Jun-97 W-7	23-Jun-97 W-8
12	Nitrate	62	meq NO_3/l	0.09	0.16	0.07	0.06	0.01	0.03	0.09	0.00
15	Bicarbonate	61	meq HCO_3/l	5.02	4.20	4.30	5.61	4.79	3.41	6.59	8.75
16	Carbonate	30	meq CO_3/l	0.02	0.01	0.02	0.04	0.01	0.07	0.11	0.03
17	Chloride	35.5	meq Cl/l	0.06	0.56	0.02	0.39	0.51	0.45	0.05	0.04
18	Sulfate	48	meq SO_4/l	2.92	0.98	1.98	0.94	0.08	0.46	3.13	0.75
19	Sodium*	23	meq Na/l	2.14	2.06	2.37	2.26	2.38	2.44	2.33	2.26
20	Potassium	39.1	meq K/l	0.24	0.10	0.18	0.23	0.26	0.04	0.31	0.16
21	Calcium	20	meq Ca/l	5.00	2.30	2.33	1.65	1.10	1.10	1.35	1.90
22	Magnesium	12.16	meq Mg/l	44.41	6.09	11.35	12.01	2.38	3.04	14.31	4.36
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

(b) Phase 2

Item No.	Item	Equivalent weight	Unit	16-Jul-97 W-1	16-Jul-97 W-2	16-Jul-97 W-3	16-Jul-97 W-4	16-Jul-97 W-5	16-Jul-97 W-6	16-Jul-97 W-7	16-Jul-97 W-8
12	Nitrate	62	mg NO_3/l	5.5	5.4	5.3	8.4	1	4	4	0.6
15	Bicarbonate	61	mg HCO_3/l	330	220	280	354	140	206	738	470
16	Carbonate	30	mg CO_3/l	0.66	0.56	0.36	0.88	0.18	1.04	2.34	0.74
17	Chloride	35.5	mg Cl/l	18	16	17	17	18	6.1	19	10
18	Sulfate	48	mg SO_4/l	420	100	240	300	99	36		37
19	Sodium*	23	mg Na/l	49.1	47	54.2	52.3	54.5	56	53.3	52.1
20	Potassium	39.1	mg K/l	10	4	7	9	6	3	10	7
21	Calcium	20	mg Ca/l	150	45	36	28	19	25	28	25
22	Magnesium	12.16	mg Mg/l	300	82	154	52	97	33	211	143

Item No.	Item	Equivalent weight	Unit	16-Jul-97 W-1	16-Jul-97 W-2	16-Jul-97 W-3	16-Jul-97 W-4	16-Jul-97 W-5	16-Jul-97 W-6	16-Jul-97 W-7	16-Jul-97 W-8
12	Nitrate	62	meq NO_3/l	0.09	0.09	0.09	0.14	0.02	0.06	0.06	0.01
15	Bicarbonate	61	meq HCO_3/l	5.41	3.61	4.59	5.80	2.30	3.41	12.10	7.70
16	Carbonate	30	meq CO_3/l	0.02	0.02	0.01	0.03	0.01	0.03	0.08	0.02
17	Chloride	35.5	meq Cl/l	0.51	0.45	0.48	0.48	0.51	0.17	0.54	0.28
18	Sulfate	48	meq SO_4/l	8.75	2.08	5.00	6.25	2.06	0.75	0.00	0.77
19	Sodium*	23	meq Na/l	2.13	2.04	2.36	2.27	2.37	2.43	2.32	2.27
20	Potassium	39.1	meq K/l	0.26	0.10	0.18	0.23	0.15	0.08	0.28	0.18
21	Calcium	20	meq Ca/l	7.50	2.25	1.80	1.40	0.95	1.25	1.40	1.25
22	Magnesium	12.16	meq Mg/l	24.67	5.10	12.66	4.28	7.98	2.71	17.35	11.76
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

(c) Phase 3

Item No.	Item	Equivalent weight	Unit	23-Jul-97 W-1	23-Jul-97 W-2	23-Jul-97 W-3	23-Jul-97 W-4	23-Jul-97 W-5	23-Jul-97 W-6	23-Jul-97 W-7	23-Jul-97 W-8
12	Nitrate	62	mg NO_3/l	9.6	9.8	9.6	28	0.8	5.6	6	0.5
15	Bicarbonate	61	mg HCO_3/l	428	280	244	312	152	214	1006	396
16	Carbonate	30	mg CO_3/l	0.26	0.88	0.48	0.98	0.96	2.14	3.18	0.40
17	Chloride	35.5	mg Cl/l	15	17	17	17	17	5	17	9
18	Sulfate	48	mg SO_4/l	1000	190	400	500	220	40	500	40
19	Sodium*	23	mg Na/l	49	47	54	52.1	54.2	56.1	53.1	52.2
20	Potassium	39.1	mg K/l	9	4	7	8	8	1	10	7
21	Calcium	20	mg Ca/l	236	67	260	80	26	27	42	80
22	Magnesium	12.16	mg Mg/l	188	98	234	774	116	56	251	396

Item No.	Item	Equivalent weight	Unit	23-Jul-97 W-1	23-Jul-97 W-2	23-Jul-97 W-3	23-Jul-97 W-4	23-Jul-97 W-5	23-Jul-97 W-6	23-Jul-97 W-7	23-Jul-97 W-8
12	Nitrate	62	meq NO_3/l	0.15	0.16	0.15	0.45	0.01	0.09	0.10	0.01
15	Bicarbonate	61	meq HCO_3/l	7.02	4.59	4.00	5.11	2.49	3.51	16.49	6.49
16	Carbonate	30	meq CO_3/l	0.01	0.03	0.02	0.03	0.03	0.07	0.11	0.01
17	Chloride	35.5	meq Cl/l	0.42	0.48	0.48	0.48	0.48	0.14	0.48	0.25
18	Sulfate	48	meq SO_4/l	20.83	3.96	8.33	10.42	4.58	0.83	10.42	0.83
19	Sodium	23	meq Na/l	2.13	2.04	2.35	2.27	2.36	2.44	2.31	2.27
20	Potassium*	39.1	meq K/l	0.23	0.10	0.18	0.20	0.15	0.03	0.26	0.18
21	Calcium	20	meq Ca/l	11.80	3.35	13.00	3.00	1.30	1.35	2.10	4.00
22	Magnesium	12.16	meq Mg/l	15.46	8.06	19.24	63.65	9.54	4.61	20.64	32.57
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

* results from Atomic Emission Spectroscopy Technique

Annex VIII-5 (1/9)

Electric Charge Balance among Major Ions for Well Samples in the case of using chloride and potassium concentration obtained from the speedy water analyzer

(a) Phase 1

Item No.	Item	Equivalent weight	Unit	23-Jun-97 SW-1	23-Jun-97 SW-2	23-Jun-97 SW-3	23-Jun-97 SW-4	26-Jun-97 SW-5	23-Jun-97 SW-6	23-Jun-97 SW-7	23-Jun-97 SW-8
12	Nitrate	62	mg NO_3/l	5.5	9.8	4.1	3.9	0.5	2	5.8	0.21
15	Bicarbonate	61	mg HCO_3/l	306	256	262	342	292	208	402	534
16	Carbonate	30	mg CO_3/l	0.60	0.16	0.52	1.08	0.30	2.08	3.20	0.86
17	Chloride	35.5	mg Cl/l	2	19.9	0.8	14	18	16	1.9	1.4
18	Sulfate	48	mg SO_4/l	140	47	95	45	4	22	150	36
19	Sodium*	23	mg Na/l	49.3	47.4	54.6	52	54.8	56.2	53.6	52
20	Potassium	39.1	mg K/l	9.5	4.1	7	9	10	1.7	12	6.1
21	Calcium	20	mg Ca/l	100	46	47	33	22	22	27	38
22	Magnesium	12.16	mg Mg/l	540	74	138	146	29	37	174	53

Item No.	Item	Equivalent weight	Unit	23-Jun-97 W-1	23-Jun-97 W-2	23-Jun-97 W-3	23-Jun-97 W-4	26-Jun-97 W-5	23-Jun-97 W-6	23-Jun-97 W-7	23-Jun-97 W-8
12	Nitrate	62	meq NO_3/l	0.09	0.16	0.07	0.06	0.01	0.03	0.09	0.00
15	Bicarbonate	61	meq HCO_3/l	5.02	4.20	4.30	5.61	4.79	3.41	6.59	8.75
16	Carbonate	30	meq CO_3/l	0.02	0.01	0.02	0.04	0.01	0.07	0.11	0.03
17	Chloride	35.5	meq Cl/l	0.06	0.56	0.02	0.39	0.51	0.45	0.05	0.04
18	Sulfate	48	meq SO_4/l	2.92	0.98	1.98	0.94	0.08	0.46	3.13	0.75
19	Sodium*	23	meq Na/l	2.14	2.06	2.37	2.26	2.38	2.44	2.33	2.26
20	Potassium	39.1	meq K/l	0.24	0.10	0.18	0.23	0.26	0.04	0.31	0.16
21	Calcium	20	meq Ca/l	5.00	2.30	2.33	1.65	1.10	1.10	1.35	1.90
22	Magnesium	12.16	meq Mg/l	44.41	6.09	11.35	12.01	2.38	3.04	14.31	4.36
	Anion		meq anion/l	8.10	5.90	8.38	7.04	5.40	4.42	9.97	9.58
	Cation		meq cation/l	51.79	10.55	16.23	16.15	6.12	6.33	18.30	8.68

(b) Phase 2

Item No.	Item	Equivalent weight	Unit	16-Jul-97 W-1	16-Jul-97 W-2	16-Jul-97 W-3	16-Jul-97 W-4	16-Jul-97 W-5	16-Jul-97 W-6	16-Jul-97 W-7	16-Jul-97 W-8
12	Nitrate	62	mg NO_3/l	5.5	5.4	5.3	8.4	1	4	4	0.6
15	Bicarbonate	61	mg HCO_3/l	330	220	280	354	140	208	738	470
16	Carbonate	30	mg CO_3/l	0.66	0.56	0.36	0.88	0.18	1.04	2.34	0.74
17	Chloride	35.5	mg Cl/l	18	18	17	17	18	6.1	19	10
18	Sulfate	48	mg SO_4/l	420	100	240	300	99	36		37
19	Sodium*	23	mg Na/l	49.1	47	54.2	52.3	54.5	56	53.3	52.1
20	Potassium	39.1	mg K/l	10	4	7	9	6	3	10	7
21	Calcium	20	mg Ca/l	150	45	38	28	19	25	28	25
22	Magnesium	12.16	mg Mg/l	300	62	154	52	97	33	211	143

Item No.	Item	Equivalent weight	Unit	16-Jul-97 W-1	16-Jul-97 W-2	16-Jul-97 W-3	16-Jul-97 W-4	16-Jul-97 W-5	16-Jul-97 W-6	16-Jul-97 W-7	16-Jul-97 W-8
12	Nitrate	62	meq NO_3/l	0.09	0.09	0.09	0.14	0.02	0.06	0.06	0.01
15	Bicarbonate	61	meq HCO_3/l	5.41	3.61	4.59	5.80	2.30	3.41	12.10	7.70
16	Carbonate	30	meq CO_3/l	0.02	0.02	0.01	0.03	0.01	0.03	0.08	0.02
17	Chloride	35.5	meq Cl/l	0.51	0.45	0.48	0.48	0.51	0.17	0.54	0.28
18	Sulfate	48	meq SO_4/l	8.75	2.08	5.00	6.25	2.06	0.75	0.00	0.77
19	Sodium*	23	meq Na/l	2.13	2.04	2.36	2.27	2.37	2.43	2.32	2.27
20	Potassium	39.1	meq K/l	0.26	0.10	0.18	0.23	0.15	0.08	0.26	0.18
21	Calcium	20	meq Ca/l	7.50	2.25	1.80	1.40	0.95	1.25	1.40	1.25
22	Magnesium	12.16	meq Mg/l	24.67	5.10	12.66	4.28	7.98	2.71	17.35	11.76
	Anion		meq anion/l	14.78	6.25	10.17	12.70	4.89	4.43	12.78	8.79
	Cation		meq cation/l	34.56	9.49	17.00	8.18	11.45	6.48	21.33	15.45

(c) Phase 3

Item No.	Item	Equivalent weight	Unit	23-Jul-97 W-1	23-Jul-97 W-2	23-Jul-97 W-3	23-Jul-97 W-4	23-Jul-97 W-5	23-Jul-97 W-6	23-Jul-97 W-7	23-Jul-97 W-8
12	Nitrate	62	mg NO_3/l	9.6	9.8	9.6	28	0.8	5.6	6	0.5
15	Bicarbonate	61	mg HCO_3/l	428	280	244	312	152	214	1006	396
16	Carbonate	30	mg CO_3/l	0.26	0.86	0.48	0.98	0.96	2.14	3.18	0.40
17	Chloride	35.5	mg Cl/l	15	17	17	17	17	5	17	9
18	Sulfate	48	mg SO_4/l	1000	190	400	500	220	40	500	40
19	Sodium*	23	mg Na/l	49	47	54	52.1	54.2	56.1	53.1	52.2
20	Potassium	39.1	mg K/l	9	4	7	8	6	1	10	7
21	Calcium	20	mg Ca/l	236	87	260	60	26	27	42	80
22	Magnesium	12.16	mg Mg/l	188	98	234	774	116	56	251	396

Item No.	Item	Equivalent weight	Unit	23-Jul-97 W-1	23-Jul-97 W-2	23-Jul-97 W-3	23-Jul-97 W-4	23-Jul-97 W-5	23-Jul-97 W-6	23-Jul-97 W-7	23-Jul-97 W-8
12	Nitrate	62	meq NO_3/l	0.15	0.16	0.15	0.45	0.01	0.09	0.10	0.01
15	Bicarbonate	61	meq HCO_3/l	7.02	4.59	4.00	5.11	2.49	3.51	16.49	6.49
16	Carbonate	30	meq CO_3/l	0.01	0.03	0.02	0.03	0.03	0.07	0.11	0.01
17	Chloride	35.5	meq Cl/l	0.42	0.48	0.48	0.48	0.48	0.14	0.48	0.25
18	Sulfate	48	meq SO_4/l	20.83	3.96	8.33	10.42	4.58	0.83	10.42	0.83
19	Sodium	23	meq Na/l	2.13	2.04	2.35	2.27	2.36	2.44	2.31	2.27
20	Potassium*	39.1	meq K/l	0.23	0.10	0.18	0.20	0.15	0.03	0.26	0.18
21	Calcium	20	meq Ca/l	11.80	3.35	13.00	3.00	1.30	1.35	2.10	4.00
22	Magnesium	12.16	meq Mg/l	15.46	8.06	19.24	63.65	9.54	4.61	20.64	32.57
	Anion		meq anion/l	28.44	9.21	12.96	16.49	7.60	4.64	27.59	7.80
	Cation		meq cation/l	29.62	13.55	34.77	66.12	13.35	8.42	25.31	39.01

* results from Atomic Emission Spectroscopy Technique

Annex VIII-5 (2/9)

Methods for analyses on Major Ions

Ion	method
carbonate and bicarbonate	calculated from alkalinity and pH
chloride	1) turbidimetric method (Altai City) 2) Energy Dispersive X-ray Fluorescence Technique (Ulaanbaatar) (Element Cl) 3) Titration method (Ulaanbaatar)
sulfate	1) Turbidimetric method (Altai City) 2) Energy Dispersive X-ray Fluorescence Technique (Ulaanbaatar) (Element S) 3) Gravimetric method (Ulaanbaatar)
sodium	Atomic Emission Spectroscopy
potassium	1) Turbidimetric method (Altai City) 2) Energy Dispersive X-ray Fluorescence Technique (Ulaanbaatar) (Element K)
calcium	1) Titration 2) Energy Dispersive X-ray Fluorescence Technique (Ulaanbaatar) (Element Ca)
magnesium	calculated from total hardness and Ca concentration

Annex VIII-5 (3/9)

Comparison among some analysis methods for calcium, chloride, potassium and sulfate for wells

(a) Calcium

	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8
Phase 1	mg Ca/l							
Titration	100	46	47	33	22	22	27	38
Xray*	135	52	68	923	18	24	34	37
Phase 2	mg Ca/l							
Titration	150	45	36	28	19	25	28	25
Xray*	148	45	69	87	18	24	22	33
Phase 3	mg Ca/l							
Titration	236	67	260	60	26	27	42	80
Xray*	159	56	70	83	23	32	29	36

(b) Chloride

	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8
Phase 1	mg Cl/l							
Turbidimetric	2	19.9	0.8	14	18	16	1.9	1.4
Xray*	28	36	100	2229	71	16	214	35
Titration	18	17			20	21		
Phase 2	mg Cl/l							
Turbidimetric	18	16	17	17	18	6.1	19	10
Xray*	14	<3	58	139	18	6	57	22
Titration	18	17			19	21		
Phase 3	mg Cl/l							
Turbidimetric	15	17	17	17	17	5	17	9
Xray*	25	10	138	140	25	19	236	17

(c) Potassium

	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8
Phase 1	mg K/l							
Turbidimetric	9.5	4.1	7	9	10	1.7	>10	6.1
Xray*	16	5	7.7	80.4	3.1	2.5	31.4	17
Phase 2	mg K/l							
Turbidimetric	10	4	7	9	6	3	10	7
Xray*	13.2	3.7	8.6	12.2	5.1	5	19.4	6.7
Phase 3	mg K/l							
Turbidimetric	9	4	7	8	6	1	10	7
Xray*	15	6	8.6	11.1	8.6	3.2	21.4	7

(d) Sulfate

	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8
Phase 1	mg SO_4/l							
Turbidimetric	140	47	95	45	<5	22	150	36
Xray* #	3780	1059	1713	22035	813	162	2118	390
Gravimetric	1170	825			276	57		
Phase 2	mg SO_4/l							
Turbidimetric	420	100	240	300	99	36		37
Xray* #	3861	867	2052	2295	771	195	1632	237
Gravimetric	1180	829			274	58		
Phase 3	mg SO_4/l							
Turbidimetric	1000	190	400	500	220	40	500	40
Xray* #	4590	1200	2110	2120	1170	453	2270	321

* energy dispersive total reflection X-ray fluorescence technique
# the calculated value provided that all sulfur element in Appendices 7.4.1 to 7.4.3 is in sulfate ion

Annex VIII-5 (4/9)

Electric Charge Balance among Major Ions for Well Samples in the case of using chloride and potassium concentration obtained from ED-TRXRF technique

(a) Phase 1

Item No.	Item	Equivalent weight	Unit	23-Jun-97 SW-1	23-Jun-97 SW-2	23-Jun-97 SW-3	23-Jun-97 SW-4	26-Jun-97 SW-5	23-Jun-97 SW-6	23-Jun-97 SW-7	23-Jun-97 SW-8
12	Nitrate	62	mg NO_3/l	5.5	9.8	4.1	3.9	0.5	2	5.8	0.21
15	Bicarbonate	61	mg HCO_3/l	306	256	262	342	292	208	402	434
16	Carbonate	30	mg CO_3/l	0.60	0.16	0.52	1.08	0.30	2.08	3.20	0.86
17	Chloride*	35.5	mg Cl/l	28	36	100	139	71	16	214	35
18	Sulfate	48	mg SO_4/l	140	47	95	45	4	22	150	36
19	Sodium**	23	mg Na/l	49.3	47.4	54.6	52	54.8	56.2	53.6	52
20	Potassium*	39.1	mg K/l	16	5	7.7	80.4	3.1	2.5	31.4	17
21	Calcium	20	mg Ca/l	100	48	47	33	22	22	27	38
22	Magnesium	12.16	mg Mg/l	540	74	138	146	29	37	174	53

Item No.	Item	Equivalent weight	Unit	23-Jun-97 SW-1	23-Jun-97 SW-2	23-Jun-97 SW-3	23-Jun-97 SW-4	26-Jun-97 SW-5	23-Jun-97 SW-6	23-Jun-97 SW-7	23-Jun-97 SW-8
12	Nitrate	62	meq NO_3/l	0.09	0.16	0.07	0.06	0.01	0.03	0.09	0.00
15	Bicarbonate	61	meq HCO_3/l	5.02	4.20	4.30	5.61	4.79	3.41	6.59	7.11
16	Carbonate	30	meq CO_3/l	0.02	0.01	0.02	0.04	0.01	0.07	0.11	0.03
17	Chloride*	35.5	meq Cl/l	0.79	1.01	2.82	3.92	2.00	0.45	6.03	0.99
18	Sulfate	48	meq SO_4/l	2.92	0.98	1.98	0.94	0.08	0.46	3.13	0.75
19	Sodium**	23	meq Na/l	2.14	2.06	2.37	2.26	2.38	2.44	2.33	2.26
20	Potassium*	39.1	meq K/l	0.41	0.13	0.20	2.06	0.08	0.06	0.80	0.43
21	Calcium	20	meq Ca/l	5.00	2.30	2.33	1.65	1.10	1.10	1.35	1.90
22	Magnesium	12.16	meq Mg/l	44.41	6.09	11.35	12.01	2.38	3.04	14.31	4.38
	Anion		meq anion/l	8.83	8.35	9.17	10.56	6.89	4.42	15.94	8.88
	Cation		meq cation/l	51.96	10.57	16.24	17.97	5.95	6.65	18.79	8.95
	Sulfate (cal)#		mg SO_4/l	2210	250	434	401	-41	129	287	39

(b) Phase 2

	Item	Equivalent weight	Unit	16-Jul-97 SW-1	16-Jul-97 SW-2	16-Jul-97 SW-3	16-Jul-97 SW-4	16-Jul-97 SW-5	16-Jul-97 SW-6	16-Jul-97 SW-7	16-Jul-97 SW-8
12	Nitrate	62	mg NO_3/l	5.5	5.4	5.3	8.4	1	4	4	0.6
15	Bicarbonate	61	mg HCO_3/l	330	220	280	354	140	208	738	470
16	Carbonate	30	mg CO_3/l	0.66	0.56	0.36	0.88	0.18	1.04	2.34	0.74
17	Chloride*	35.5	mg Cl/l	14	16	58	139	18	6	57	22
18	Sulfate	48	mg SO_4/l	420	100	240	300	99	36		37
19	Sodium**	23	mg Na/l	49.1	47	54.2	52.3	54.5	56	53.3	52.1
20	Potassium*	39.1	mg K/l	13.2	3.7	8.6	12.2	5.1	5	19.4	8.7
21	Calcium	20	mg Ca/l	150	45	36	28	19	25	28	25
22	Magnesium	12.16	mg Mg/l	300	62	154	170	97	33	211	143

Item No.	Item	Equivalent weight	Unit	16-Jul-97 SW-1	16-Jul-97 SW-2	16-Jul-97 SW-3	16-Jul-97 SW-4	16-Jul-97 SW-5	16-Jul-97 SW-6	16-Jul-97 SW-7	16-Jul-97 SW-8
12	Nitrate	62	meq NO_3/l	0.09	0.09	0.09	0.14	0.02	0.06	0.06	0.01
15	Bicarbonate	61	meq HCO_3/l	5.41	3.61	4.59	5.80	2.30	3.41	12.10	7.70
16	Carbonate	30	meq CO_3/l	0.02	0.02	0.01	0.03	0.01	0.03	0.08	0.02
17	Chloride*	35.5	meq Cl/l	0.39	0.45	1.63	3.92	0.51	0.17	1.61	0.62
18	Sulfate	48	meq SO_4/l	8.75	2.08	5.00	6.25	2.06	0.75	0.00	0.77
19	Sodium**	23	meq Na/l	2.13	2.04	2.36	2.27	2.37	2.43	2.32	2.27
20	Potassium*	39.1	meq K/l	0.34	0.09	0.22	0.31	0.13	0.13	0.50	0.17
21	Calcium	20	meq Ca/l	7.50	2.25	1.80	1.40	0.95	1.25	1.40	1.25
22	Magnesium	12.16	meq Mg/l	24.67	5.10	12.66	13.98	7.98	2.71	17.35	11.76
	Anion		meq anion/l	14.66	8.25	11.32	16.13	4.89	4.43	13.85	9.13
	Cation		meq cation/l	34.84	9.49	17.04	17.97	11.43	6.53	21.57	15.45
	Sulfate#		mg SO_4/l	1379	256	515	388	413	137	371	340

(c) Phase 3

Item No.	Item	Equivalent weight	Unit	23-Jul-97 SW-1	23-Jul-97 SW-2	23-Jul-97 SW-3	23-Jul-97 SW-4	23-Jul-97 SW-5	23-Jul-97 SW-6	23-Jul-97 SW-7	23-Jul-97 SW-8
12	Nitrate	62	mg NO_3/l	9.8	9.8	9.8	28	0.8	5.8	6	0.5
15	Bicarbonate	61	mg HCO_3/l	428	280	244	312	152	214	1006	396
16	Carbonate	30	mg CO_3/l	0.26	0.88	0.48	0.98	0.96	2.14	3.18	0.40
17	Chloride*	35.5	mg Cl/l	25	10	138	140	25	19	236	17
18	Sulfate**	48	mg SO_4/l	1000	190	400	500	220	40	500	40
19	Sodium	23	mg Na/l	49	47	54	52.1	54.2	56.1	53.1	52.2
20	Potassium*	39.1	mg K/l	15	6	8.6	11.1	8.6	3.2	21.4	7
21	Calcium	20	mg Ca/l	236	67	280	60	28	27	42	80
22	Magnesium	12.16	mg Mg/l	188	98	234	774	116	56	251	396

Item No.	Item	Equivalent weight	Unit	23-Jul-97 SW-1	23-Jul-97 SW-2	23-Jul-97 SW-3	23-Jul-97 SW-4	23-Jul-97 SW-5	23-Jul-97 SW-6	23-Jul-97 SW-7	23-Jul-97 SW-8
12	Nitrate	62	meq NO_3/l	0.15	0.16	0.15	0.45	0.01	0.09	0.10	0.01
15	Bicarbonate	61	meq HCO_3/l	7.02	4.59	4.00	5.11	2.49	3.51	16.49	6.49
16	Carbonate	30	meq CO_3/l	0.01	0.03	0.02	0.03	0.03	0.07	0.11	0.01
17	Chloride*	35.5	meq Cl/l	0.70	0.28	3.89	3.94	0.70	0.54	6.65	0.48
18	Sulfate	48	meq SO_4/l	20.83	3.96	8.33	10.42	4.58	0.83	10.42	0.83
19	Sodium**	23	meq Na/l	2.13	2.04	2.35	2.27	2.36	2.44	2.31	2.27
20	Potassium*	39.1	meq K/l	0.38	0.15	0.22	0.28	0.22	0.08	0.55	0.18
21	Calcium	20	meq Ca/l	11.80	3.35	13.00	3.00	1.30	1.35	2.10	4.00
22	Magnesium	12.16	meq Mg/l	15.48	8.06	19.24	63.65	9.54	4.61	20.64	32.57
	Anion		meq anion/l	28.56	8.86	16.24	19.51	7.81	4.95	33.66	7.82
	Cation		meq cation/l	29.77	13.61	34.81	69.20	13.42	8.48	25.80	39.01
	Sulfate#		mg SO_4/l	1058	418	1292	2885	489	209	113	1537

* results from Energy Dispersion Total Reflection X-ray Fluorescence Technique
** results from Atomic Emission Spectroscopy Technique
# sulfate concentration calculated from the ion balance

Annex VIII-5 (5/9)

Calculation of the Theoretical Dry Residual from Data in Table 4

(a) Phase 1

Item No.	Item	Unit	23-Jun-97 SW-1	23-Jun-97 SW-2	23-Jun-97 SW-3	23-Jun-97 SW-4	26-Jun-97 SW-5	23-Jun-97 SW-6	23-Jun-97 SW-7	23-Jun-97 SW-8
12	Nitrate	mg NO_3/l	5.5	9.8	4.1	3.9	0.5	2	5.8	0.21
15	Bicarbonate	mg HCO_3/l	306	256	262	342	292	208	402	434
16	Carbonate	mg CO_3/l	0.60	0.16	0.52	1.08	0.30	2.08	3.20	0.86
17	Chloride*	mg Cl/l	28	36	100	139	71	16	214	35
18	Sulfate#	mg SO_4/l	2210	250	434	401	0	129	287	39
19	Sodium**	mg Na/l	49.3	47.4	54.6	52	54.8	56.2	53.6	52
20	Potassium*	mg K/l	16	5	7.7	80.4	3.1	2.5	31.4	17
21	Calcium	mg Ca/l	100	46	47	33	22	22	27	38
22	Magnesium	mg Mg/l	540	74	138	146	29	37	174	53
34	Silica	mg SiO_2/l	14	13	11	11		9	11	12
	Dry residue (cal)	mg/l	3114	607	925	1036	324	378	1005	461
7	Conductivity	mS/m	276	115.4	238	295	174.7	52.5	71.7	84.1

(b) Phase 2

	Item	Unit	16-Jul-97 SW-1	16-Jul-97 SW-2	16-Jul-97 SW-3	16-Jul-97 SW-4	16-Jul-97 SW-5	16-Jul-97 SW-6	16-Jul-97 SW-7	16-Jul-97 SW-8
12	Nitrate	mg NO_3/l	5.5	5.4	5.3	8.4	1	4	4	0.6
15	Bicarbonate	mg HCO_3/l	330	220	280	354	140	208	738	470
16	Carbonate	mg CO_3/l	0.66	0.56	0.36	0.88	0.18	1.04	2.34	0.74
17	Chloride*	mg Cl/l	14	16	58	139	18	6	57	22
18	Sulfate#	mg SO_4/l	1379	256	515	388	413	137	371	340
19	Sodium**	mg Na/l	49.1	47	54.2	52.3	54.5	56	53.3	52.1
20	Potassium*	mg K/l	13.2	3.7	8.6	12.2	5.1	5	19.4	6.7
21	Calcium	mg Ca/l	150	45	36	28	19	25	28	25
22	Magnesium	mg Mg/l	300	62	154	170	97	33	211	143
34	Silica	mg SiO_2/l	14	14	12	13	1.1	7	11	15
	Dry Residue(cal)	mg/l	2088	558	981	986	678	376	1120	836
7	Conductivity	mS/m	284	100	243	288	143	46	282	83

(c) Phase 3

Item No.	Item	Unit	23-Jul-97 SW-1	23-Jul-97 SW-2	23-Jul-97 SW-3	23-Jul-97 SW-4	23-Jul-97 SW-5	23-Jul-97 SW-6	23-Jul-97 SW-7	23-Jul-97 SW-8
12	Nitrate	mg NO_3/l	9.6	9.8	9.6	28	0.8	5.6	6	0.5
15	Bicarbonate	mg HCO_3/l	428	280	244	312	152	214	1006	396
16	Carbonate	mg CO_3/l	0.26	0.88	0.48	0.98	0.96	2.14	3.18	0.40
17	Chloride*	mg Cl/l	25	10	138	140	25	19	236	17
18	Sulfate#	mg SO_4/l	1058	418	1292	2885	489	209	113	1537
19	Sodium**	mg Na/l	49	47	54	52.1	54.2	56.1	53.1	52.2
20	Potassium*	mg K/l	15	6	8.6	11.1	8.6	3.2	21.4	7
21	Calcium	mg Ca/l	236	67	260	60	26	27	42	80
22	Magnesium	mg Mg/l	188	98	234	774	116	56	251	396
34	Silica	mg SiO_2/l	2.3	5.2	3.5	5.2	1.3	5.4	5.2	2.7
	Dry Residue (cal)	mg/l	1794	800	2120	4110	797	489	1226	2288
7	Conductivity	mS/m	436	186.7	360	450	224	91.3	524	134.7

* results from Energy Dispersion Total Reflection X-ray Fluorescence Technique
** results from Atomic Emission Spectroscopy Technique
# sulfate concentration calculated from the ion balance

Annex VIII-5 (6/9)

Electric Charge Balance among Major Ions for Well Samples in the case of using chloride and potassium concentration obtained from ED-TRXRF technique

(a) Phase 1

Item No.	Item	Equivalent weight	Unit	23-Jun-97 SW-1	23-Jun-97 SW-2	23-Jun-97 SW-3	23-Jun-97 SW-4	26-Jun-97 SW-5	23-Jun-97 SW-6	23-Jun-97 SW-7	23-Jun-97 SW-8
12	Nitrate	62	mg NO_3/l	5.5	9.8	4.1	3.9	0.5	2	5.8	0.21
15	Bicarbonate	61	mg HCO_3/l	306	256	262	342	292	208	402	434
16	Carbonate	30	mg CO_3/l	0.60	0.16	0.52	1.06	0.30	2.08	3.20	0.86
17	Chloride*	35.5	mg Cl/l	28	36	100	139	71	16	214	35
18	Sulfate#	48	mg SO_4/l	1170	340	540	45	280	57	680	130
19	Sodium**	23	mg Na/l	49.3	47.4	54.8	52	54.8	58.2	53.6	52
20	Potassium*	39.1	mg K/l	16	5	7.7	80.4	3.1	2.5	31.4	17
21	Calcium	20	mg Ca/l	100	46	47	33	22	22	27	38
22	Magnesium	12.16	mg Mg/l	540	74	138	148	29	37	174	53

Item No.	Item	Equivalent weight	Unit	23-Jun-97 SW-1	23-Jun-97 SW-2	23-Jun-97 SW-3	23-Jun-97 SW-4	26-Jun-97 SW-5	23-Jun-97 SW-6	23-Jun-97 SW-7	23-Jun-97 SW-8
12	Nitrate	62	meq NO_3/l	0.09	0.16	0.07	0.06	0.01	0.03	0.09	0.00
15	Bicarbonate	61	meq HCO_3/l	5.02	4.20	4.30	5.61	4.79	3.41	6.59	7.11
16	Carbonate	30	meq CO_3/l	0.02	0.01	0.02	0.04	0.01	0.07	0.11	0.03
17	Chloride*	35.5	meq Cl/l	0.79	1.01	2.82	3.92	2.00	0.45	6.03	0.99
18	Sulfate#	48	meq SO_4/l	24.38	7.08	11.25	0.94	5.83	1.19	14.17	2.71
19	Sodium**	23	meq Na/l	2.14	2.06	2.37	2.26	2.38	2.44	2.33	2.26
20	Potassium*	39.1	meq K/l	0.41	0.13	0.20	2.06	0.08	0.06	0.80	0.43
21	Calcium	20	meq Ca/l	5.00	2.30	2.33	1.65	1.10	1.10	1.35	1.90
22	Magnesium	12.16	meq Mg/l	44.41	6.09	11.35	12.01	2.38	3.04	14.31	4.36
	Anion		meq anion/l	30.29	12.46	18.45	10.58	12.64	5.15	26.99	10.84
	Cation		meq cation/l	51.96	10.57	16.24	17.97	5.95	6.65	18.79	8.95
	Magnesium (cal)##		meq Mg/l	276	97	165	56	110	19	274	76

(b) Phase 2

	Item	Equivalent weight	Unit	16-Jul-97 SW-1	16-Jul-97 SW-2	16-Jul-97 SW-3	16-Jul-97 SW-4	16-Jul-97 SW-5	16-Jul-97 SW-6	16-Jul-97 SW-7	16-Jul-97 SW-8
12	Nitrate	62	mg NO_3/l	5.5	5.4	5.3	8.4	1	4	4	0.6
15	Bicarbonate	61	mg HCO_3/l	330	220	280	354	140	208	738	470
16	Carbonate	30	mg CO_3/l	0.66	0.56	0.36	0.88	0.18	1.04	2.34	0.74
17	Chloride*	35.5	mg Cl/l	14	16	58	139	18	6	57	22
18	Sulfate#	48	mg SO_4/l	1160	280	650	730	270	58	520	80
19	Sodium**	23	mg Na/l	49.1	47	54.2	52.3	54.5	56	53.3	52.1
20	Potassium*	39.1	mg K/l	13.2	3.7	8.6	12.2	5.1	5	19.4	8.7
21	Calcium	20	mg Ca/l	150	45	36	28	19	25	28	25
22	Magnesium	12.16	mg Mg/l	300	62	154	170	97	33	211	143

Item No.	Item	Equivalent weight	Unit	16-Jul-97 SW-1	16-Jul-97 SW-2	16-Jul-97 SW-3	16-Jul-97 SW-4	16-Jul-97 SW-5	16-Jul-97 SW-6	16-Jul-97 SW-7	16-Jul-97 SW-8
12	Nitrate	62	meq NO_3/l	0.09	0.09	0.09	0.14	0.02	0.06	0.06	0.01
15	Bicarbonate	61	meq HCO_3/l	5.41	3.61	4.59	5.80	2.30	3.41	12.10	7.70
16	Carbonate	30	meq CO_3/l	0.02	0.02	0.01	0.03	0.01	0.03	0.06	0.02
17	Chloride*	35.5	meq Cl/l	0.39	0.45	1.63	3.92	0.51	0.17	1.61	0.82
18	Sulfate	48	meq SO_4/l	24.58	5.83	13.54	15.21	5.63	1.21	10.83	1.67
19	Sodium**	23	meq Na/l	2.13	2.04	2.36	2.27	2.37	2.43	2.32	2.27
20	Potassium*	39.1	meq K/l	0.34	0.09	0.22	0.31	0.13	0.13	0.50	0.17
21	Calcium	20	meq Ca/l	7.50	2.25	1.80	1.40	0.95	1.25	1.40	1.25
22	Magnesium	12.16	meq Mg/l	24.87	5.10	12.86	13.98	7.98	2.71	17.35	11.76
	Anion		meq anion/l	30.50	10.00	19.86	25.09	8.45	4.89	24.88	10.03
	Cation		meq cation/l	34.84	9.49	17.04	17.97	11.43	6.53	21.57	15.45
	Magnesium (cal)##		meq Mg/l	250	68	188	257	61	13	249	77

(c) Phase 3

Item No.	Item	Equivalent weight	Unit	23-Jul-97 SW-1	23-Jul-97 SW-2	23-Jul-97 SW-3	23-Jul-97 SW-4	23-Jul-97 SW-5	23-Jul-97 SW-6	23-Jul-97 SW-7	23-Jul-97 SW-8
12	Nitrate	62	mg NO_3/l	9.6	9.8	9.6	28	0.8	5.8	6	0.5
15	Bicarbonate	61	mg HCO_3/l	426	280	244	312	152	214	1006	396
16	Carbonate	30	mg CO_3/l	0.26	0.88	0.48	0.98	0.96	2.14	3.18	0.40
17	Chloride*	35.5	mg Cl/l	25	10	138	140	25	19	236	17
18	Sulfate#	48	mg SO_4/l	1430	380	670	680	380	140	720	110
19	Sodium	23	mg Na/l	49	47	54	52.1	54.2	56.1	53.1	52.2
20	Potassium*	39.1	mg K/l	15	6	8.6	11.1	8.8	3.2	21.4	7
21	Calcium	20	mg Ca/l	238	67	260	60	26	27	42	80
22	Magnesium	12.16	mg Mg/l	188	98	234	774	116	56	251	398

Item No.	Item	Equivalent weight	Unit	23-Jul-97 SW-1	23-Jul-97 SW-2	23-Jul-97 SW-3	23-Jul-97 SW-4	23-Jul-97 SW-5	23-Jul-97 SW-6	23-Jul-97 SW-7	23-Jul-97 SW-8
12	Nitrate	62	meq NO_3/l	0.15	0.16	0.15	0.45	0.01	0.09	0.10	0.01
15	Bicarbonate	61	meq HCO_3/l	7.02	4.59	4.00	5.11	2.49	3.51	16.49	6.49
16	Carbonate	30	meq CO_3/l	0.01	0.03	0.02	0.03	0.03	0.07	0.11	0.01
17	Chloride*	35.5	meq Cl/l	0.70	0.28	3.89	3.94	0.70	0.54	6.65	0.48
18	Sulfate#	48	meq SO_4/l	29.79	7.92	13.96	14.17	7.92	2.92	15.00	2.29
19	Sodium**	23	meq Na/l	2.13	2.04	2.35	2.27	2.36	2.44	2.31	2.27
20	Potassium*	39.1	meq K/l	0.38	0.15	0.22	0.28	0.22	0.08	0.55	0.18
21	Calcium	20	meq Ca/l	11.80	3.35	13.00	3.00	1.30	1.35	2.10	4.00
22	Magnesium	12.16	meq Mg/l	15.46	8.06	19.24	63.65	9.54	4.61	20.64	32.57
	Anion		meq anion/l	37.52	12.82	21.86	23.26	11.14	7.03	38.25	9.26
	Cation		meq cation/l	29.77	13.61	34.81	69.20	13.42	8.48	25.80	39.01
	Magnesium (cal)##		meq Mg/l	282	88	77	215	88	38	405	34

* results from energy dispersion total reflection X-ray fluorescence technique
** results from atomic emission spectroscopy technique
# sulfate concentration calculated from the correlation between the results from gravimetric method and from ED-TRXRF method
magnesium concentration calculated from the ion balance

Annex VIII-5 (7/9)

Table 7 Calculation of the Theoretical Dry Residual from Data in Table 6

(a) Phase 1

Item No.	Item	Unit	23-Jun-97 SW-1	23-Jun-97 SW-2	23-Jun-97 SW-3	23-Jun-97 SW-4%	26-Jun-97 SW-5	23-Jun-97 SW-6	23-Jun-97 SW-7	23-Jun-97 SW-8
12	Nitrate	mg NO_3/l	5.5	9.8	4.1	3.9	0.5	2	5.8	0.21
15	Bicarbonate	mg HCO_3/l	306	256	262	342	292	208	402	434
16	Carbonate	mg CO_3/l	0.60	0.16	0.52	1.08	0.30	2.08	3.20	0.86
17	Chloride*	mg Cl/l	28	36	100	139	71	16	214	35
18	Sulfate#	mg SO_4/l	1170	340	540	401	280	57	680	130
19	Sodium**	mg Na/l	49.3	47.4	54.6	52	54.8	56.2	53.6	52
20	Potassium*	mg K/l	16	5	7.7	80.4	3.1	2.5	31.4	17
21	Calcium	mg Ca/l	100	46	47	33	22	22	27	38
22	Magnesium##	mg Mg/l	276	97	165	146	110	19	274	76
	Dry Residue	mg/l	1796	707	1047	1025	685	279	1487	563
7	Conductivity	mS/m(at 25°C)	276	115.4	238	295	174.7	52.5	71.7	84.1

(b) Phase 2

	Item	Unit	16-Jul-97 SW-1	16-Jul-97 SW-2	16-Jul-97 SW-3	16-Jul-97 SW-4	16-Jul-97 SW-5	16-Jul-97 SW-6	16-Jul-97 SW-7	16-Jul-97 SW-8
12	Nitrate	mg NO_3/l	5.5	5.4	5.3	8.4	1	4	4	0.6
15	Bicarbonate	mg HCO_3/l	330	220	280	354	140	208	738	470
16	Carbonate	mg CO_3/l	0.66	0.56	0.36	0.88	0.18	1.04	2.34	0.74
17	Chloride*	mg Cl/l	14	16	58	139	18	6	57	22
18	Sulfate#	mg SO_4/l	1180	280	650	730	270	58	520	80
19	Sodium**	mg Na/l	49.1	47	54.2	52.3	54.5	56	53.3	52.1
20	Potassium*	mg K/l	13.2	3.7	8.6	12.2	5.1	5	19.4	6.7
21	Calcium	mg Ca/l	150	45	36	28	19	25	28	25
22	Magnesium##	mg Mg/l	250	68	188	257	61	13	249	77
	Dry Residue	mg/l	1825	574	1138	1402	498	270	1296	495
7	Conductivity	mS/m(at 25°C)	284	100	243	288	143	46	282	83

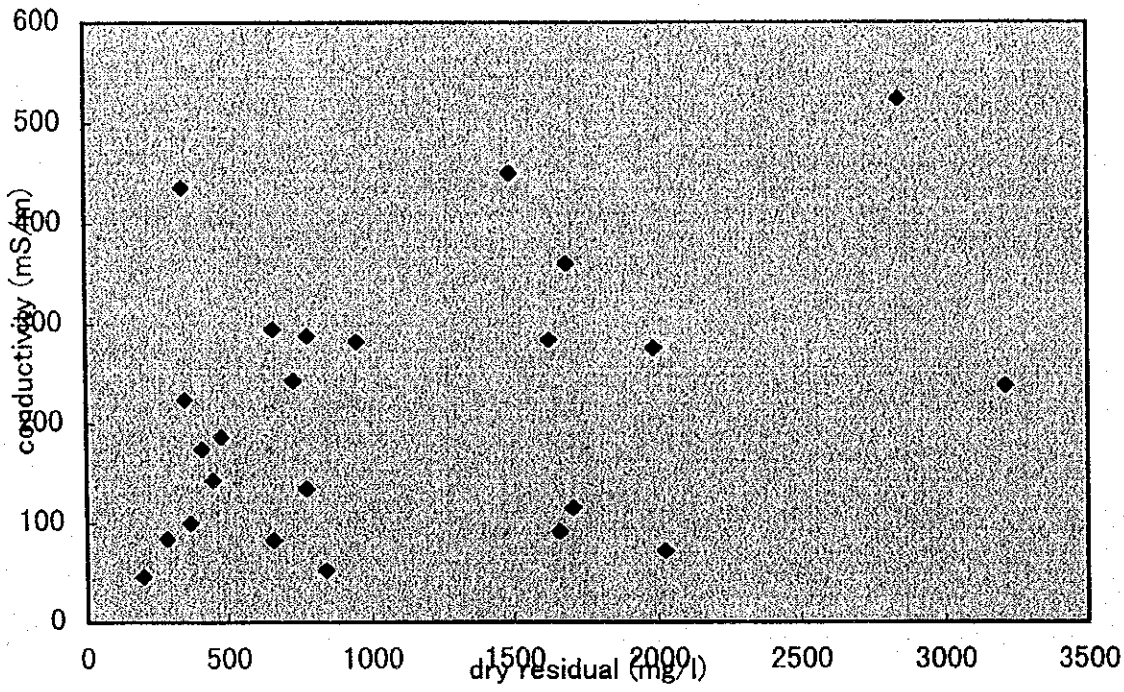
(c) Phase 3

Item No.	Item	Unit	23-Jul-97 SW-1	23-Jul-97 SW-2	23-Jul-97 SW-3	23-Jul-97 SW-4	23-Jul-97 SW-5	23-Jul-97 SW-6	23-Jul-97 SW-7	23-Jul-97 SW-8
12	Nitrate	mg NO_3/l	9.6	9.8	9.6	28	0.8	5.6	6	0.5
15	Bicarbonate	mg HCO_3/l	428	280	244	312	152	214	1006	396
16	Carbonate	mg CO_3/l	0.26	0.88	0.48	0.98	0.96	2.14	3.18	0.40
17	Chloride*	mg Cl/l	25	10	138	140	25	19	236	17
18	Sulfate#	mg SO_4/l	1430	380	670	680	380	140	720	110
19	Sodium**	mg Na/l	49	47	54	52.1	54.2	56.1	53.1	52.2
20	Potassium*	mg K/l	15	6	8.6	11.1	8.6	3.2	21.4	7
21	Calcium	mg Ca/l	236	67	260	60	26	27	42	80
22	Magnesium##	mg Mg/l	282	88	77	215	88	38	405	34
	Dry Residue	mg/l	2257	746	1338	1341	658	396	1981	496
7	Conductivity	mS/m(at 25°C)	436	186.7	360	450	224	91.3	524	134.7

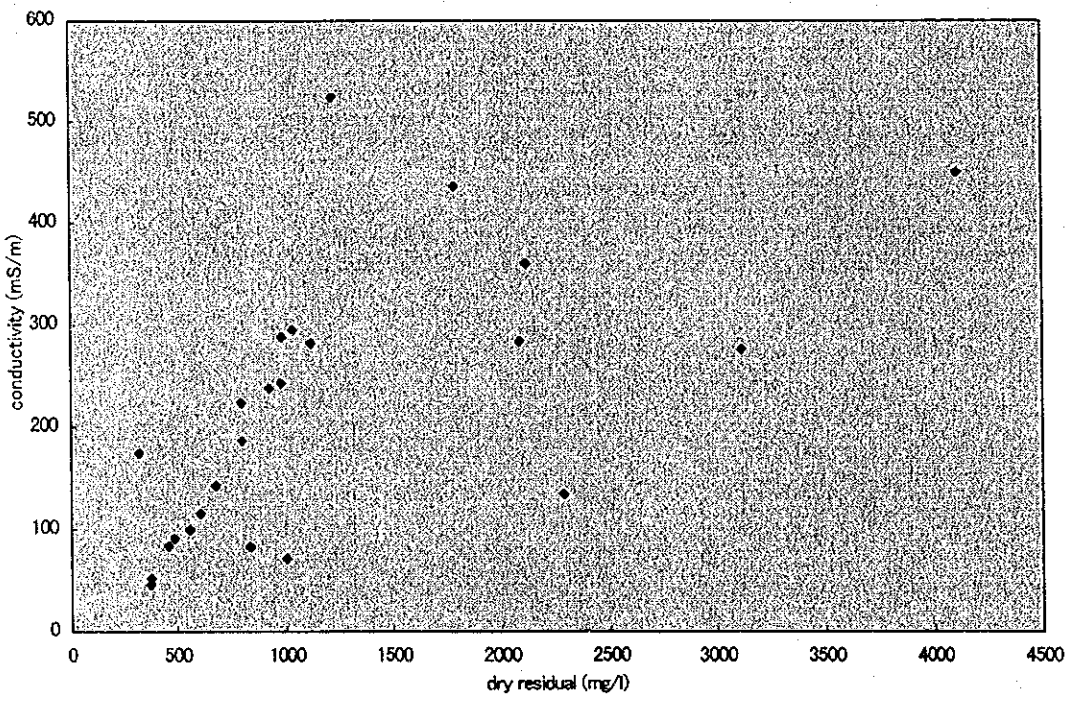
* results from energy dispersion total reflection X-ray fluorescence technique
** results from atomic emission spectroscopy technique
# sulfate concentration calculated from the correlation between the results from gravimetric method and those from ED-TRXRF method
magnesium concentration calculated from the ion balance

Annex VIII-5 (8/9) Data Correlation

Relationship between dry residul and conductivity
(using th the data from Annex VI-1 Table(1/15)-(3/15))

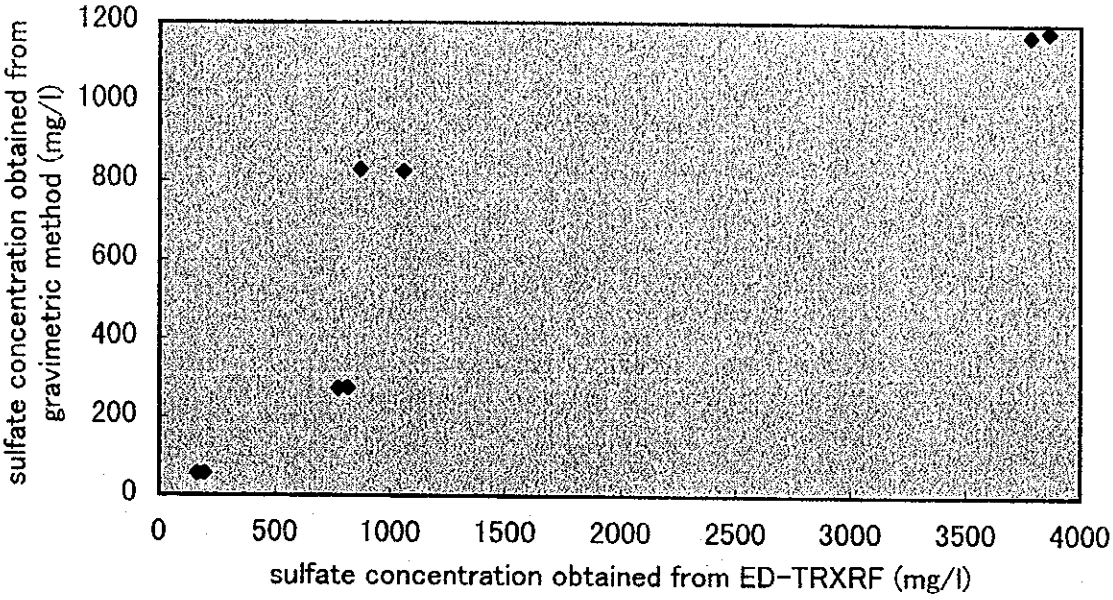


Relationship between dry residul and conductivity
(using th the data from Annex VI-5 Table (4/9))



Annex VIII-5 (9/9) Data Correlation

Relationship between sulfate concentrations from ED-TRXRF and those from gravimetric method



Relationship between dry residual and conductivity (using data from Annex VI-5 Table (6/9))