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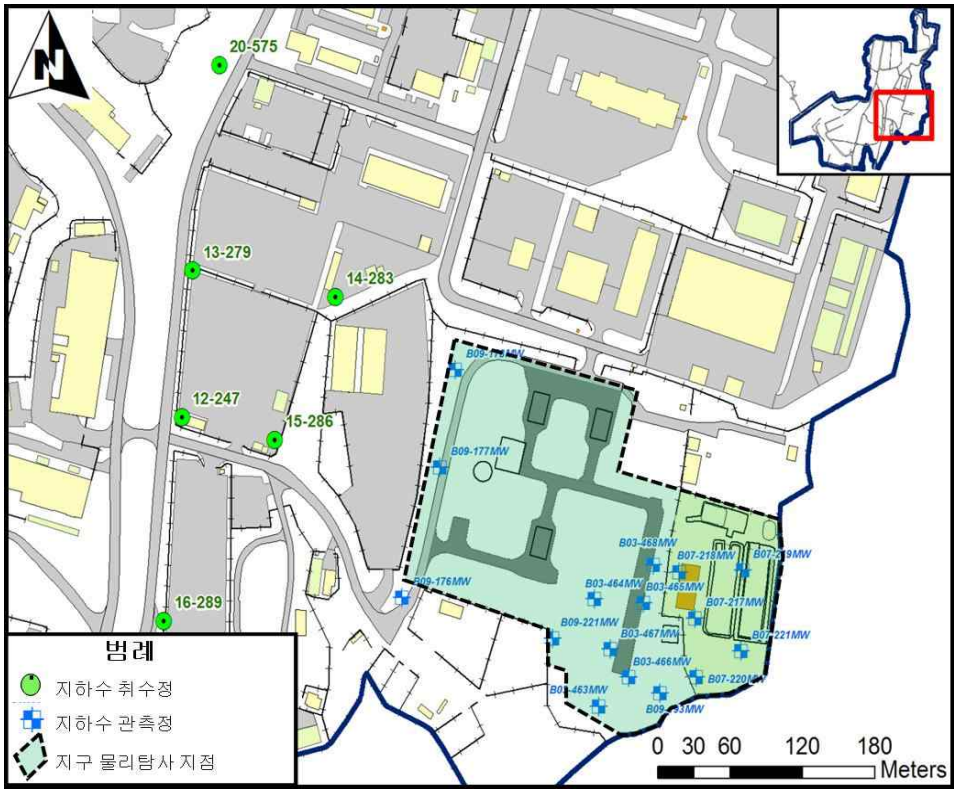
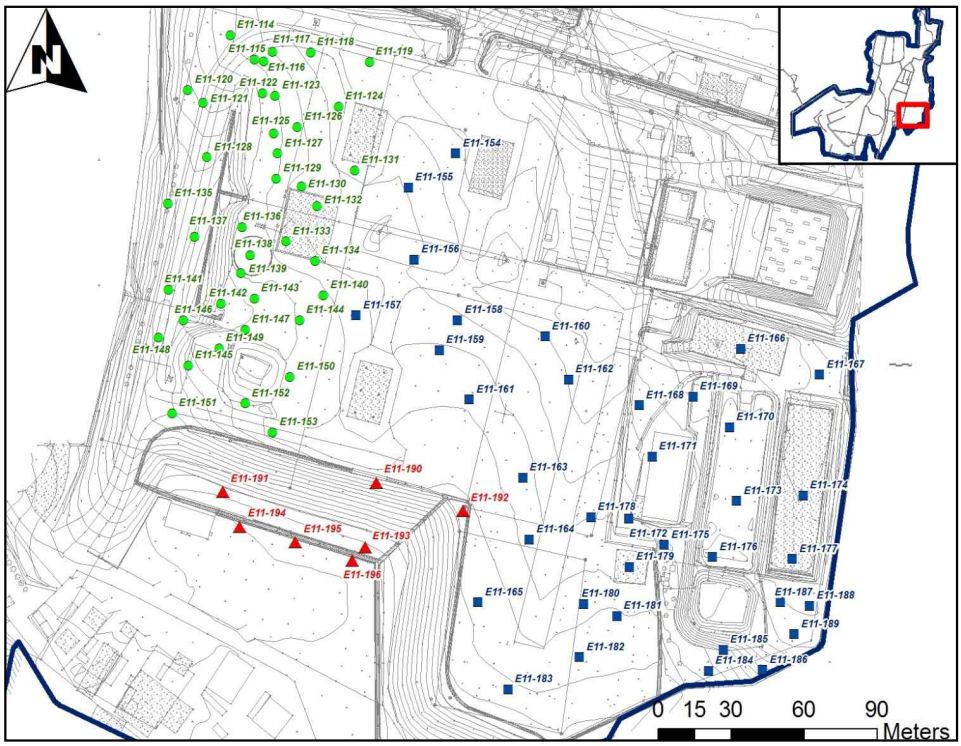
Annex 1

Surveyed areas of on/off post Camp Carroll

○ Surveyed locations of Helipad and Area D, on-post

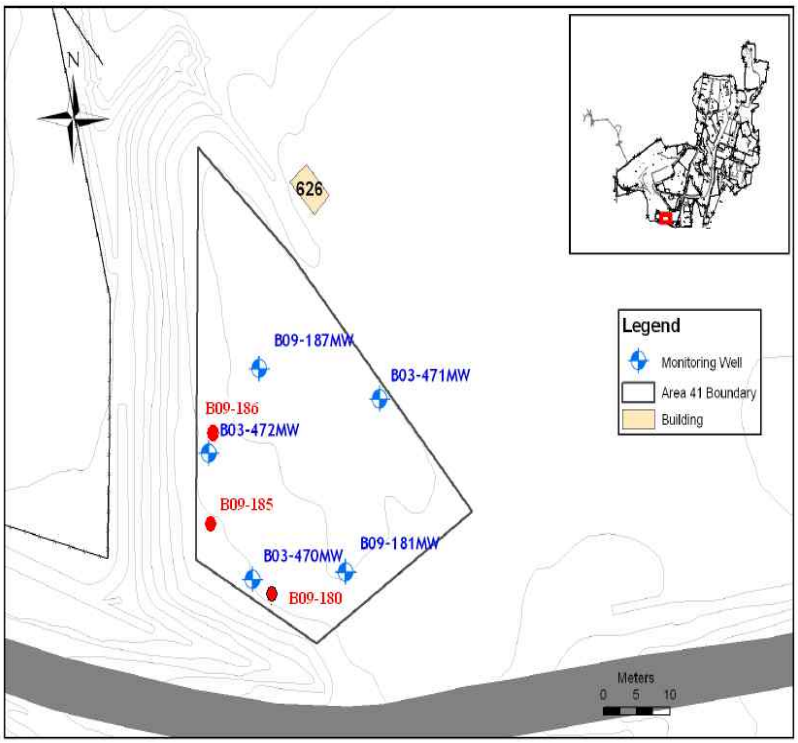


<Surveyed areas for groundwater, 22 locations>



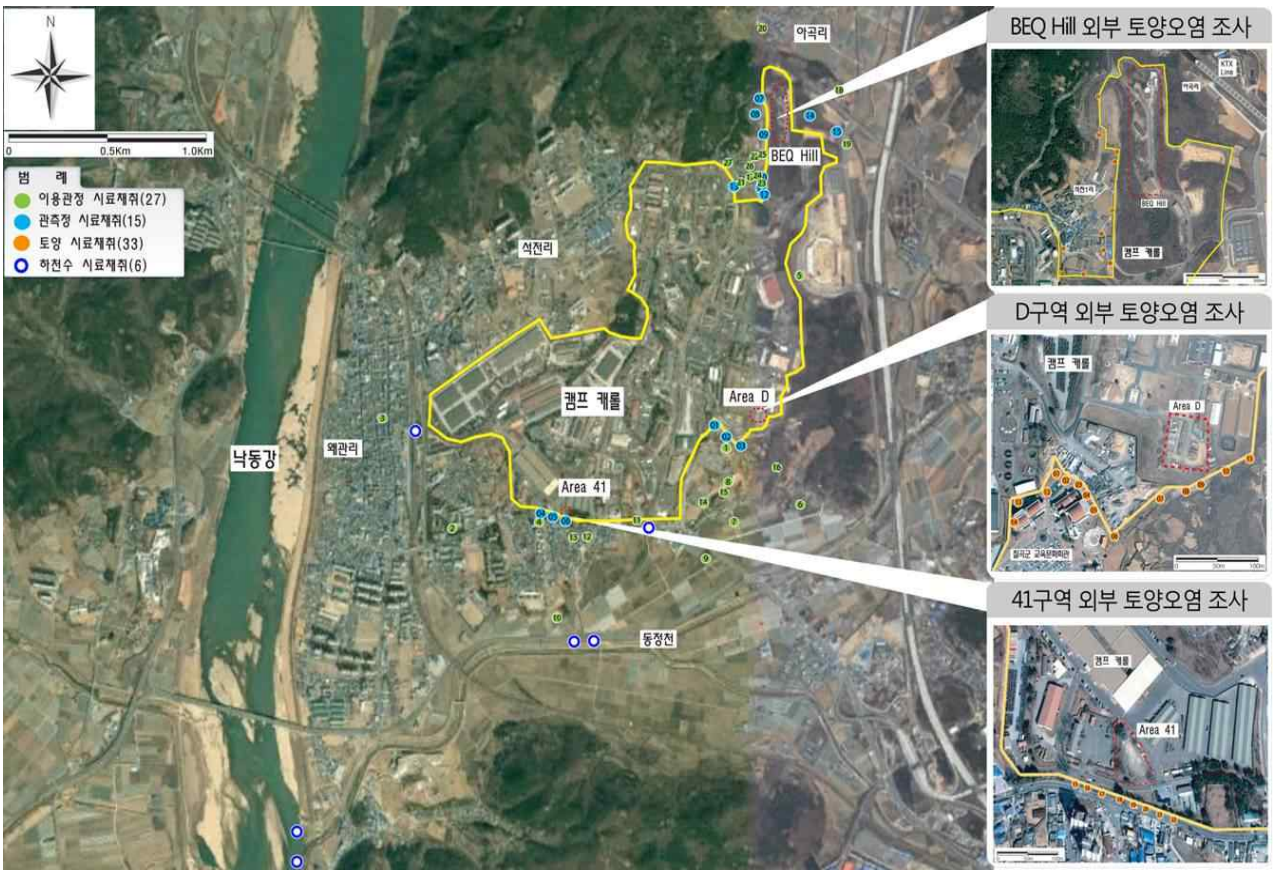
<Surveyed areas for soil, 83 locations>

○ Surveyed locations of Area 41



<Soil (3 locations) and groundwater (5 locations) surveyed areas>

○ Off-post survey areas



Annex 2

On-post soil survey Result

① West Helipad (40 locations)

1. Herbicides

❍ Not detected at any locations

2. Dioxin

❍ Both sides found trace amounts: the ROK detected 0.002 - 0.416 pg-TEQ/g, and the US detected 0.005 - 1.156 pg-TEQ/g.

❍ Neither country detected 2,3,7,8-TCDD.

<Table 2-1-1> Dioxin/Furan concentration and standards (unit: pg-TEQ/g)

Item	Standards (US)	Concentration by depth				Remarks
		S1 (< 0.5 m)	S2 (0.5~2m)	S3 (2~5m)	S4 (> 5m)	
dioxin	1,000 pg/g (2,3,7,8-TCDD)	0.013 ~ 1.156	0.005 ~ 1.041	0.002 ~ 0.416	0.005 ~ 0.365	

※ The ROK used I-TEF and the US used WHO-TEF for calculating the above TEQ. The US calculation included J-flag (the value between the Limit of Detection and the Limit of Quantitation).

3. Organo-Chlorine Pesticides (OCPs)

❍ Eleven items including HCH, Lindane, Dieldrin, DDE, DDD, DDT were detected.

❍ Only 2 out of 40 sampling spots exceeded the US soil standards.

- Lindane (2 spots), HCH (2 spots), DDD and DDT (1 spot) exceeded the US soil standards.
- Other substances were detected at a level below the standards or undetected.

<Table 2-1-2> OCPs concentration and standards (unit: μg/kg)

Item	Standards (US)	Concentration by depth				Remarks (exceeding the standards)
		S1 (< 0.5 m)	S2 (0.5~2m)	S3 (2~5m)	S4 (> 5m)	
α-HCH	77 μg/kg	ND	ND ~ 4,880	ND ~ 2.60	ND ~ 0.03	E11-118, 124 (2 spots)
β-HCH	270 μg/kg	ND	ND	ND ~ 4.38	ND ~ 0.02	
Lindane	520 μg/kg	ND ~ 13.5	ND ~ 163,000	ND ~ 1,130	ND ~ 728	E11-118, 124 (2 spots)
δ-HCH	-	ND	ND ~ 0.04 5,360	ND ~ 18.47	ND ~ 0.09	
Dieldrin	30 μg/kg	ND	ND	ND ~ 0.05	ND	
4,4′-DDE	1,400 μg/kg (sum)	ND	ND ~ 0.03	ND ~ 0.22	ND ~ 0.20	
2,4′-DDD	2,000 μg/kg (sum)	ND	ND	ND ~ 2.72	ND ~ 0.23	
4,4′-DDD		ND	ND ~ 0.04 10,700	ND ~ 8.49	ND ~ 1.16	E11-118
2,4′-DDT	1,700 μg/kg (sum)	ND	ND ~ 0.02	ND ~ 0.12	ND ~ 0.04	
4,4′-DDT		ND ~ 450	ND ~ 1,110 2,990	ND ~ 0.29	ND ~ 0.16	E11-118
α-Endosulfan	370 mg/kg	ND	ND	ND ~ 0.03	ND ~ 0.04	

4. Organo-phosphorus Pesticides (OPPs)

❍ Not detected in any samples

5. Volatile Organic Compounds (VOCs)

❍ Sixteen items including PCE, TCE, Benzene and Toluene were detected.

❍ PCE exceeded the ROK Worrisome Level of Soil Contamination at 1 spot. Other items were below the standards.

<Table 2-1-3> VOCs concentration and standards (unit: μg/kg)

Item	Standards (ROK[1]/US[2])	Concentration by depth				Remarks (exceeding the Standards)
		S1 (< 0.5 m)	S2 (0.5~2m)	S3 (2~5m)	S4 (> 5m)	
PCE	4,000 μg/kg[1]	ND ~ 6.9	ND ~ 18,000	ND ~ 52.8	ND ~ 8.68	E11-119
TCE	8,000 μg/kg[1]	ND	ND	ND	ND ~ 8.58	
Benzene	1,000 μg/kg[1]	ND	ND	ND ~ 117	ND ~ 26.6	
Toluene	20,000 μg/kg[1]	ND ~ 6.22	ND ~ 1,900	ND ~ 500	ND ~ 200	
m-, p-Xylene	15,000 μg/kg[1] (sum)	ND	ND ~ 988	ND	ND	
o-Xylene		ND	ND ~ 695	ND	ND	
cis-1,2-Dichloroethene	160 mg/kg[2]	ND	ND	ND ~ 215	ND ~ 22.4	
Carbontetrachloride	610 μg/kg[2]	-	ND ~ 300	ND	ND	
2-Butanone	-	ND	ND ~ 49.8	ND ~ 22.8	ND	
Acetone	61,000 mg/kg[2]	ND ~ 250	ND ~ 191	ND ~ 118	ND ~ 104	
1,2,4-Trichlorobenzene	22 mg/kg[2]	ND	ND ~ 921	ND ~ 4.5	ND	
1,2,4-Trimethylbenzene	62 mg/kg[2]	ND	ND ~ 1,390	ND	ND	
1,3,5-Trimethylbenzene	780 mg/kg[2]	ND	ND	ND ~ 736	ND	
Chlorobenzene	290 mg/kg[2]	ND	ND	ND ~ 8.36	ND	
Naphthalene	-	ND	ND ~ 7,660	ND ~ 8.51	ND	

6. Semi-Volatile Organic Compounds (Semi-VOCs)

❍ Three items: 2-Methylnaphthalene, Dimethylphthalate and Pyrene were detected.

<Table 2-1-4> SVOCs concentration and standards (unit: μg/kg)

Item	Standards	Concentration by depth				Remarks
		S1 (< 0.5 m)	S2 (0.5~2m)	S3 (2~5m)	S4 (> 5m)	
2-Methylnaphthalene	-	ND	ND ~ 2,180	ND	ND	
Dimethylphthalate	-	ND	ND ~ 616	ND	ND	
Pyrene	-	ND	ND	ND - 8	ND	

7. Heavy metals

❍ Eleven items including arsenic (As), chromium (Cr), lead (Pb) and cadmium (Cd) were detected.

❍ Arsenic exceeded the ROK Worrisome Level of Soil Contamination at 2 spots. Other items were below the standards.

<Table 2-1-5> Heavy metals concentration and standards (unit: mg/kg)

Item	Standards (ROK[1]/US[2])	Concentration by depth				Remarks (exceeding the standards)
		S1 (< 0.5 m)	S2 (0.5~2m)	S3 (2~5m)	S4 (> 5m)	
Arsenic (As)	25 mg/kg[1]	ND ~ 39	ND ~ 29.2	ND ~ 5.33	ND ~ 5.65	E-135, 150 (2 spots)
Barium (Ba)	mg/kg[2]	57.8 ~ 136	60.8 ~ 409	48.3 ~ 209	48.5 ~ 141	
Cadmium(Cd)	4 mg/kg[1]	ND ~ 2.76	ND ~ 1.16	ND ~ 1.40	ND ~ 0.65	
Chromium (Cr)	-	1.71 ~16.7	ND ~ 6.73	ND ~ 10.3	3.45 ~ 9.7	
Lead (Pb)	200 mg/kg[1]	5.04 ~138	4.09 ~ 27.2	4.78 ~ 25.55	4.81 ~ 20.94	
Mercury (Hg)	4 mg/kg[1]	ND	ND	ND ~ 0.01	ND ~ 0.01	
Selenium(Se)	390 mg/kg[2]	ND	ND ~ 0.18	ND ~ 0.28	ND ~ 0.29	
Silver (Ag)	390 mg/kg[2]	ND ~ 0.49	ND	ND	ND	
Zinc (Zn)	300 mg/kg[1]	-	44.91 ~ 69.39	34.70 ~ 62.39	41.33	
Copper (Cu)	150 mg/kg[1]	-	2.06 ~ 5.91	0.54 ~ 7.06	6.55	
Nickel (Ni)	100 mg/kg[1]	-	2.37 ~ 3.39	ND ~ 5.46	5.78	

② Rest of helipad and Area D (36 spots)

1. Herbicides

❍ Not detected at any sampling spot

2. Dioxin

❍ Both the ROK and US analysis detected trace amounts. The ROK: 0.018 - 4.012 pg-TEQ/g, and the US: 0.001 - 10.087 pg-TEQ/g.

❍ The US detected 7.44 pg/g and 0.57 pg/g of 2,3,7,8-TCDD at 2 different sampling spots.

- It is more than 100 times lower than the US EPA recommendation for residential areas (1,000 pg/g, 2,3,7,8-TCDD), so it would not affect human health.

<Table 2-2-1> Dioxin/furan concentration and standards (unit: pg-TEQ/g)

Item	Standards (US)	Concentration by depth				Remarks (exceeding the standards)
		S1 (< 0.5 m)	S2 (0.5~2m)	S3 (2~5m)	S4 (> 6.5m)	
Dioxin	1,000 pg/g (2,3,7,8-TCDD)	0.006 ~ 4.192	0.003 ~ 4.855	0.001 ~ 10.087	0.002 ~ 0.358	
2,3,7,8-TCDD		0.57 pg/g		7.44 pg/g		E11-171, 181 (2 spots)

※ The ROK used I-TEF and the US used WHO-TEF for calculating the above TEQ. The US calculation included J-flag (the value between the Limit of Detection and the Limit of Quantitation).

3. Organo-Chlorine Pesticides (OCPs)

❍ Twenty items including HCH, Lindane, Dieldrin, DDE, DDD and DDT were detected.

❍ α-HCH, Lindane, Dieldrin, DDE, DDD and DDT exceeded the US soil standards at 14 spots.

<Table 2-2-2> OCPs concentration and standards (unit: μg/kg)

Item	Standards (US)	Concentration by depth				Remarks (exceeding the Standards)
		S1 (< 0.5 m)	S2 (0.5~2m)	S3 (2~5m)	S4 (> 5m)	
α-HCH	77 μg/kg	ND ~ 417	ND	ND ~ 7.23	ND	E11-174
β-HCH	270 μg/kg	ND ~ 112	ND ~ 24.3	ND ~ 9.11	ND	
Lindane	520 μg/kg	ND ~ 13,900	ND ~ 4,010	ND ~ 305	ND ~ 43.8	E11-167, 174 (2 spots)
δ-HCH	-	ND ~ 427	ND	ND ~ 84.7	ND ~ 1.58	
HCB	120 mg/kg	-	-	ND ~ 0.07	-	
Heptachlor Epoxide	53 μg/kg	ND ~ 11.1	ND	ND ~ 0.05	ND	
Aldrin	29 μg/kg	ND ~ 9.27	ND ~ 4.3	ND ~ 0.97	ND	
Dieldrin	30 μg/kg	ND ~ 127 336	ND ~ 74.3	ND ~ 27.54	ND	E11-167, 172, 173, 176, 178, 179, 185, 187, 188 (7 spots)
Endrin	18,000 μg/kg			ND ~ 0.04		
trans-Chlordane	1,600 μg/kg (sum)	ND ~ 35.7	ND ~ 93	ND ~ 2.03	ND	
cis-Chlordane		ND ~ 33.4	ND ~ 78.7	ND ~ 1.44	ND	
trans-Nonachlor	-	-	-	ND ~ 0.45	-	
cis-Nonachlor		-	-	ND ~ 0.31	-	
2,4′-DDE	1,400 μg/kg (sum)	-	-	ND ~ 21.49	-	
4,4′-DDE		ND ~ 2,830	ND ~ 0.15 491	ND ~ 308	ND ~ 4.28	E11-170, 178, 179 (3 spots)
2,4′-DDD	2,000 μg/kg (sum)	-	-	ND ~ 777.47	-	
4,4′-DDD		ND ~ 13,500	ND ~ 1,880	ND ~ 4,180	ND ~ 129	E11-178, 179, 182, 188 (4 spots)
2,4′-DDT	1,700 μg/kg (sum)	-	ND ~ 0.09	ND ~ 507.57	-	
4,4′-DDT		ND ~ 70,200	ND ~ 11,200	ND ~ 7,470	ND	E11-167, 170, 171, 172, 174, 178, 179, 181, 182, 184, 187, 188 (12 spots)
α-Endosulfan	370 mg/kg	ND	ND	ND ~ 0.25	ND	

4. Organo-phosphorus Pesticides (OPPs)

❍ Not detected in any samples

5. Volatile Organic Compounds (VOCs)

❍ Nineteen items including PCE, TCE, Benzene and Toluene were detected.

❍ PCE and Toluene exceeded the ROK Worrisome Level of Soil Contamination at two sampling spots.

<Table 2-2-3> VOCs concentration and standards (unit: μg/kg)

Item	Standards (ROK[1]/US[2])	Concentration by depth				Remarks (exceeding the Standards)
		S1 (< 0.5 m)	S2 (0.5~2m)	S3 (2~5m)	S4 (> 5m)	
PCE	4,000 μg/kg[1]	ND ~ 32,300	ND ~ 86.8	ND ~ 684	ND ~ 489	E11-179
TCE	8,000 μg/kg[1]	ND	ND ~ 7.97	ND ~ 55.1	ND ~ 587	
Benzene	1,000 μg/kg[1]	ND	ND ~ 100	ND ~ 100	ND	
Toluene	20,000 μg/kg[1]	ND	ND ~ 100	ND ~ 1,620	ND ~ 21,300	E11-180
cis-1,2-Dichloro ethene	160 mg/kg[2]	ND ~ 438	ND ~ 16	ND ~ 558	ND ~ 293	
Methyl iodide	-	ND ~ 7.92	ND ~ 6.32	ND	ND	
Carbon disulfide	820 mg/kg[2]	ND ~ 6.67	ND	ND	ND	
2-Butanone	-	ND ~ 28	ND	ND	ND	
Acetone	61,000 mg/kg[2]	ND ~ 98.8	ND ~ 76.5	ND ~ 80.7	ND ~ 75.9	
1,2,4-Trichlorob enzene	22,000 μg/kg[2]	ND ~ 295	ND	ND	ND	
1,4-Dichloroben zene	2400 μg/kg[2]	ND ~ 339	ND	ND	ND	
trans-1,2-Dichlo roethene	150 mg/kg[2]	ND	ND	ND ~ 4.37	ND	
Vinyl chloride	60 μg/kg[2]	ND	ND	ND	ND ~ 56.1	
Chloroform	290 μg/kg[2]	ND	ND	ND	ND ~ 26.7	
2-Chlorotoluene	1,600 mg/kg[2]	ND	ND	ND	ND ~ 10.4	
4-Chlorotoluene	1,600 mg/kg[2]	ND	ND	ND	ND ~ 19.7	
Chlorobenzene	290 mg/kg[2]	ND ~ 278	ND	ND ~ 5.25	ND	
Chloroethane	-	ND	ND	ND ~ 10.7	ND	
Naphthalene	-	ND ~ 2,560	ND	ND	ND	

6. Semi-Volatile Organic Compounds (Semi-VOCs)

❍ Two items: 2-Methylnaphthalene and Bis(2-Ethylhexyl)phthalate were detected.

<Table 2-2-4> SVOCs concentration and standards (unit: μg/kg)

Item	Standards (US)	Concentration by depth				Remarks
		S1 (< 0.5 m)	S2 (0.5~2m)	S3 (2~5m)	S4 (> 5m)	
2-Methylnaphthalene	-	ND ~ 1,450	ND ~ 878	ND	ND	
Bis(2-Ethylhexyl)phthalate	35,000 μg/kg	ND ~ 602	ND	ND	ND	

7. Heavy Metals

❍ Eleven items including Arsenic (As), Chromium (Cr), Lead (Pb), Cadmium (Cd) were detected.

❍ Arsenic (As) exceeded the Worrisome Level of Soil Contamination at 3 out of 40 sampling spots. Other pollutants were detected at levels below the standards or undetected at all.

<Table 2-2-5> Heavy metals concentration and standards (unit: mg/kg)

Item	Standards (ROK[1]/US[2])	Concentration by depth				Remarks (exceeding the standards)
		S1 (< 0.5 m)	S2 (0.5~2m)	S3 (2~5m)	S4 (> 5m)	
Arsenic (As)	25 mg/kg[1]	2.54 ~ 308	2.85 ~ 40.1	1.82 ~ 56.2	ND ~ 24.6	E-155, 163, 188 (3 spots)
Barium (Ba)	15,000 mg/kg[2]	32.9 ~ 112	54.7 ~ 171	45.9 ~ 822	61 ~ 128	
Cadmium(Cd)	4 mg/kg[1]	ND ~ 1.65	ND ~ 1.72	ND ~ 1.54	ND ~ 0.81	
Chromium (Cr)	-	2.4 ~11.5	2.28 ~ 19.6	3.09 ~ 10.4	2.85 ~ 12.5	
Lead (Pb)	200 mg/kg[1]	6 ~31.7	5.22 ~ 34.1	ND ~ 25.1	4.35 ~ 28.8	
Mercury (Hg)	4 mg/kg[1]	ND ~ 0.031	ND ~ 0.034	ND ~ 0.020	ND ~ 0.026	
Selenium(Se)	390 mg/kg[2]	ND	ND ~ 0.10	ND ~ 0.17	ND	
Silver (Ag)	390 mg/kg[2]	ND ~ 2.34	ND	ND	ND	
Zinc (Zn)	300 mg/kg[1]	-	51.34	34.70 ~ 62.39	-	
Copper (Cu)	150 mg/kg[1]	-	6.82	0.54 ~ 7.06	-	
Nickel(Ni)	100 mg/kg[1]	-	2.23	ND ~ 5.46	-	

③ The Area Steve House Identified [7 spots)

1. Herbicides

❍ Not detected in any samples

2. Dioxin

❍ Both the ROK and US detected small amounts: the ROK detected 0.004 - 0.615 pg-TEQ/g, and the US detected 0.007 - 1.006 pg-TEQ/g.

❍ Neither country detected 2,3,7,8-TCDD.

<Table 2-3-1> Dioxin/Furan concentration and standards (unit: pg-TEQ/g)

Item	Standards (EPA)	Concentration by depth				Remarks
		S1 (< 0.5 m)	S2 (0.5~2m)	S3 (2~5m)	S4 (> 6.5m)	
Dioxin	1,000 pg/g (2,3,7,8-TCDD)	0.005 ~ 0.308	0.010 ~ 0.138	0.004 ~ 1.006	0.038 ~ 0.543	

※ The ROK used I-TEF and the US used WHO-TEF for calculating the above TEQ. The US calculation included J-flag (the value between the Limit of Detection and the Limit of Quantitation).

3. Organo-Chlorine Pesticides (OCPs)

❍ Thirteen items including HCH, Lindane, Dieldrin, DDE, DDD and DDT were detected.

❍ DDE and DDT exceeded the US soil standards at 1 spot, but other pollutants were detected at levels below the standards or not detected at all.

<Table 2-3-2> OCPs concentration and standards (unit: μg/kg)

Item	Standards (US)	concentration by depth				Remarks (exceeding the standards)
		S1 (< 0.5 m)	S2 (0.5~2m)	S3 (2~5m)	S4 (> 5m)	
β-HCH	270 μg/kg	ND	ND	ND ~ 0.13	ND	
Lindane	520 μg/kg	ND	ND ~ 2.88	ND ~ 0.40	ND	
δ-HCH	-	ND	ND	ND ~ 0.03	ND	
Dieldrin	30 μg/kg	ND	ND	ND ~ 0.46	ND	
trans-Chlordane	1,600 μg/kg (sum)	ND	ND	ND ~ 0.13	ND	
cis-Chlordane		ND	ND	ND ~ 0.10	ND	
trans-Nonachlor	-	-	-	ND ~ 0.05	-	
2,4′-DDE	1,400 μg/kg (sum)	-	-	ND ~ 8	-	
4,4′-DDE		ND ~ 9.1	ND ~ 10.2	ND ~ 25.8	ND ~ 8.51	
2,4′-DDD	2,000 μg/kg (sum)	-	-	ND ~ 8.76	-	
4,4′-DDD		ND ~ 3.86	ND ~ 4,560	ND ~ 39.1	ND ~ 207	E11-191
2,4′-DDT	1,700 μg/kg (sum)	-	ND	ND ~ 54.46	-	
4,4′-DDT		ND ~ 21.1	ND ~ 20,000	ND ~ 167.94	ND ~ 1,220	E11-191

4. Organo-Phosphorus Pesticides (OPPs)

❍ Not detected in any samples

5. Volatile Organic Compounds (VOCs)

❍ Three items: Toluene, Benzene and Acetone were detected at levels below the standards.

<Table 2-3-3> VOCs concentration and standards (unit: μg/kg)

Item	Standards (ROK)	Concentration by depth				Remarks (exceeding the standards)
		S1 (< 0.5 m)	S2 (0.5~2m)	S3 (2~5m)	S4 (> 5m)	
Benzene	1,000 μg/kg	ND	ND	ND ~ 100	ND	
Toluene	20,000 μg/kg	ND ~ 5.9	ND	ND	ND	
Acetone	61,000 mg/kg[2)]	ND ~ 108	ND	ND	ND	

6. Semi-Volatile Organic Compounds (Semi-VOCs)

❍ One item: Bis (2-Ethylhexyl) phthalate was detected, and the level was 50 times less than the US soil standards

<Table 4-4> SVOCs concentration and standards (unit: μg/kg)

Item	Standards (US)	Concentration by depth				Remarks
		S1 (< 0.5 m)	S2 (0.5~2m)	S3 (2~5m)	S4 (> 5m)	
Bis(2-Ethylhexyl)phthalate	35,000 μg/kg	ND ~ 708	ND	ND	ND	

7. Heavy Metals

❍ Nine items including arsenic (As), chromium (Cr), lead (Pb) and cadmium (Cd) were detected, but none of them exceeded the ROK Worrisome Level of Soil Contamination.

<Table 2-3-5> Heavy metal concentration and standards (unit: mg/kg)

Item	Standards (ROK[1]/US[2])	Concentration by depth				Remarks (exceeding the standards)
		S1 (< 0.5 m)	S2 (0.5~2m)	S3 (2~5m)	S4 (> 5m)	
Arsenic (As)	25 mg/kg[1]	1.28 ~ 9.71	1.76 ~ 11.6	1.25 ~ 15.35	ND ~ 2.55	
Barium (Ba)	15,000 mg/kg[2]	57 ~ 92	53.7 ~ 114	53.1 ~ 187	75.1 ~ 131	
Cadmium(Cd)	4 mg/kg[1]	ND ~ 1.69	ND ~ 1.3	ND ~ 1.35	ND ~ 0.67	
Chromium (Cr)	-	2.76 ~4.11	3.07 ~ 6.81	2.28 ~ 15.4	2.08 ~ 9.08	
Lead (Pb)	200 mg/kg[1]	6.8 ~15.3	3.19 ~ 14.1	ND ~ 34.7	4.17 ~ 9.08	
Selenium(Se)	390 mg/kg[2]	ND	ND	0.07 ~0.13	ND	
Zinc (Zn)	300 mg/kg[1]	-	-	24.85 ~ 110.82	-	
Copper (Cu)	150 mg/kg[1]	-	-	2.92 ~ 12.70	-	
Nickel (Ni)	100 mg/kg[1]	-	-	2.03 ~ 5.74	-	

④ Area 41 (3 locations)

1. Herbicides (2,4-D, 2,4,5-T)

❍ Not detected in any samples

※ The following results are based on the 2010 Environmental Report ("Report for Environmental Site Investigation, Area 41", 13 locations),

2. Dioxin

❍ Trace amounts, 0.001~1.332 pg-TEQ/g, were detected

❍ 2,3,7,8-TCDD was not detected at all.

<Table 2-4-1> Dioxin/Furan concentration and standards (unit: pg-TEQ/g)

Item	Standards (EPA)	Concentration by depth (I-TEQ)			Remarks
		S1 (< 2 m)	S2 (2~4m)	S3 (4~6m)	
Dioxin	1,000 pg/g (2,3,7,8-TCDD)	0.003 ~ 1.332	0.001 ~ 0.175	0.002 ~ 0.122	

3. Organo-Chlorine Pesticides (OCPs)

❍ Eight items including HCH, Lindane, Dieldrin, DDE, DDD, DDT were detected.

❍ DDE, DDD and DDT exceeded the US soil standards at 4 locations, but other items were at levels below the standards or not detected at all.

<Table 2-4-2> OCPs concentration and standards (unit: μg/kg)

Items	Standards (US)	concentration by depth			Remarks (exceeding the standards)
		S1 (< 2 m)	S2 (2~4m)	S3 (4~6m)	
β-HCH	270 μg/kg	ND	ND ~ 25	ND ~ 19	
Lindane	520 μg/kg	ND	ND ~ 36	ND ~ 38	
δ-HCH	-	ND	ND ~ 5	ND ~ 4	
Dieldrin	30 μg/kg	ND ~ 13	ND	ND	
trans-Chlordane	1,600 μg/kg	ND ~ 430	ND	ND	
4,4′-DDE	1,400 μg/kg	ND ~ 3,900	ND ~ 12	ND ~ 5	B09-185
4,4′-DDD	2,000 μg/kg	ND ~ 18,000	ND ~ 9	ND ~ 31	B09-185
4,4′-DDT	1,700 μg/kg	ND ~ 43,000	ND ~ 150	ND ~ 66	B09-185, B09-186, B09-187, B09-190

4. Volatile Organic Compounds (VOCs)

- Five items such as Tetrachloroehthylene and Xylene were detected.
- Tetrachloroehthylene was above the standards at 1 location, but other items were at levels below the standards or not detected at all.

<Table 2-4-3> VOCs concentration and standards (unit: μg/kg)

Items	Standards (ROK[1]/US[2])	Concentration by depth			Remarks (exceeding the standards)
		S1 (< 2 m)	S2 (2~4 m)	S3 (4~6 m)	
Ethylbenzene	50,000 μg/kg	ND	ND	ND ~ 70	
Xylene	15,000 μg/kg	ND	ND	ND ~ 380	
Tetrachloroethylene	4,000 μg/kg	ND ~ 31,000	ND ~ 8,800	ND ~ 4,800	B09-185
Acetone	61,000 mg/kg[2]	ND ~ 1,300	ND ~ 2,300	ND ~ 2,100	
Methylene chloride		ND ~ 130	ND ~ 130	ND ~ 150	

5. Semi-Volatile Organic Compounds (Semi-VOCs)

❍ Four items including Naphthalene and Pyrene were detected.

<Table 2-4-4> SVOCs concentration and standards (unit: μg/kg)

Items	Standards (US)	Concentration by depth			Remarks (exceeding the standards)
		S1 (< 2 m)	S2 (2~4 m)	S3 (4~6 m)	
Fluorene		ND ~ 490	ND	ND	
2-Methylnaphthalene		ND ~ 5,400	ND ~ 1,200	ND	
Naphthalene		ND ~ 1,100	ND	ND	
Pyrene		ND ~ 900	ND	ND	

6. Heavy metals

❍ Four items such as arsenic (As) and lead (Pb) were detected, but none of them exceeded the standards for soil.

<Table 2-4-5> Heavy metal concentration and standards (unit: mg/kg)

Items	Standards (ROK[1)]/US[2)])	Concentration by depth S1 (< 2 m)	Remarks (exceeding the standards)
Arsenic (As)	25 mg/kg[1)]	2.4 ~ 5.3	
Barium (Ba)	15,000 mg/kg[2)]	40 ~ 140	
Chromium (Cr)	-	3.4 ~ 17.9	
Lead (Pb)	200 mg/kg[1)]	5.9 ~ 54.9	

Annex 3

On-post Groundwater Investigation Result

① Helipad and Area D (22 locations, released on 5 Aug)

1. Herbicides (2,4-D, 2,4,5-T), PAHs (15 kinds), TPH

❍ Not detected in any samples

※ PAHs : Polycyclic Aromatic Hydrocarbons

※ TPH : Total Petroleum Hydrocarbons

2. Dioxin (17 kinds)

❍ Not detected at any supply well, and trace amounts were detected at 3 monitoring wells

❍ The dioxin at monitoring wells was not 2,3,7,8-TCDD.

❍ The dioxin concentration level was about 1/30,000 of the EPA drinking water standards, and around 1/70 of the average Chilgok county's rivers (0.070 pg-TEQ/L).

<Table 3-1-1> Dioxin/Furan concentration and LOQ of On-post groundwater/monitoring wells

Standard*	Monitoring wells			Limit of Quantitation (LOQ)
	Helipad Area	Vicinity of Area D		
	No. 3 (B09-178MW)	No. 5 (B03-463MW)	No. 8 (B07-220MW)	
30 pg/L (2,3,7,8-TCDD)	0.001 (pg-TEQ/L)	0.001 (pg-TEQ/L)	0.001 (pg-TEQ/L)	0.5 pg/L

* EPA drinking water standards

3. Organo-Chlorine Pesticides (OCPs, 25 items)

□ Groundwater supply wells (6 locations)

❍ Eight items such as HCH and Dieldrin were detected in groundwater supply wells

❍ The concentration level of Lindane and Dieldrin respectively were ranged between 1/100 - 4/10,000 and 4/100 - 2/100 of WHO drinking water standards.

<Table 3-1-2> OCPs concentration and LOQ of on-post groundwater (unit: μg/L)

Items	WHO drinking water guideline	groundwater (μg/L)						LOQ
		No.1 (20-575)	No.2 (14-283)	No.3 (16-289)	No.4 (15-286)	No.5 (12-247)	No.6 (13-279)	
α-HCH	-	ND	0.0049	ND	0.0021	0.0023	ND	0.0005
β-HCH	-	ND	0.0116	ND	0.0075	0.0059	ND	
γ-HCH(Lindane)	2	0.0009	0.0213	0.0005	0.0046	0.0102	0.0009	
δ-HCH	-	ND	0.0105	ND	0.0048	0.0054	ND	
Heptachlor Epoxide	-	ND	0.0006	ND	0.0006	ND	ND	
Dieldrin	0.03 (Aldrin+ Dieldrin)	ND	0.0013	ND	0.0012	0.0007	ND	
2,4′-DDD	1	ND	0.0007	ND	ND	ND	ND	
β-Endosulfan		ND	ND	ND	ND	ND	0.0006	

□ Groundwater monitoring well (16 locations)

❍ Nineteen items such as HCH, Dieldrin and DDT were detected at groundwater monitoring wells

❍ Lindane and Dieldrin exceeded the WHO drinking water guideline at 2 wells and 6 wells respectively. Other items did not exceeded the WHO drinking water guidelines.

<Table 3-1-3> OCPs concentration and LOQ of on-post groundwater monitoring well (unit: μg/L)

Items	WHO drinking water standards	Monitoring well (μg/L)																LOQ
		Helipad area			Vicinity of Area D													
		No.1 (B09-176MW)	No.2 (B09-177MW)	No.3 (B09-178MW)	No.4 (B09-221MW)	No.5 (B03-463MW)	No.6 (B07-219MW)	No.7 (B07-221MW)	No.8 (B07-220MW)	No.9 (B07-217MW)	No.10 (B07-218MW)	No.11 (B09-193MW)	No.12 (B03-466MW)	No.13 (B03-467MW)	No.14 (B03-464MW)	No.15 (B03-468MW)	No.16 (B03-465MW)	
α-HCH	-	0.0014	0.0006	0.0698	ND	0.3739	0.0270	0.0317	0.0121	0.0435	0.0010	0.0224	0.0344	0.0085	0.0006	ND	0.0032	0.0005
β-HCH	-	ND	0.0014	0.0008	ND	0.6278	0.1861	0.0080	0.1810	0.0005	0.0185	0.2448	0.7498	0.0647	0.0027	0.0018	0.0274	
γ-HCH(Lindane)	2	0.0312	0.0011	2.7260	0.0202	3.6488	0.0834	0.0208	0.1004	0.0463	0.0069	0.1200	0.2791	0.0017	0.0065	0.0028	0.0103	
δ-HCH	-	ND	ND	0.2900	ND	1.1484	0.0358	0.0393	0.0121	0.0041	0.0009	0.0485	0.2117	0.3414	0.0023	0.0011	0.0074	
Heptachlor Epoxide	-	0.0014	ND	ND	ND	0.0010	0.0012	ND	0.0043	ND	0.0090	0.0084	0.0100	0.0064	ND	0.0006	0.0026	
Dieldrin	0.03 (Aldrin+ Dieldrin)	0.0032	0.0010	0.0034	ND	0.0054	0.2110	0.0309	0.0422	0.0241	0.0305	0.0577	0.0798	0.0007	ND	ND	0.0076	
Endrin	0.6	0.0012	0.0022	ND	ND	ND	0.0034	ND	0.0006	ND	ND	ND	0.0005	ND	ND	ND	ND	
trans-Chlordane	0.2 (t+ c-Chlordane)	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0032	ND	ND	ND	ND	ND	ND	
cis-Chlordane		ND	ND	ND	ND	0.0008	0.0009	ND	0.0006	ND	0.0041	0.0017	0.0010	ND	ND	ND	0.0006	
trans-Nonachlor	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0008	ND	ND	ND	ND	ND	ND	
2,4′-DDE	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0008	ND	ND	ND	ND	ND	ND	
4,4′-DDE		ND	ND	ND	ND	ND	ND	ND	0.0043	ND	0.0089	0.0007	ND	ND	0.0006	ND	ND	
2,4′-DDD		ND	ND	ND	ND	ND	0.0006	ND	0.0015	ND	0.0210	ND	0.0097	ND	ND	ND	ND	
4,4′-DDD		ND	ND	ND	ND	ND	0.0005	0.0011	0.0027	ND	0.0499	ND	ND	ND	ND	ND	0.0007	
2,4′-DDT		ND	ND	ND	ND	ND	0.0005	ND	0.0043	ND	0.0044	ND	ND	ND	ND	ND	ND	
4,4′-DDT		ND	ND	ND	ND	ND	0.0011	0.0012	0.0425	ND	0.0197	0.0010	ND	ND	0.0014	0.0023	ND	
Pentachlorobenzene		ND	ND	ND	ND	ND	ND	ND	0.0033	ND	ND	0.0019	0.0017	ND	ND	ND	ND	
α-Endosulfan		0.0019	ND	ND	ND	ND	ND	0.0006	0.0012	ND	0.0082	0.0033	ND	0.0022	0.0006	ND	ND	
β-Endosulfan		0.0035	0.0019	ND	ND	ND	ND	ND	ND	ND	ND	0.0007	ND	0.0013	0.0010	0.0006	ND	

4. Volatile Organic Compounds (VOCs, 18 items)

□ Groundwater supply wells (6 locations)

❍ Seven items such as TCE and PCE were detected at groundwater supply wells

❍ TCE and PCE exceeded the EPA drinking water standards at 5 wells and 2 wells respectively. Other items were below the standards.

<Table 3-1-4> VOCs concentration and LOQ of on-post groundwater (unit: mg/L)

Items	standard	Groundwater						LOQ
		No.1 (20-575)	No.2 (14-283)	No.3 (16-289)	No.4 (15-286)	No.5 (12-247)	No.6 (13-279)	
1,1-Dichloroethene	0.03	ND	0.001	0.012	0.001	0.008	0.002	0.001
Chloroform	0.08	0.001	ND	ND	ND	ND	ND	0.001
1,1,1-Trichloroethane	0.1	ND	ND	0.003	ND	0.002	ND	0.001
Trichloroethene	0.03	0.090	0.038	0.038	0.025	0.071	0.042	0.001
Tetrachloroethene	0.01	0.002	0.002	0.046	0.007	0.030	0.004	0.001
trans-1,2-Dichloroethene	0.1	ND	ND	ND	ND	0.001	ND	0.0005
cis-1,2-Dichloroethene	0.07*	0.008	0.006	0.048	0.010	0.046	0.007	0.0005

* EPA drinking water standards

□ Groundwater monitoring well (16 locations)

❍ Eleven items such as TCE, PCE and *cis*-1,2-DCE were detected in groundwater monitoring wells.

❍ TCE exceeded the EPA standards in 7 wells, PCE 12 wells and *cis*-1,2-DCE 7 wells. Other items were below the standards.

<Table 3-1-5> VOCs concentration and LOQ of on-post groundwater monitoring wells (unit: mg/L)

Items	Standard	Monitoring wells																LOQ
		Helipad area			Vicinity of Area D													
		No.1 (B09-1 76MW)	No.2 (B09-1 77MW)	No.3 (B09-1 78MW)	No.4 (B09-2 21MW)	No.5 (B03-4 63MW)	No.6 (B07-2 19MW)	No.7 (B07-2 21MW)	No.8 (B07-2 20MW)	No.9 (B07-2 17MW)	No.10 (B07-2 18MW)	No.11 (B09-1 93MW)	No.12 (B03-4 66MW)	No.13 (B03-4 67MW)	No.14 (B03-4 64MW)	No.15 (B03-4 68MW)	No.16 (B03-4 65MW)	
1,1-Dichloroethene	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.007	0.001
Methylene chloride	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.001	0.002
Chloroform	0.08	ND	ND	ND	ND	0.001	ND	0.006	0.002	0.005	ND	0.002	0.002	ND	ND	ND	ND	0.001
Benzene	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.008	ND	ND	0.005	0.001
Trichloroethene	0.03	0.001	ND	ND	ND	0.077	0.102	0.201	0.238	0.743	0.004	0.427	0.021	ND	0.016	ND	0.132	0.001
Tetrachloroethene	0.01	0.002	ND	0.211	ND	0.241	0.415	0.198	0.125	0.497	0.033	0.063	0.227	ND	0.031	0.034	0.025	0.001
o-Xylene	0.5 (o+m+p -xylene)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.002	ND	ND	ND	0.001
m-Xylene		ND	ND	ND	ND	ND	0.001	ND	ND	ND	ND	ND	ND	0.001	ND	ND	0.001	0.001
p-Xylene		ND	ND	ND	ND	ND	0.001	ND	ND	ND	ND	ND	ND	0.002	ND	ND	0.001	0.001
trans-1,2-Dichloroethene	0.1	ND	ND	ND	ND	ND	0.003	0.001	0.001	0.005	ND	0.001	ND	ND	ND	ND	0.042	0.0005
cis-1,2-Dichloroethene	0.07*	ND	ND	ND	0.001	0.129	0.076	0.099	0.089	0.280	0.031	0.099	0.041	ND	ND	ND	1.346	0.0005

* EPA drinking water standards

5. Heavy metal (13 items)

□ Groundwater supply wells (6 locations)

❍ Seven items such as Fe, Se and Zn were detected at groundwater supply wells.

❍ Trace metals: lead, arsenic, mercury, cadmium or chromium 6 were not detected.

<Table 3-1-6> Heavy metal concentration and LOQ of on-post groundwater (unit: mg/L)

Items	Standard	Groundwater						LOQ
		No.1 (20-575)	No.2 (14-283)	No.3 (16-289)	No.4 (15-286)	No.5 (12-247)	No.6 (13-279)	
Al	0.2	ND	0.02	ND	ND	ND	ND	0.02
Fe	0.3	0.06	1.54	0.10	2.24	2.35	1.45	0.05
Mn	0.05	ND	0.018	ND	0.067	0.04	0.016	0.005
Zn	3	ND	0.604	ND	3.879	2.960	0.305	0.002
Se	0.01	ND	0.010	ND	0.063	0.047	0.006	0.005
B	1	0.07	0.13	0.03	0.06	0.06	0.14	0.01
Ba	2	0.04	0.02	0.04	0.02	0.03	0.02	0.002

□ Groundwater monitoring wells (16 locations)

❍ Six items such as Al and Mn were found in monitoring wells.

❍ Trace metals: lead, arsenic, mercury, cadmium or chromium 6 were not detected.

<Table 3-1-7> Heavy metal concentration and LOQ of on-post groundwater monitoring wells (unit: mg/L)

Item	Standard	Monitoring wells																LOQ
		Helipad area			Vicinity of Area D													
		No.1 (B09-176MW)	No.2 (B09-177MW)	No.3 (B09-178MW)	No.4 (B09-221MW)	No.5 (B03-463MW)	No.6 (B07-219MW)	No.7 (B07-221MW)	No.8 (B07-220MW)	No.9 (B07-217MW)	No.10 (B07-218MW)	No.11 (B09-193MW)	No.12 (B03-466MW)	No.13 (B03-467MW)	No.14 (B03-464MW)	No.15 (B03-468MW)	No.16 (B03-465MW)	
Al	0.2	0.18	ND	0.10	0.07	ND	0.08	0.03	0.07	N.D	0.99	0.06	N.D	N.D	0.24	0.52	0.03	0.02
Fe	0.3	0.05	0.05	0.25	0.12	0.07	0.06	0.07	0.08	0.06	0.07	0.08	N.D	N.D	0.11	N.D	N.D	0.05
Mn	0.05	0.021	ND	ND	0.005	0.016	ND	0.024	0.032	0.015	0.113	0.101	0.601	6.457	0.008	0.007	0.299	0.005
Zn	3	0.015	0.011	0.117	0.007	0.008	ND	0.006	ND	0.007	0.009	0.011	0.004	0.003	0.014	N.D	0.005	0.002
B	1	ND	ND	ND	ND	0.01	0.04	0.02	0.04	N.D	N.D	N.D	0.03	0.10	0.01	0.01	0.01	0.01
Ba	2	0.06	0.05	0.03	0.04	0.05	0.04	0.13	0.11	0.06	0.08	0.06	0.07	0.08	0.12	0.01	0.19	0.002

② Area 41 (5 locations, announced on 9 Sept)

1. Herbicides (2,4-D, 2,4,5-T / US tested for 5 items)

[Initial test result]

- ❍ The ROK detected a trace amount of 2,4,5-T at 1 location out of 5 (The US did not detected it at all).
- ❍ Other items were not detected at any locations.

<Table 3-2-1> Herbicides concentration and standards (unit: μg/L)

Items	**Concentration (5 monitoring wells)**	**Standards** (WHO)	**Remarks** (exceeding the standards)
2,4-D	ND	30 ug/L	-
2,4,5-T	ND ~ 0.161	9 ug/L	-

[Re-test result, conducted after the announcement on 9 Sept]

- ❍ Not detected by either side

2. Dioxin (17 kinds)

- ❍ Trace amounts were detected at 4 locations out of 5.
- ❍ 2,3,7,8-TCDD was not detected at any locations.

<Table 3-2-2> Dioxin/Furan concentration and standards (unit: pg-TEQ/L)

Unit	**Concentration (5 monitoring wells)**	**Standards** (EPA)	**Remarks** (exceeding the standards)
pg-TEQ/L	ND ~ 0.013	30 pg/L (2,3,7,8-TCDD)	-

3. Organo-Chlorine Pesticides (OCPs, 25 items/US 22 items)

❍ Fourteen items such as α-HCH, β-HCH and Dieldrin were detected at 5 locations.

- Only Dieldrin exceeded the WHO drinking water guideline at 2 locations. No other items exceeded it at any locations.

❍ The other 11 items were not detected at any locations.

<Table 3-2-3> OCPs concentration and standards (unit: ng/L)

Items	**Concentration (5 monitoring wells)**	**Standards** (WHO)	**Remarks** (exceeding the standards)
α-HCH	ND ~ 646.8		-
β-HCH	ND ~ 898.5		-
ɣ-HCH(Lindane)	0.9 ~ 202.9	2000	-
δ-HCH	ND ~ 516.4		-
Heptachlor Epoxide	ND ~ 31.9		-
Dieldrin	ND ~ 685.5	30 (Aldrin+Dieldrin)	2 wells
Endrin	ND ~ 3.2	600	-
2,4′-DDE	ND ~ 1.7	1000	-
4,4′-DDE	ND ~ 9.9	1000	-
2,4′-DDD	0.8 ~ 76.5	1000	-
4,4′-DDD	1.4 ~ 211	1000	-
2,4′-DDT	ND ~ 38.1	1000	-
4,4′-DDT	1.5 ~ 244	1000	-
Pentachlorobenzene	ND ~ 1.3		-

4. Organo-phosphorus Pesticides (OPPs, US 27 items)

❍ Not detected in any samples

5. Volatile Organic Compounds (VOCs, 18 items / 67 items)

❍ Ten items including Methylene chloride, TCE and PCE were detected at 5 locations.

- TCE exceeded the drinking water standards at 3 locations and PCE at 5 locations. Other items met the standards.

❍ The other 57 items were not detected at any locations.

<Table 3-2-4> VOCs concentration and standards (unit: mg/L)

Items	**concentration (5 monitoring wells)**	**Standards** (drinking water standards)	**Remarks** (exceeding the standards)
Methylene chloride	ND ~ 0.002	0.02	-
Chloroform	ND ~ 0.029	0.08	-
Carbon tetrachloride	ND ~ 0.017	0.02	
Benzene	ND ~ 0.002	0.01	-
Trichloroethene	0.002 ~ 2.744	0.03	3 wells
Toluene	ND ~ 0.009	0.7	-
Dibromochloromethane	ND ~ 0.001	0.1	-
Tetrachloroethene	0.114 ~ 9.592	0.01	5 wells
trans-1,2-Dichloroethene	ND ~ 0.0016	0.1	-
cis-1,2-Dichloroethene	0.0011 ~ 0.0700	0.07 (EPA)	1 well

6. Semi-Volatile Organic Compounds (Semi-VOCs, 15 items/US 62 items)

❍ Bis(2-Ethylhexyl)phthalate was detected at 3 locations.

❍ The other 61 items were not detected at any locations.

<Table 3-2-5> VOCs concentration and standards (unit: ug/L)

Item	**Concentration (5 monitoring wells)**	**Standards** (EPA)	**Remarks** (exceeding the standards)
Bis(2-Ethylhexyl)phthalate	5.23 ~ 6.28	6	1 well

7. TPHs

❍ Not detected in any samples

※ TPHs : Total Petroleum Hydrocarbons

8. Heavy metals (13 items/US 8 items)

❍ Six items such as Al and Fe were detected at 5 locations.

❍ Trace metals such as lead, arsenic, mercury and cadmium were not detected.

<Table 3-2-6> Heavy metals concentration and standards (unit: mg/L)

Items	**Concentration (5 monitoring wells)**	**Standards** (drinking water standards)	**Remarks** (exceeding the standards)
Al	0.02 ~ 0.58	0.2	1 well
Fe	0.43 ~ 2.51	0.3	5 wells
Mn	ND ~ 0.031	0.3	-
Zn	0.004 ~ 0.028	3	-
B	ND ~ 0.03	1	-
Ba	0.007 ~ 0.417	2 (EPA)	-

Annex 4

Off-post soil and sediment investigation result

① Soil survey (22 location, announced on 5 Aug)

1. Herbicides (2,4-D, 2,4,5-T)

❍ Not detected in any samples

2. Dioxin (17 items)

❍ Seventy-three samples were taken from 22 locations. Among them, 68 samples showed 0.001 - 1.152 pg TEQ/g of dioxin, and 5 samples had no dioxin

- 2,3,7,8-TCDD was not detected.
- No sample exceeded either the US residential guideline (1,000 pg/g, 2,3,7,8-TCDD) or Japanese guideline (1,000 pg TEQ/g).

<Table 4-1-1> Dioxin concentration of off-post soil samples at each location

Unit	Location																					LOQ
	CCOS 01	CCOS 02	CCOS 03	CCOS 04	CCOS 05	CCOS 06	CCOS 07	CCOS 08	CCOS 09	CCOS 10	CCOS 11	CCOS 12	CCOS 13	CCOS 14	CCOS 15	CCOS 16	CCOS 17	CCOS 18	CCOS 19	CCOS 20	CCOS 21	CCOS 22	
pg-TEQ/g	0.026~ 0.197	0.129~ 0.312	0.009~ 0.059	0.005~ 0.017	0.010~ 0.047	0.001~ 0.147	0.011~ 0.126	0.012~ 0.060	0.035~ 0.055	0.037~ 0.546	0.018~ 0.033	0.060~ 0.251	0.011~ 0.034	0.144~ 0.426	ND~ 0.509	0.023~ 0.157	0.025~ 1.152	ND~ 0.006	0.001~ 0.109	0.002~ 0.350	0.001~ 0.586	ND~ 0.485	MDL 0.1 pg/g (for each)

※ US residential guideline (1998) : 1,000 pg/g (2,3,7,8-TCDD), Japanese guideline (1999) : 1,000 pg TEQ/g

※ Nationwide dioxin concentration in soil

(unit: pg-TEQ/g)

		'05	'06	'08	'09	Average
nation wide	min.	0.009	0.009	0.039	0.041	0.020
	max.	80.934	69.203	10.814	16.149	35.420
	avg.	4.548	3.902	1.903	2.280	2.527
Waegwan		0.126	0.077	-	-	0.102

※ Source: '05~'06: Report of Nationwide Monitoring of Endocrine Disruptors (NIER)
'08~'09: Report of Nationwide Monitoring of Persistent Organic Pollutants (MOE)

3. Organo-Chlorine Pesticides (OCPs, 22 items)

❍ Seventeen items such as DDT were detected (0.020 ~ 6.578 μg/kg)

- HCH, DDT and Chlordane congeners contributed the most.

❍ Detected level was lower than the maximum value of nationwide POPs monitoring result.

<Table 4-1-2> Number of locations and range of concentration of OCPs detection

Item	Off-post survey (2011)	POPs monitoring	
		2008	2009
α-HCH	ND~0.026	-	-
β-HCH	ND~0.835	-	-
γ-HCH(Lindane)	ND~0.076	-	-
δ-HCH	ND~0.108	-	-
HCB	ND~0.600	ND~2.362	ND~4.898
Heptachlor	ND	ND~0.530	ND
Heptachlor epoxide	ND~0.063	ND~1.305	ND
Aldrin	ND	ND~0.659	ND
Dieldrin	ND~0.292	ND~1.010	ND
Endrin	ND	ND	ND
Oxychlordane	ND~0.024	ND~10.729	ND~9.660
trans-Chlordane (γ)	ND~0.052	ND~6.402	
cis-Chlordane (α)	ND~0.035	ND~1.067	
trans-Nonachlor	ND~0.065	ND	
cis-Nonachlor	ND	ND~0.618	
2,4′-DDE	ND~0.319	ND~0.772	ND~79.237
4,4′-DDE	ND~6.578	ND~40.741	
2,4′-DDD	ND~0.742	ND~1.373	
4,4′-DDD	ND~0.890	ND~6.492	
2,4′-DDT	ND~0.898	ND~2.881	
4,4′-DDT	ND~4.714	ND~23.723	
Mirex	ND	ND~0.915	ND

※The measurement of ‘09 added DDT and Chlordane and put the sum of them.

<Table 4-1-3> OCPs concentration range of each off-post soil sampling location (unit: μg/kg)

Item	Sampling location																					LOQ
	CCOS 01	CCOS 02	CCOS 03	CCOS 04	CCOS 05	CCOS 06	CCOS 07	CCOS 08	CCOS 09	CCOS 10	CCOS 11	CCOS 12	CCOS 13	CCOS 14	CCOS 15	CCOS 16	CCOS 17	CCOS 18	CCOS 19	CCOS 20	CCOS 21	CCOS 22	
α-HCH	ND	ND	ND	ND	ND	ND~ 0.026	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02
β-HCH	ND	ND	ND	ND	ND	ND~ 0.049	0.029~ 0.056	0.093~ 0.214	0.029~ 0.032	0.027~ 0.031	0.029~ 0.033	0.029~ 0.050	ND	0.029~ 0.035	ND~ 0.103	ND~ 0.074	ND~ 0.050	ND	ND	ND~ 0.835	ND~ 0.057	0.021~ 0.033	0.02
γ-HCH (Lindane)	ND	ND	ND	ND	ND	ND	ND~ 0.024	0.023~ 0.076	ND~ 0.031	ND	ND	ND~ 0.024	ND	ND~ 0.044	ND~ 0.022	ND	ND	ND	ND	ND	ND	ND	0.02
δ-HCH	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND~ 0.108	ND	ND	0.02
HCB	ND	ND~ 0.032	ND~ 0.036	ND~ 0.036	ND~ 0.027	ND~ 0.026	0.095~ 0.101	0.088~ 0.112	0.096~ 0.107	0.108~ 0.600	0.088~ 0.093	0.084~ 0.173	0.065~ 0.079	0.084~ 0.157	0.033~ 0.054	0.023~ 0.040	0.036~ 0.101	0.023~ 0.041	ND~ 0.045	ND~ 0.030	ND~ 0.114	0.052~ 0.069	0.02
Heptachlor Epoxide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND~ 0.063	ND	ND	ND	ND	ND	ND	ND	0.02
Dieldrin	ND	ND	ND	ND	ND	ND	ND~ 0.046	0.046~ 0.292	ND	ND	ND~ 0.035	ND	ND	ND	ND	ND	ND	ND~ 0.022	ND	ND	ND	ND	0.02
Oxychlordane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND~ 0.024	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02
trans-Chlordane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND~ 0.029	ND	ND~ 0.034	ND~ 0.052	ND	ND	ND	ND	ND	ND	ND	0.02
cis-Chlordane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND~ 0.029	ND	ND~ 0.035	ND	ND	ND	ND	ND	ND	ND	ND	0.02
trans-Nonachlor	ND	ND	ND	ND	ND	ND	ND	ND	ND~ 0.022	ND	ND~ 0.065	ND~ 0.047	ND	ND~ 0.027	ND~ 0.022	ND	ND	ND	ND	ND	ND	ND	0.02
2,4′-DDE	ND	ND~ 0.037	ND~ 0.123	ND~ 0.133	ND	ND~ 0.171	ND	ND~ 0.026	ND~ 0.093	ND	ND~ 0.040	ND~ 0.050	ND	0.021~ 0.319	ND~ 0.074	ND	ND~ 0.060	ND	ND	ND	ND	ND	0.02
4,4′-DDE	ND~ 0.047	ND~ 1.547	0.029~ 3.670	ND~ 3.486	ND~ 0.679	ND~ 2.574	ND~ 0.084	ND~ 0.499	0.490~ 3.484	0.291~ 1.389	ND~ 6.467	0.050~ 1.371	0.082~ 0.390	0.909~ 1.642	ND~ 6.578	ND~ 0.117	ND~ 2.942	ND~ 0.683	ND~ 0.024	ND	ND~ 0.136	ND~ 0.042	0.02
2,4′-DDD	ND	ND~ 0.174	ND	ND	ND~ 0.093	ND	ND	ND~ 0.020	ND~ 0.323	ND	ND~ 0.091	ND~ 0.176	ND~ 0.020	ND~ 0.181	ND~ 0.174	ND	ND~ 0.742	ND	ND	ND	ND	ND	0.02
4,4′-DDD	ND	ND~ 0.394	ND	ND	ND~ 0.351	ND~ 0.025	ND	ND~ 0.022	ND~ 0.087	ND~ 0.028	ND	0.021~ 0.481	0.060~ 0.067	ND	ND~ 0.890	ND~ 0.032	ND	ND	ND	ND	ND~ 0.074	ND	0.02
2,4′-DDT	ND	ND~ 0.218	ND~ 0.396	ND~ 0.466	ND~ 0.033	ND	ND~ 0.023	ND~ 0.108	ND	ND	ND	ND~ 0.111	ND~ 0.034	ND	ND~ 0.898	ND	ND	ND	ND	ND	ND~ 0.021	ND	0.02
4,4′-DDT	ND	ND~ 1.611	ND~ 2.015	ND	ND~ 0.242	ND~ 0.035	ND~ 0.196	ND~ 0.295	ND	ND	ND	0.128~ 3.425	ND~ 0.269	ND~ 0.231	ND~ 4.714	ND	ND	ND	ND~ 0.227	ND	ND~ 0.142	ND~ 0.051	0.02

※ The results were sorted based on the MDL because the official test method does not set LOQ for OCPs

4. Volatile Organic Compounds (VOCs, 20 items)

❍ Not detected in any samples

5. PAHs (15 kinds)

❍ Detected at 5 locations out of 22.

<Table 4-1-4> PAHs concentration range and LOQ of each off-post soil sampling location (unit: mg/kg)

Item	Sampling location																					LOQ
	CCOS 01	CCOS 02	CCOS 03	CCOS 04	CCOS 05	CCOS 06	CCOS 07	CCOS 08	CCOS 09	CCOS 10	CCOS 11	CCOS 12	CCOS 13	CCOS 14	CCOS 15	CCOS 16	CCOS 17	CCOS 18	CCOS 19	CCOS 20	CCOS 21	CCOS 22	
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND~ 0.005	ND	ND	ND	ND	ND	ND	ND	ND	0.005
Anthracene	ND	ND	ND	ND	ND	ND~ 0.006	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND~ 0.005	ND	ND	ND	0.005
Fluoranthene	ND	ND	ND~ 0.005	ND	ND	ND~ 0.014	ND	ND~ 0.007	ND	ND	ND	ND	ND	ND~ 0.005	ND	ND	ND	ND	ND	ND	ND	ND	0.005
Pyrene	ND	ND	ND	ND	ND	ND~ 0.018	ND	ND	ND	ND	ND	ND	ND	ND~ 0.007	ND	ND	ND	ND	ND	ND	ND	ND	0.005
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND~ 0.012	ND	ND~ 0.005	ND	ND	ND	ND	ND	ND~ 0.007	ND	ND	ND	ND	ND	ND	ND	ND	0.005
Chrysene	ND	ND	ND	ND	ND	ND~ 0.013	ND	ND~ 0.007	ND	ND	ND	ND	ND	ND~ 0.007	ND	ND	ND	ND	ND	ND	ND	ND	0.005
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND~ 0.007	ND	ND	ND	ND	ND	ND	ND	ND~ 0.006	ND	ND	ND	ND	ND	ND	ND	ND	0.005
Benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND~ 0.006	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.005
Ideno(1,2,3)pyrene	ND	ND	ND	ND	ND	ND~ 0.007	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.005
Benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND~ 0.006	ND	ND	ND	ND	ND	ND	ND	ND~ 0.005	ND	ND	ND	ND	ND	ND	ND	ND	0.005
PAHs	ND	ND	ND~ 0.005	ND	ND	ND~ 0.088	ND	ND~ 0.019	ND	ND	ND	ND	ND	ND~ 0.043	ND	ND	ND	ND	ND~ 0.005	ND	ND	ND	

※ Benzo(a)pyrene Worrisome Level of Soil Contamination (Category 1): 0.7mg/kg

6. Heavy metal (9 items)

❍ Out of 135 samples from 22 locations, zinc (Zn) exceeded the ROK Worrisome Level of Soil contamination in 1 sample (residential area standard, 300 mg/kg).

<Table 4-1-5> Concentration and LOQ of zinc where it exceeded the standard (unit: mg/kg)

Item	Standard Worrisome Level of Soil Contamination (Category 1)	Sampling location	Depth (m)	Concentration	LOQ
Zn (zinc)	300	CCOS09	1	1039.86	0.07

❍ The Trace metals: cadmium, lead, arsenic, mercury and Chromium 6 did not exceed the ROK Worrisome Level of Soil Contamination at any sampling location.

<Table 4-1-6> Heavy metal concentration range and LOQ of each off-post soil sampling location (unit: mg/kg)

Item	Standard (worrisome level of soil contamination, Category 1)	Sampling location																					LOQ
		CCOS 01	CCOS 02	CCOS 03	CCOS 04	CCOS 05	CCOS 06	CCOS 07	CCOS 08	CCOS 09	CCOS 10	CCOS 11	CCOS 12	CCOS 13	CCOS 14	CCOS 15	CCOS 16	CCOS 17	CCOS 18	CCOS 19	CCOS 20	CCOS 21	CCOS 22	
Zn(zinc)	300	42.81~ 65.51	23.75~ 106.26	29.78~ 71.60	8.10~ 73.30	22.14~ 72.33	41.01~ 60.01	56.24~ 68.91	62.91~ 133.51	90.74~ 1039.86	74.71~ 224.90	59.91~ 114.97	34.42~ 227.36	40.55~ 113.29	26.55~ 112.72	19.46~ 91.27	23.97~ 43.64	21.21~ 103.87	38.87~ 124.07	34.41~ 46.81	34.82~ 54.46	23.43~ 127.02	20.59~ 55.06	0.07
Cd(cadmium)	4	0.75~ 0.95	0.72~ 1.15	0.40~ 1.14	0.09~ 1.05	0.18~ 1.07	0.49~ 1.06	0.79~ 1.09	0.87~ 1.96	1.38~ 2.72	1.55~ 3.41	0.76~ 1.67	0.62~ 2.68	0.72~ 1.32	0.65~ 1.28	0.59~ 2.73	0.59~ 1.24	0.99~ 2.31	0.44~ 1.77	0.40~ 0.62	0.68~ 0.89	0.65~ 2.46	0.44~ 2.06	0.02
Cu(copper)	150	2.85~ 9.05	6.08~ 22.64	3.50~ 8.93	3.38~ 9.19	2.10~ 12.60	3.20~ 10.04	7.75~ 11.67	7.87~ 15.35	9.50~ 15.78	10.37~ 13.31	5.60~ 24.77	3.41~ 20.85	4.16~ 16.39	8.67~ 12.18	2.53~ 30.61	ND~ 7.11	1.81~ 14.99	2.27~ 11.70	2.07~ 4.74	2.19~ 4.96	1.12~ 10.02	0.64~ 2.28	0.03
Pb(lead)	200	6.16~ 15.48	9.42~ 17.13	6.60~ 19.98	5.67~ 19.04	2.47~ 19.74	8.90~ 18.89	11.58~ 30.87	19.59~ 32.41	14.58~ 38.15	16.08~ 37.78	20.40~ 68.68	8.85~ 25.07	14.22~ 35.35	14.86~ 33.05	5.04~ 30.03	6.13~ 18.41	5.66~ 14.54	4.76~ 22.75	7.88~ 17.53	8.81~ 39.90	13.86~ 23.93	5.89~ 15.66	0.20
As(arsenic)	25	0.84~ 3.74	2.72~ 5.48	0.57~ 4.07	ND~ 2.79	ND~ 3.68	0.38~ 5.41	2.81~ 4.73	3.03~ 10.35	4.84~ 9.61	4.36~ 8.23	3.84~ 9.95	1.76~ 5.52	3.02~ 5.08	3.66~ 6.69	ND~ 7.63	2.29~ 7.15	0.84~ 6.26	ND~ 0.63	ND~ 1.00	ND~ 2.72	1.05~ 4.34	0.55~ 1.96	0.25
Hg(mercury)	4	ND~ 0.04	0.02~ 0.04	0.01~ 0.06	0.02~ 0.05	0.01~ 0.17	ND	ND	ND~ 0.04	ND~ 0.02	ND~ 0.06	0.02~ 0.05	ND~ 0.03	ND~ 0.01	ND~ 0.02	ND~ 0.06	0.01 0.09	ND~ 0.05	0.01 0.06	ND~ 0.02	ND~ 0.03	ND	ND~ 0.01	0.01
Ba(barium)	-	83.38~ 111.18	80.18~ 131.38	66.28~ 106.38	23.62~ 139.71	38.68~ 117.91	68.88~ 123.42	60.68~ 102.35	72.21~ 115.58	92.68~ 225.66	80.01~ 349.63	78.41~ 115.05	77.09~ 113.02	86.86~ 130.96	91.39~ 114.82	68.12~ 191.70	49.18~ 87.39	44.95~ 213.30	79.65~ 339.96	63.95~ 91.55	65.27~ 107.54	71.84~ 216.63	65.12~ 129.81	-
Ni(nickel)	100	4.63~ 6.46	4.73~ 7.57	3.45~ 7.50	1.09~ 8.52	2.32~ 7.80	1.85~ 6.43	2.91~ 3.58	3.07~ 4.20	3.26~ 4.55	4.00~ 4.65	3.13~ 5.36	3.17~ 4.56	3.53~ 6.35	4.67~ 5.82	3.94~ 42.64	1.99~ 9.42	5.00~ 10.06	2.74~ 28.92	2.61~ 3.49	1.89~ 3.46	1.98~ 4.02	1.22~ 3.30	0.35

7. TPHs

❍ Not detected in any samples

※ TPHs : Total Petroleum Hydrocarbons

8. Other items

❍ Organo-phosphorus compounds, PCB or cyan were not detected in any samples.

❍ Fluorine exceeded the ROK Worrisome Level of Soil Contamination (residential area standard, 400 mg/kg) at 13 samples taken from 7 different locations.

<Table 4-1-7> Fluorine concentration range of each off-post soil sampling location (unit: mg/kg)

Item	Standard worrisome level of soil contamination (Category 1)	Sampling location																					LOQ
		CCOS 01	CCOS 02	CCOS 03	CCOS 04	CCOS 05	CCOS 06	CCOS 07	CCOS 08	CCOS 09	CCOS 10	CCOS 11	CCOS 12	CCOS 13	CCOS 14	CCOS 15	CCOS 16	CCOS 17	CCOS 18	CCOS 19	CCOS 20	CCOS 21	CCOS 22	
F(fluorine)	400	409~575	176~466	244~398	17~358	159~310	41~224	214~320	259~419	358~519	360~459	298~525	148~196	146~239	108~190	82~216	40~415	ND~100	ND~45	ND~108	49~161	ND~190	ND~129	10

② Additional Soil survey (11 location)

※ The ROK conducted additional soil survey.

1. Herbicides (2,4-D, 2,4,5-T)

❍ Not found in any samples

2. Dioxin (17 kinds)

❍ Out of 22 samples taken from 11 locations, 12 samples showed 0.003-0.385 pg TEQ/g of dioxin. The other 10 samples did not contain dioxin.

- 2,3,7,8-TCDD was not detected
- None of them exceeded the US residential guideline (1,000 pg/g, 2,3,7,8-TCDD) or Japanese guideline (1,000 pg TEQ/g).

<Table 4-2-1> Dioxin concentration range of each soil sampling location

Unit	Sampling location											LOQ
	CCOS 23	CCOS 24	CCOS 25	CCOS 26	CCOS 27	CCOS 28	CCOS 29	CCOS 30	CCOS 31	CCOS 32	CCOS 33	
pg-TEQ/g	ND	ND~ 0.011	0.013~ 0.029	ND~ 0.385	ND	ND~ 0.005	0.008~ 0.011	0.059~ 0.197	ND	0.034	ND	MDL 0.1 pg/g (for each)

※ US residential guideline (1998) : 1,000 pg/g (2,3,7,8-TCDD), Japanese guideline (1999) : 1,000 pg TEQ/g)

3. Volatile Organic Compounds VOCs, 20 items)

❍ Not found in any samples (51 samples from 11 locations)

4. Heavy metal (8 items)

❍ Out of 51 samples taken from 11 different locations, lead (Pb) exceeded the ROK Worrisome Level of Soil Contamination in 1 sample (residential area standard, 200 mg/kg).

※ As military facilities fall into Category 3 (industrial area) under the current law, this area does not violate the standard applied to it.

<Table 4-2-2> Heavy metal concentration range and LOQ of each sampling location (unit: mg/kg)

Item	Standard (worrisome level of soil contamination, Category 1)	Sampling location											LOQ
		CCOS 23	CCOS 24	CCOS 25	CCOS 26	CCOS 27	CCOS 28	CCOS 29	CCOS 30	CCOS 31	CCOS 32	CCOS 33	
Zn(Zinc)	300	44.50~ 68.23	38.87~ 50.97	27.05~ 81.50	98.13~ 116.37	31.44~ 87.60	36.90~ 73.77	32.95~ 96.53	63.50~ 103.20	33.07~ 90.40	60.17~ 89.13	78.00~ 88.00	0.07
Cd(Cadmium)	4	0.78~ 1.21	0.66~ 0.90	0.54~ 1.12	1.07~ 1.33	0.53~ 0.86	0.65~ 1.06	0.66~ 1.09	0.92~ 0.99	0.65~ 1.00	0.86~ 1.13	0.92~ 1.07	0.02
Cu(Copper)	150	26.40~ 76.77	21.43~ 28.82	7.54~ 20.73	11.32~ 31.90	9.10~ 23.93	7.13~ 34.37	5.53~ 12.29	10.76~ 60.67	7.85~ 12.63	6.57~ 13.51	8.66~ 26.45	0.03
Pb(Lead)	200	9.57~ 12.56	13.93~ 20.84	12.47~ 19.73	15.19~ 25.25	11.22~ 14.27	13.15~ 25.39	11.22~ 33.07	30.87~ 378.67	12.66~ 16.09	13.12~ 26.38	7.61~ 13.48	0.20
As(Arsenic)	25	4.06~ 6.52	4.91~ 8.11	3.15~ 5.75	5.83~ 6.65	3.71~ 6.06	5.22~ 7.51	5.22~ 7.42	4.99~ 8.36	4.66~ 7.46	4.54~ 7.93	4.49~ 4.70	0.25
Hg(Mercury)	4	ND~ 0.02	ND~ 0.01	ND	ND~ 0.02	ND~ 0.02	0.01~ 0.02	0.01~ 0.13	ND~ 0.07	0.01~ 0.02	ND~ 0.05	ND~ 0.03	0.01
Ni(Nickel)	100	6.34~ 6.60	6.54~ 10.71	2.49~ 6.85	5.98~ 6.88	4.55~ 6.93	5.05~ 14.14	4.47~ 6.47	6.15~ 7.66	4.66~ 7.33	4.44~ 5.93	5.51~ 5.84	0.35
Cr^{6+} (Chromium 6)	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.5

5. TPHs

❍ Out of 51 samples taken from 11 locations, 3 samples taken from 2 different locations showed TPHs, but they met the standard.

※ TPHs : Total Petroleum Hydrocarbons

<Table 4-2-3> TPH concentration range of each soil sampling location

Unit	Sampling location											LOQ
	CCOS 23	CCOS 24	CCOS 25	CCOS 26	CCOS 27	CCOS 28	CCOS 29	CCOS 30	CCOS 31	CCOS 32	CCOS 33	
mg/kg	ND	ND	ND	ND	ND	ND	ND~ 43	ND	ND	ND~ 146	ND	10

6. PCB

❍ Not found in any samples

③ Sediment of River (5 locations, announced on 5 Aug)

1. Herbicides (2,4-D and 2,4,5-T)

❍ Not found in any samples

2. Dioxin (17 kinds)

❍ 2,3,7,8-TCDD was not detected.

❍ Other dioxin was found in the upper stream of Dongjung-cheon at the level of 0.004 pg TEQ/g, and at 0.880 pg TEQ/g in the lower stream; however, they are around 3/100,000 - 6/1000 of Japanese guideline and lower than the average of nationwide sediments.

<Table 4-3-1> Dioxin/Furan concentration and LOQ of river sediments

Standard	Sample number (pg TEQ/g)					LOQ
	upper Nakdong -1	lower Nakdong -1	upper Donjung -1	lower Dongjung -1	Carroll stream	
-	0.002	0.003	0.004	0.880	0.008	0.1 pg/g

※ Japanese Guideline (1999) : 150 pg TEQ/g

※ Nationwide dioxin concentration in sediment (unit: pg-TEQ/g)

		'05	'06	'08	'09	Average
Nation wide	min.	0.006	0.005	0.006	0.001	0.004
	max.	53.624	32.434	12.627	3.828	20.503
	avg.	7.328	5.786	1.293	0.860	3.053

※ Source: '05~'06 : Report of Nationwide Monitoring of Endocrine Disruptors (NIER)
'08~'09 : Report of Nationwide Monitoring of Persistent Organic Pollutant (MOE)

3. Organo-Chlorine Pesticides (OCPs, 22 items)

❍ Four items were detected in the range between 0.022 and 0.912 μg/kg.

❍ The concentration level is lower than the maximum value of nationwide POPs monitoring result (see Table 3-2).

<Table 4-3-2> OCPs concentration and MDL of river sediment

Item	Standard	Sample number					MDL
		upper Nakdong-1	lower Nakdong-1	upper Dongjung-1	lower Donjung-1	Carroll stream	
β-HCH	-	ND	ND	ND	ND	0.145	0.02
HCB		ND	ND	ND	0.022	ND	
2,4′-DDE		ND	ND	ND	ND	0.027	
4,4′-DDE		ND	ND	0.034	0.244	0.912	

4. Volatile Organic Compounds (VOCs, 20 items)

❍ Not found in any samples

5. PAHs (16 kinds)

❍ 0.02 mg/kg of PAHs was found in Carroll stream

❍ Benzo(a)pyrene is 100 times lower than the standard

<Table 4-3-3> PAHs concentration and LOQ of river sediment (unit: mg/kg)

Item	Standard	Sample number					LOQ
		upper Nakdong-1	lower Nakdong-1	upper Dongjung-1	lower Dongjung-1	Carroll Stream	
Pyrene	-	ND	ND	ND	ND	0.005	0.005
Fluoranthene	-	ND	ND	ND	ND	0.005	
Benzo(a)pyrene	0.7	ND	ND	ND	ND	0.01	
PAHs	-	ND	ND	ND	ND	0.02	

6. Heavy metal (9 items)

❍ All items were below the ROK Worrisome Level of Soil Contamination (residential area standard)

<Table 4-3-4> Heavy metal concentration and LOQ of sediment (unit: mg/kg)

Item	Standard (worrisome level of soil contamination, Category 1)	Sample number					LOQ
		upper Nakdong-1	lower Nakdong-1	upper Dongjung-1	lower Dongjung-1	Carroll Stream	
Zn (Zinc)	300	34.59	46.49	27.60	58.39	116.75	0.07
Cd (Cadmium)	4	0.51	0.71	0.41	0.75	1.37	0.02
Cu (Copper)	150	6.59	5.73	3.85	6.74	19.67	0.03
Pb (Lead)	200	8.26	7.89	7.86	11.16	16.10	0.20
As (Arsenic)	25	4.19	2.53	6.94	6.55	2.28	0.25
Hg(Mercury)	4	ND	0.03	ND	0.02	0.02	0.01
Ba (Barium)	-	44.00	53.40	41.40	47.80	45.70	-
Ni (Nickel)	100	7.70	9.16	8.06	7.99	5.06	0.35

7. TPHs

❍ Not found in any samples

※ TPHs : Total Petroleum Hydrocarbons

8. Other items

❍ Organo-phosphorus compounds, PCB or cyan were not found in any samples.

❍ Fluorine was below the ROK Worrisome Level of Soil Contamination (residential area standard).

<Table 4-3-5> Fluorine concentration and LOQ of sediment (unit: mg/kg)

Item	Standard (worrisome level of soil contamination, Category 1)	Sample number					LOQ
		upper Nakdong-1	lower Nakdong-1	upper Dongjung-1	lower Dongjung-1	Carroll Stream	
F (Fluorine)	400	288	319	145	172	205	10

Annex 5

Off-post groundwater and stream water

① Groundwater (10 locations) and Stream water (6 locations) (announced on 16 June)

1. Herbicides (2,4-D, 2,4,5-T)

○ Not found in any samples of groundwater or stream water

2. Dioxin

○ (groundwater) Not found in any samples

○ (stream water) Trace amounts were found at 3 locations (Carroll Stram, Waegwan Station, lower Dongjung-cheon)

<Table 5-1-1> (concentration: pg-TEQ/L)

item \ location	Carroll Stream	Waegwan Stat.	lower Dongjung	EPA drinking water standard
Dioxin	0.001	0.010	0.001	30 (2,3,7,8-TCDD)

⇒ It is 3,000 - 30,000 times lower than EPA drinking water standard, and 7 - 70 times lower than the average of the recent Waegwan monitoring level (0.070 pg-TEQ/L)

※ Dioxin concentration of the part of Nakdong River located in Waegwan (unit: pg-TEQ/L)

	'05	'06	'08	'09	Average
Spring	0.098	0.005	0.435	0.000	0.135
Fall	0.003	0.011	0.003	0.003	0.005
Average	0.050	0.008	0.219	0.002	0.070

※ Source: '05~'06: Report of Nationwide Monitoring of Endocrine Disruptors (NIER)

'08~'09: 2009 Report of Nationwide Monitoring of Persistent Organic Pollutants (MOE)

3. Organo-Chlorine Pesticides (OCPs)

○ OCPs were detected at 2 groundwater wells and 1 stream water sample, but none of them violated the WHO drinking water guideline.

<Table 5-1-2> (unit: ng/L)

Item \ Location	Groundwater well		Stream	WHO Drinking water guideline
	No.1 (residential-drinking)	No.4 (residential-drinking)	Carroll Stream	
Dieldrin	1.134	-	-	30
α-HCH	-	5.519	-	-
β-HCH	-	36.384	0.700	-
ɣ-HCH	-	14.183	-	2,000
δ-HCH	-	6.931	-	-
Endrin	-	11.742	-	600

4. Volatile Organic Compounds

○ Four kinds of VOCs were detected at 4 groundwater wells and 2 stream water samples. Groundwater well No. 4, which is currently under construction for building water supply system, exceeded the domestic drinking water standard for Tetrachloroethene.

<Table 5-1-3> (unit: mg/L)

Item \ Location	Groundwater well				Stream		Drinking water standard
	No.1 (residential-drinking)	No.2 (residential -not for drinking)	No.3 (residential -not for drinking)	No.4 (residential-drinking)	Carroll Stream	Waegwan station	
Chloroform	-	0.001	0.001	0.001	-	0.001	0.08
Trichloroethene	0.012	-	-	0.023	-	-	0.03
Tetrachloroethene	0.006	-	-	0.026	0.001	-	0.01
cis-1,2-Dichloroethene	0.017	-	-	0.005	-	-	0.07

5. 1,4-Dioxane

○ Three groundwater wells contained 1,4-Dioxane but did not exceed the ROK drinking water standard.

<Table 5-1-4> (unit: mg/L)

Item \ location	Groundwater well			Drinking water standard
	No.2 (residential -not for drinking)	No.3 (residential -not for drinking)	No.4 (residential -drinking)	
1,4-Dioxane	0.002	0.003	0.002	0.05

6. PAHs, TPH, OCPs, Carbaryl, Chlorination byproducts, Haloacetic acids

○ Not found in any samples.

7. General Items

○ Three groundwater wells: No.1, No.9 and No.10 had 7 items exceeding the ROK drinking water standards; however, hydro ion, iron, manganese and turbidity affect the esthetic aspect only. They are not directly related to health.

- Well No.1 had Total colony count and total coliforms exceeding the standards.
- As the well No.9 is used for agriculture, there is no standards for it in terms of total colony count, iron, manganese and turbidity. Thus the well meets the standards.
- Well No. 10 is used for residential purposes, so its hydro ion exceeds the standards.

※ Well No.10 was dug during the apartment construction, and now it is used for various purposes like cleaning.

<Table 5-1-5> (unit: mg/L)

Item \ Location	Groundwater well			Drinking water standard
	No.1 (Residential-drinking)	No.9 (Agriculture-not for drinking)	No.10 (Residential -not for drinking)	
Ammoniacal nitrogen	-	-	0.98	0.5
Hydro ion	-	-	9.5	5.8~8.5
Iron	-	1.430	-	0.3
Manganese	-	2.011	-	0.3
Turbidity (NTU)	-	5.53	-	1
Total colony count(CFU/ml)	8,300	1,610	160	100
Total coliforms	Detected	-	-	ND

○ As for stream water, the main stream of Nakdong River had COD, SS and total phosphate equivalents to II - IV of the conforming standard of the ROK government, which means it is okay to use after proper treatment.

② 2nd groundwater test (16 wells, announced on 9 Sept)

[10 supply wells]

1. Herbicides (2,4-D, 2,4,5-T)

❍ Trace amounts of 2,4-D and 2,4,5-T were detected by the first survey, and subsequent survey was conducted for four wells. 2,4-D and 2,4,5-T were not detected in the re-test.

<Table 5-2-1> Concentration and LOQ of herbicides (unit: μg/L)

Item	EPA Drinking water standard	Sample number										LOQ
		CCOG-11	CCOG-12	CCOG-13	CCOG-14	CCOG-15	CCOG-16	CCOG-17	CCOG-18	CCOG-19	CCOG-20	
2,4-D	70 μg/L(1) 30 μg/L(2)	ND	ND	ND	ND	ND	ND	1st::0.00088 2nd:ND	ND	ND	ND	0.000569 μg/L
2,4,5-T	9 μg/L(2)	ND	ND	ND	ND	ND	ND	1st::0.00178 2nd:ND	ND	ND	ND	0.001163 μg/L

※ (1) EPA Drinking water standard

※ (2) WHO Drinking water guideline

2. Dioxin (17 kinds)

❍ Four out of 10 wells (CCOG-17, 18, 19, 20) were samples and analyzed.

❍ Nothing was detected in any samples.

<Table 5-2-2> Dioxin/Furan concentration and LOQ (unit: pg-TEQ/L)

Unit	EPA Drinking water standard	Sample number										LOQ
		CCOG-11	CCOG-12	CCOG-13	CCOG-14	CCOG-15	CCOG-16	CCOG-17	CCOG-18	CCOG-19	CCOG-20	
pg-TEQ/L	30 pg/L (2,3,7,8-TCDD)	not sampled						ND	ND	ND	ND	0.5 pg/L (for each item)

3. Organo-Chlorine Pesticides (OCPs, 22 kinds)

❍ Six items including α-HCH, ɣ-HCH(Lindane) and Dieldrin were detected at 4 out of 10 locations (0.7 ~ 8.4 ng/L).

- Currently WHO has a drinking water guideline for Lindane and Dieldrin. The detected levels were respectively about 4/10,000 and 4/100 of the WHO guideline.

❍ The other 16 items were not found in any samples.

<Table 5-2-3> OCPs concentration and LOQ (unit: ng/L)

Item	WHO Drinking water guideline	Sample number										LOQ
		CCOG-11	CCOG-12	CCOG-13	CCOG-14	CCOG-15	CCOG-16	CCOG-17	CCOG-18	CCOG-19	CCOG-20	
α-HCH	-	ND	ND	4.4	ND	ND	ND	ND	ND	ND	ND	Method Detection Limit 0.5 (for each item)
β-HCH	-	ND	ND	8.4	ND	ND	ND	ND	ND	ND	ND	
ɣ-HCH (Lindane)	2000	ND	ND	0.7	ND	ND	ND	ND	ND	ND	ND	
δ-HCH	-	ND	ND	5.8	ND	ND	ND	ND	ND	ND	ND	
Heptachlor Epoxide	-	3.6	ND	ND	ND	ND	ND	0.9	ND	ND	ND	
Dieldrin	30 (Aldrin+ Dieldrin)	ND	ND	1.3	ND	ND	1.3	ND	ND	ND	ND	

4. Volatile Organic Compounds (VOCs, 55 kinds)

❍ Five items such as TCE and PCE were detected in 4 out of 10 wells.

❍ TCE (0.130 mg/L) and PCE (0.040 mg/L) exceeded the drinking water standard at 1 well. Other items were below the standards.

❍ The other 50 items were not detected in any wells.

<Table 5-2-4> VOCs concentration and LOQ (unit: mg/L)

Item	Standard	Sample number										LOQ
		CCOG-11	CCOG-12	CCOG-13	CCOG-14	CCOG-15	CCOG-16	CCOG-17	CCOG-18	CCOG-19	CCOG-20	
Chloroform	0.08(1)	ND	0.011	ND	ND	ND	0.001	ND	ND	ND	ND	0.001
Trichloroethene	0.03(1)	ND	ND	0.010	ND	ND	0.006	**0.130**	ND	ND	ND	0.001
Tetrachloroethene	0.01(1)	ND	ND	**0.040**	ND	ND	0.009	ND	ND	ND	ND	0.001
trans-1,2-Dichloroethene	0.1(1)	ND	ND	ND	ND	ND	ND	0.0026	ND	ND	ND	0.0003
cis-1,2-Dichloroethene	0.07(2)	ND	ND	ND	ND	ND	0.0015	0.0322	ND	ND	ND	0.0002

1) ROK Drinking water standard
2) EPA Drinking water standard

5. PAHs (15 kinds)

❍ Only Anthracene was detected in 1 location out of 10.

❍ The other 14 items were not detected in any locations.

<Table 5-2-5> VOCs concentration and LOQ (unit: ng/L)

Item	Standard	Sample number										LOQ
		CCOG-11	CCOG-12	CCOG-13	CCOG-14	CCOG-15	CCOG-16	CCOG-17	CCOG-18	CCOG-19	CCOG-20	
Anthracene	-	0.553	1.861	ND	0.643	2.002	ND	1.275	0.765	ND	ND	0.407
Total-PAHs	-	0.553	1.861	ND	0.643	2.002	ND	1.275	0.765	ND	ND	-

* Drinking water standards, EPA drinking water standards and WHO drinking water guideline do not have standard for these items.
* Among PAHs, only Benzo(a)pyrene is regulated by the EPA and WHO. The standards are 200 ng/L and 700 ng/L respectively.

6. Heavy metal (13 items)

❍ Seven items such as As, B and Zn were detected in 10 locations, but they are all below the ROK drinking water standards.

❍ Trace metal such as As, Hg and Pb, Cd were not detected.

<Table 5-2-6> Heavy metal concentration and LOQ (unit: mg/L)

Item	Standard	Sample number										LOQ
		CCOG-11	CCOG-12	CCOG-13	CCOG-14	CCOG-15	CCOG-16	CCOG-17	CCOG-18	CCOG-19	CCOG-20	
As	0.01(1)	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.005	0.005
B	1.0(1)	ND	ND	ND	ND	ND	0.01	ND	ND	0.03	ND	0.01
Zn	3.0(1)	0.039	0.031	0.024	0.039	ND	ND	ND	0.002	0.002	ND	0.002
Fe	0.3(1)	ND	ND	0.09	ND	ND	ND	ND	ND	ND	ND	0.05
Mn	0.3(1)	0.016	0.014	ND	ND	ND	ND	ND	ND	ND	ND	0.005
Al	0.2(1)	ND	ND	ND	ND	0.08	ND	ND	ND	ND	ND	0.02
Ba*	2(2)	0.084	0.082	0.015	0.184	0.112	0.026	0.023	0.028	0.042	0.011	0.002

1) ROK Drinking water standard
2) EPA Drinking water standard

7. TPHs, OCPs (3 kinds), Carbaryl, Chlorination byproducts (4 kinds), Haloacetic acids (3 kinds), 1,4-Dioxane

❍ Not found in any samples.

※ OCPs (3 kinds): Diazinon, Parathion, Fenitrothion

※ Chlorination byproducts (4 kinds): Chloralhydrate, Dibromoacetonitrile, Dichloroacetonitrile, Trichloroacetonitrile

※ Haloacetic acids (3 kinds) : Dichloroaceticacid, Trichloroaceticacid, Dibromoaceticacid

8. Other items (3 microbial, 17 general items)

- ❍ Ammoniacal nitrogen, Phenol, residual chlorine, cyan were not detected.
- ❍ Out of the 10 locations, total colony counts exceeded the drinking water standards in 5 locations, total colony forms in 7 locations, Fecal Streptococcus in 4 locations, nitrate nitrogen in 3 locations and turbidity in 2 locations.

<Table 5-2-7>Other items (3 microbial, 17 general items) concentration and LOQ

Items	Standard	Sample number										LOQ
		CCOG-11	CCOG-12	CCOG-13	CCOG-14	CCOG-15	CCOG-16	CCOG-17	CCOG-18	CCOG-19	CCOG-20	
Total colony count - replica plating	100(CFU)/mL	**140**	**180**	4	**3700**	60	**160**	16	33	11	**200**	-
Total coliforms - enzyme substrate	ND/100mL	ND	**Detected**	ND	**Detected**	**Detected**	**Detected**	**Detected**	**Detected**	ND	**Detected**	-
Fecal Streptococcus - tube	ND/100mL	ND	ND	ND	**Detected**	ND	ND	**Detected**	**Detected**	ND	**Detected**	-
Fluorine	1.5 mg/L	ND	ND	ND	ND	ND	0.17	0.15	ND	ND	0.16	0.15 mg/L
Ammoniacal Nitrogen	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01 mg/L
Nitrate nitrogen	10.0 mg/L	6.3	3.9	3.4	**18.2**	**11.7**	3.3	**12.5**	5.8	4.2	3.5	0.1 mg/L
Phenol	0.005 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.005 mg/L
Hardness	300 mg/L	47	79	66	110	138	62	180	157	184	129	1 mg/L
potassium permanganate consumed	10.0 mg/L	0.6	1.3	0.9	1.4	1.0	1.3	1.2	2.3	0.9	1.5	0.3 mg/L
chromaticity	5 grade	ND	1	ND	1	ND	ND	ND	ND	ND	ND	1 grade
Surfactant	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1 mg/L
Hydro ion	5.8~8.5	6.0	6.3	6.3	6.2	6.2	6.4	6.7	6.9	7.0	7.4	-
Chlorite ion	250 mg/L	12	22	24	32	44	8	39	16	19	4	0.4 mg/L
Non-Volatile Residues	500 mg/L	178	214	184	326	343	155	384	269	283	217	5 mg/L
Turbidity	1 NTU	0.18	**1.88**	0.14	**1.31**	0.15	0.14	0.15	0.50	0.22	0.37	0.02 NTU
Sulfate ion	200 mg/L	5	27	3	11	31	4	25	41	21	9	2 mg/L
Residual chlorine	4.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.05 mg/L
Cyan	0.01 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01 mg/L
Taste	No	No	No	No	No	No	No	No	No	No	No	-
Odor	No	No	No	No	No	No	No	No	No	No	No	-

[6 Monitoring Wells]

1. Herbicides (2,4-D, 2,4,5-T), Dioxin (17 kind), TPHs

❍ Not detected in any samples.

2. Organo-Chlorine Pesticides (OCPs, 22 items)

❍ Three items: β-HCH, γ-HCH(Lindane) and Dieldrin were found in 5 out of 6 locations (0.7 ~ 21.9 ng/L)

<Table 5-2-8> OCPs concentration and LOQ (unit: ng/L)

Items	Sample number						LOQ
	CCOMW1	CCOMW2	CCOMW3	CCOMW4	CCOMW5	CCOMW6	
β-HCH	ND	1.6	0.7	21.9	0.9	ND	MDL 0.5 (for each items)
γ-HCH(Lindane)	ND	7.2	ND	2.2	ND	6.0	
Dieldrin	ND	2.4	1.2	1.0	2.4	ND	

3. Volatile Organic Compounds(VOCs, 55 kinds)

❍ 10 items such as TCE and PCE were detected at 5 out of 6 locations (0.0006 ~ 0.2221 mg/L).

<Table 5-2-9> VOCs concentration and LOQ (unit: mg/L)

Item	Sample number						LOQ
	CCOMW1	CCOMW2	CCOMW3	CCOMW4	CCOMW5	CCOMW6	
1,1-Dichloroethene	ND	0.002	ND	ND	ND	ND	0.001
Chloroform	ND	0.001	ND	ND	ND	ND	0.001
Trichloroethene	0.032	0.151	0.005	0.001	0.007	ND	0.001
Tetrachloroethene	0.001	0.049	0.004	0.001	0.015	ND	0.001
trans-1,2-Dichloroethene	ND	0.0024	ND	ND	ND	ND	0.0003
cis-1,2-Dichloroethene	0.0055	0.2221	0.0108	ND	ND	ND	0.0002
1,1-Dichloroethane	0.0015	0.0032	ND	ND	ND	ND	0.0001
1,2-Dichloropropane	ND	0.0006	ND	ND	ND	ND	0.0001
1,1,2,2-Tetrachloroethane	0.0084	ND	ND	ND	ND	ND	0.0006
Vinyl chloride	ND	0.0011	0.0043	ND	ND	ND	0.0001

4. PAHs (15 kinds)

❍ Two items: Fluoranthene and Anthracene were detected in 4 out of 6 locations (0.806 - 1.871 ng/L)

<Table 5-2-10> PAHs concentration and LOQ (unit: ng/L)

Item	Sample number						LOQ
	CCOMW1	CCOMW2	CCOMW3	CCOMW4	CCOMW5	CCOMW6	
Fluoranthene	ND	ND	ND	1.065	ND	0.886	0.504
Anthracene	ND	ND	1.454	0.806	0.913	N.D.	0.407
Total-PAHs	ND	ND	1.454	1.871	0.913	0.886	-

5. Heavy metal (13 items)

❍ Seven items including Mn and Ba were found in 6 locations.

❍ Trace metals such as As, Hg and Cd were not detected.

<Table 5-2-11> Heavy metal concentration and LOQ (unit: mg/L)

Item	Sample number						LOQ
	CCOMW1	CCOMW2	CCOMW3	CCOMW4	CCOMW5	CCOMW6	
Pb	ND	ND	ND	ND	0.005	ND	0.005
B	0.01	ND	ND	0.03	0.02	ND	0.01
Zn	0.015	0.014	0.011	0.007	0.017	0.020	0.002
Fe	ND	ND	0.48	ND	ND	ND	0.05
Mn	0.064	ND	1.467	0.299	0.261	0.148	0.005
Al	0.07	0.07	0.09	0.01	0.07	0.05	0.02
Ba	0.089	0.133	0.179	0.069	0.121	0.091	0.002

③ Additional Groundwater survey (17 locations)

※ The ROK conducted additional test.

1. Herbicides (2,4-D, 2,4,5-T)

❍ Not detected in any locations (8 supply wells, 9 monitoring wells)

2. Dioxin (17 kinds)

❍ Not found in supply wells, but 2 monitoring wells had trace amounts.

❍ 2,3,7,8-TCDD was not one of the 17 kinds of dioxin found in the analysis.

<Table 5-3-1> Dioxin/Furan concentration and LOQ (unit: pg-TEQ/L)

Unit	concentration	Standards (EPA)	Remarks (exceeding the standard)
pg-TEQ/L	ND ~0.062	30 pg/L (2,3,7,8-TCDD)	-

3. Volatile Organic Compounds (VOCs, 54 items)

□ Groundwater supply wells (8)

❍ Four items such as TCE and *cis*-1,2-DCE were detected in 6 supply wells.

- TCE exceeded the EPA drinking water standards at 4 wells and *cis*-1,2-DCE at 3 wells (These wells are overlapped with where TCE

exceeded the standards). Other 2 items were below the standard.

❍ The other 50 items were not found in any locations.

<Table 5-3-2> VOCs concentration and standards (unit: mg/L)

Item	**Concentration (8 supply wells)**	**Standards** (Drinking water standards)	**Remarks** (exceeding the standards)
Chloroform	ND ~ 0.004	0.08	-
Trichloroethene	ND ~ 0.098	0.03	4 wells
trans-1,2-Dichloroethene	ND ~ 0.0117	0.1	-
cis-1,2-Dichloroethene	ND ~ 0.1881	0.07 (EPA)	3 wells

□ Groundwater monitoring wells (9)

❍ Three items such as TCE and *cis*-1,2-DCE were detected in 4 monitoring wells, but they are within the standards.

<Table 5-3-3> VOCs concentration and standards (unit: mg/L)

Item	**Concentration (8 supply wells)**	**Standards** (Drinking water standards)	**Remarks** (exceeding the standards)
Chloroform	ND ~ 0.002	0.08	-
Trichloroethene	ND ~ 0.010	0.03	-
cis-1,2-Dichloroethene	ND ~ 0.0042	0.07 (EPA)	-

4. Other organic pollutants (10 items)

❍ Not found in any samples (8 supply wells and 9 monitoring wells)