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Ⅳ Results

❑ Table Ⅳ-1. Concentrations of analyzed contaminants from drinking water well

	Analytes	Standard (drinking water)	Drinking Water Well						LOQ	Notes
			20-575	14-283	16-289	15-286	12-247	13-279		
Herbicides (μg/L)	2,4-D	70 μg/L	ND	ND	ND	ND	ND	ND	0.101 μg/L	EPA National primary drinking water regulations
		30 μg/L								WHO Guidelines for drinking water quality
	2,4,5-T	9 μg/L	ND	ND	ND	ND	ND	ND	0.062 μg/L	WHO Guidelines for drinking water quality
Dioxins /Furans (pg/L)	2,3,7,8-TCDF		ND	ND	ND	ND	ND	ND	0.5 pg/L	EPA National primary drinking water regulations
	1,2,3,7,8-PeCDF		ND	ND	ND	ND	ND	ND		
	2,3,4,7,8-PeCDF		ND	ND	ND	ND	ND	ND		
	1,2,3,4,7,8-HxCDF		ND	ND	ND	ND	ND	ND		
	1,2,3,6,7,8-HxCDF		ND	ND	ND	ND	ND	ND		
	1,2,3,7,8,9-HxCDF		ND	ND	ND	ND	ND	ND		
	2,3,4,6,7,8-HxCDF		ND	ND	ND	ND	ND	ND		
	1,2,3,4,6,7,8-HpCDF		ND	ND	ND	ND	ND	ND		
	1,2,3,4,7,8,9-HpCDF		ND	ND	ND	ND	ND	ND		
	OCDF		ND	ND	ND	ND	ND	ND		
	2,3,7,8-TCDD	30 pg/L	ND	ND	ND	ND	ND	ND		
	1,2,3,7,8-PeCDD		ND	ND	ND	ND	ND	ND		
	1,2,3,4,7,8-HxCDD		ND	ND	ND	ND	ND	ND		
	1,2,3,6,7,8-HxCDD		ND	ND	ND	ND	ND	ND		

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	Analytes	Standard (drinking water)	Drinking Water Well						LOQ	Notes
			20-575	14-283	16-289	15-286	12-247	13-279		
	1,2,3,7,8,9-HxCDD		ND	ND	ND	ND	ND	ND		
	1,2,3,4,6,7,8-HpCDD		ND	ND	ND	ND	ND	ND		
	OCDD		ND	ND	ND	ND	ND	ND		
	I-TEQ(pg-TEQ/L)		ND	ND	ND	ND	ND	ND		
Chloriated pesticides (ng/L)	α-HCH	-	ND	4.9	ND	2.1	2.3	ND	0.5 ng/L	-
	β-HCH	-	ND	11.6	ND	7.5	5.9	ND	0.5 ng/L	-
	γ-HCH(Lindane)	2000 ng/L	0.9	21.3	0.5	4.6	10.2	0.9	0.5 ng/L	WHO Guidelines for drinking water quality
	δ-HCH	-	ND	10.5	ND	4.8	5.4	ND	0.5 ng/L	-
	HCB	-	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	Heptachlor	-	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	Heptachlor Epoxide	-	ND	0.6	ND	0.6	ND	ND	0.5 ng/L	-
	Aldrin	30 ng/L (Aldrin+ Dieldrin)	ND	ND	ND	ND	ND	ND	0.5 ng/L	WHO Guidelines for drinking water quality
	Dieldrin		ND	1.3	ND	1.2	0.7	ND	0.5 ng/L	
	Endrin	600 ng/L	ND	ND	ND	ND	ND	ND	0.5 ng/L	
	Oxychlordane	-	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	trans-Chlordane	200 ng/L (*trans*+*cis*)	ND	ND	ND	ND	ND	ND	0.5 ng/L	WHO Guidelines for drinking water quality
	cis-Chlordane		ND	ND	ND	ND	ND	ND	0.5 ng/L	
	trans-Nonachlor	-	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	cis-Nonachlor	-	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	2,4-DDE	1000 ng/L	ND	ND	ND	ND	ND	ND	0.5 ng/L	WHO Guidelines for drinking water quality
	4,4-DDE		ND	ND	ND	ND	ND	ND	0.5 ng/L	

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	Analytes	Standard (drinking water)	Drinking Water Well						LOQ	Notes
			20-575	14-283	16-289	15-286	12-247	13-279		
	2,4-DDD		ND	0.7	ND	ND	ND	ND	0.5 ng/L	
	4,4-DDD		ND	ND	ND	ND	ND	ND	0.5 ng/L	
	2,4-DDT		ND	ND	ND	ND	ND	ND	0.5 ng/L	
	4,4-DDT		ND	ND	ND	ND	ND	ND	0.5 ng/L	
	Mirex	-	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	Pentachlorobenzene		ND	ND	ND	ND	ND	ND	0.5 ng/L	
	α-Endosulfan	600 ng/L	ND	ND	ND	ND	ND	ND	0.5 ng/L	
	β-Endosulfan		ND	ND	ND	ND	ND	0.6	0.5 ng/L	
VOCs (mg/L)	1,1-Dichloroethene	0.03 mg/L	ND	0.001	0.012	0.001	0.008	0.002	0.001 mg/L	Korean drinking water standard
	Methylene chloride	0.02 mg/L	ND	ND	ND	ND	ND	ND	0.002 mg/L	
	Chloroform	0.08 mg/L	0.001	ND	ND	ND	ND	ND	0.001 mg/L	
	1,1,1-Trichloroethane	0.1 mg/L	ND	ND	0.003	ND	0.002	ND	0.001 mg/L	
	Carbon tetrachloride	0.002 mg/L	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Benzene	0.01 mg/L	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Trichloroethene	0.03 mg/L	0.090	0.038	0.038	0.025	0.071	0.042	0.001 mg/L	
	Bromodichloromethane	0.03 mg/L	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Toluene	0.7 mg/L	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Dibromochloromethane	0.1 mg/L	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Tetrachloroethene	0.01 mg/L	0.002	0.002	0.046	0.007	0.030	0.004	0.001 mg/L	
	Ethylbenzene	0.3 mg/L	ND	ND	ND	ND	ND	ND	0.001 mg/L	

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	Analytes	Standard (drinking water)	Drinking Water Well						LOQ	Notes
			20-575	14-283	16-289	15-286	12-247	13-279		
	o-Xylene	0.5 mg/L (o+m+p)	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	m-Xylene		ND	ND	ND	ND	ND	ND	0.001 mg/L	
	p-Xylene		ND	ND	ND	ND	ND	ND	0.001 mg/L	
	trans-1,2-Dichloroethene	0.1 mg/L	ND	ND	ND	ND	0.001	ND	0.0005 mg/L	EPA National primary drinking water regulations
	cis-1,2-Dichloroethene	0.07 mg/L	0.008	0.006	0.048	0.010	0.046	0.007	0.0005 mg/L	
	Bromoform	0.08 mg/L	ND	ND	ND	ND	ND	ND	0.001 mg/L	
PAHs (ng/L)	Acenaphthylene	-	ND	ND	ND	ND	ND	ND	0.017 ng/L	-
	Acenaphthene	-	ND	ND	ND	ND	ND	ND	0.035 ng/L	
	Fluorene	-	ND	ND	ND	ND	ND	ND	0.027 ng/L	
	Phenanthrene	-	ND	ND	ND	ND	ND	ND	0.049 ng/L	
	Anthracene	-	ND	ND	ND	ND	ND	ND	0.015 ng/L	
	Fluoranthene	-	ND	ND	ND	ND	ND	ND	0.022 ng/L	
	Pyrene	-	ND	ND	ND	ND	ND	ND	0.032 ng/L	
	Benzo(a)anthracene	-	ND	ND	ND	ND	ND	ND	0.031 ng/L	
	Chrysene	-	ND	ND	ND	ND	ND	ND	0.014 ng/L	
	Benzo(b)fluoranthene	-	ND	ND	ND	ND	ND	ND	0.019 ng/L	
	Benzo(k)fluoranthene	-	ND	ND	ND	ND	ND	ND	0.029 ng/L	
	Benzo(a)pyrene	200ng/L	ND	ND	ND	ND	ND	ND	0.023 ng/L	EPA National primary drinking water regulations
		700ng/L								WHO Guidelines for drinking water quality
	Indeno(1,2,3)Pyrene	-	ND	ND	ND	ND	ND	ND	0.022 ng/L	-

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	Analytes	Standard (drinking water)	Drinking Water Well						LOQ	Notes
			20-575	14-283	16-289	15-286	12-247	13-279		
	Dibenz(a,h)anthracene	-	ND	ND	ND	ND	ND	ND	0.019 ng/L	
	Benzo(g,h,i)perylene	-	ND	ND	ND	ND	ND	ND	0.027 ng/L	
	Total-PAHs	-	ND	ND	ND	ND	ND	ND	-	
TPHs (mg/L)	TPHs	1.5mg/L	ND	ND	ND	ND	ND	ND	0.2 mg/L	Groundwater remediation goal
Metals (mg/L)	Al	0.2 mg/L	ND	0.02	ND	ND	ND	ND	0.02 mg/L	Korean drinking water standard
	Fe	0.3 mg/L	0.06	1.54	0.10	2.24	2.35	1.45	0.05 mg/L	
	Mn	0.05 mg/L	ND	0.018	ND	0.067	0.04	0.016	0.005 mg/L	
	Zn	3 mg/L	ND	0.604	ND	3.879	2.960	0.305	0.002 mg/L	
	Cr	0.05 mg/L	ND	ND	ND	ND	ND	ND	0.02 mg/L	
	Cd	0.005 mg/L	ND	ND	ND	ND	ND	ND	0.002 mg/L	
	Cu	1 mg/L	ND	ND	ND	ND	ND	ND	0.008 mg/L	
	Pb	0.01 mg/L	ND	ND	ND	ND	ND	ND	0.005 mg/L	
	As	0.01 mg/L	ND	ND	ND	ND	ND	ND	0.005 mg/L	
	Se	0.01 mg/L	ND	0.010	ND	0.063	0.047	0.006	0.005 mg/L	
	B	1 mg/L	0.07	0.13	0.03	0.06	0.06	0.14	0.01 mg/L	
	Hg	0.001 mg/L	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Ba	2 mg/L	0.04	0.02	0.04	0.02	0.03	0.02	0.002 mg/L	EPA drinking water MCL

4/4/05

❑ Table Ⅳ-2. Concentrations of analyzed contaminants from monitoring well

	Analytes	Standard (drinking water)	Monitoring Well								LOQ	Notes
			B09-176MW	B09-177MW	B09-178MW	B09-221MW	B03-463MW	B07-219MW	B07-221MW	B07-220MW		
Herbicides (μg/L)	2,4-D	70 μg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.101 μg/L	EPA National primary drinking water regulations
		30 μg/L										WHO Guidelines for drinking water quality
	2,4,5-T	9 μg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.062 μg/L	WHO Guidelines for drinking water quality
Dioxins /Furans (pg/L)	2,3,7,8-TCDF		ND	ND	ND	ND	ND	ND	ND	ND	0.5 pg/L	EPA National primary drinking water regulations
	1,2,3,7,8-PeCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	2,3,4,7,8-PeCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,4,7,8-HxCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,6,7,8-HxCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,7,8,9-HxCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	2,3,4,6,7,8-HxCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,4,6,7,8-HpCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,4,7,8,9-HpCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	OCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	2,3,7,8-TCDD	30 pg/L	ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,7,8-PeCDD		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,4,7,8-HxCDD		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,6,7,8-HxCDD		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,7,8,9-HxCDD		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,4,6,7,8-HpCDD		ND	ND	ND	ND	ND	ND	ND	ND		
	OCDD		ND	ND	0.8	ND	0.621	ND	ND	1.308		
	I-TEQ(pg-TEQ/L)				0.001	ND	0.001	ND	ND	0.001		

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	Analytes	Standard (drinking water)	Monitoring Well								LOQ	Notes
			B09-176MW	B09-177MW	B09-178MW	B09-221MW	B03-463MW	B07-219MW	B07-221MW	B07-220MW		
Chloriated pesticides (ng/L)	α-HCH	-	1.4	0.6	69.8	ND	373.9	27.0	31.7	12.1	0.5 ng/L	-
	β-HCH	-	ND	1.4	0.8	ND	627.8	186.1	8.0	181.0	0.5 ng/L	-
	γ-HCH(Lindane)	2000 ng/L	31.2	1.1	2726.0	20.2	3648.8	83.4	20.8	100.4	0.5 ng/L	WHO Guidelines for drinking water quality
	δ-HCH	-	ND	ND	290.0	ND	1148.4	35.8	39.3	12.1	0.5 ng/L	-
	HCB	-	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	Heptachlor	-	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	Heptachlor Epoxide	-	1.4	ND	ND	ND	1.0	1.2	ND	4.3	0.5 ng/L	-
	Aldrin	30 ng/L (Aldrin+ Dieldrin)	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	WHO Guidelines for drinking water quality
	Dieldrin		3.2	1.0	3.4	ND	5.4	211.0	30.9	42.2	0.5 ng/L	
	Endrin	600 ng/L	1.2	2.2	ND	ND	ND	3.4	ND	0.6	0.5 ng/L	
	Oxychlordane	-	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	trans-Chlordane	200 ng/L (*trans*+*cis*)	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	WHO Guidelines for drinking water quality
	cis-Chlordane		ND	ND	ND	ND	0.8	0.9	ND	0.6	0.5 ng/L	
	trans-Nonachlor	-	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	cis-Nonachlor	-	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	2,4-DDE	1000 ng/L	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	WHO Guidelines for drinking water quality
	4,4-DDE		ND	ND	ND	ND	ND	ND	ND	4.3	0.5 ng/L	
	2,4-DDD		ND	ND	ND	ND	ND	0.6	ND	1.5	0.5 ng/L	
	4,4-DDD		ND	ND	ND	ND	ND	0.5	1.1	2.7	0.5 ng/L	
	2,4-DDT		ND	ND	ND	ND	ND	0.5	ND	4.3	0.5 ng/L	
	4,4-DDT		ND	ND	ND	ND	ND	1.1	1.2	42.5	0.5 ng/L	

	Analytes	Standard (drinking water)	Monitoring Well								LOQ	Notes
			B09-176MW	B09-177MW	B09-178MW	B09-221MW	B03-463MW	B07-219MW	B07-221MW	B07-220MW		
	Mirex	-	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	Pentachlorobenzene		ND	ND	ND	ND	ND	ND	ND	3.3	0.5 ng/L	
	α-Endosulfan	600 ng/L	1.9	ND	ND	ND	ND	ND	0.6	1.2	0.5 ng/L	
	β-Endosulfan		3.5	1.9	ND	ND	ND	ND	ND	ND	0.5 ng/L	
VOCs (mg/L)	1,1-Dichloroethene	0.03 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	Korean drinking water standard
	Methylene chloride	0.02 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.002 mg/L	
	Chloroform	0.08 mg/L	ND	ND	ND	ND	0.001	ND	0.006	0.002	0.001 mg/L	
	1,1,1-Trichloroethane	0.1 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Carbon tetrachloride	0.002 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Benzene	0.01 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Trichloroethene	0.03 mg/L	0.001	ND	ND	ND	0.077	0.102	0.201	0.238	0.001 mg/L	
	Bromodichloromethane	0.03 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Toluene	0.7 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Dibromochloromethane	0.1 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Tetrachloroethene	0.01 mg/L	0.002	ND	0.211	ND	0.241	0.415	0.198	0.125	0.001 mg/L	
	Ethylbenzene	0.3 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	o-Xylene	0.5 mg/L (o+m+p)	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	m-Xylene		ND	ND	ND	ND	ND	0.001	ND	ND	0.001 mg/L	
	p-Xylene		ND	ND	ND	ND	ND	0.001	ND	ND	0.001 mg/L	
	trans-1,2-Dichloroethene	0.1 mg/L	ND	ND	ND	ND	ND	0.003	0.001	0.001	0.0005 mg/L	EPA National

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	Analytes	Standard (drinking water)	Monitoring Well								LOQ	Notes
			B09-176MW	B09-177MW	B09-178MW	B09-221MW	B03-463MW	B07-219MW	B07-221MW	B07-220MW		
	cis-1,2-Dichloroethene	0.07 mg/L	ND	ND	ND	0.001	0.129	0.076	0.099	0.089	0.0005 mg/L	primary drinking water regulations
	Bromoform	0.08 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
PAHs (ng/L)	Acenaphthylene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.017 ng/L	-
	Acenaphthene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.035 ng/L	
	Fluorene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.027 ng/L	
	Phenanthrene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.049 ng/L	
	Anthracene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.015 ng/L	
	Fluoranthene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.022 ng/L	
	Pyrene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.032 ng/L	
	Benzo(a)anthracene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.031 ng/L	
	Chrysene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.014 ng/L	
	Benzo(b)fluoranthene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.019 ng/L	
	Benzo(k)fluoranthene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.029 ng/L	
	Benzo(a)pyrene	200 ng/L	ND	ND	ND	ND	ND	ND	ND	ND	0.023 ng/L	EPA National primary drinking water regulations
		700 ng/L										WHO Guidelines for drinking water quality
	Indeno(1,2,3)Pyrene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.022 ng/L	-
	Dibenz(a,h)anthracene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.019 ng/L	
	Benzo(g,h,i)perylene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.027 ng/L	
	Total-PAHs	-	ND	ND	ND	ND	ND	ND	ND	ND	-	
TPHs (mg/L)	TPHs	1.5mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.2 mg/L	Groundwater remediation goal

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	Analytes	Standard (drinking water)	Monitoring Well								LOQ	Notes
			B09-176MW	B09-177MW	B09-178MW	B09-221MW	B03-463MW	B07-219MW	B07-221MW	B07-220MW		
Metals (mg/L)	Al	0.2 mg/L	0.18	ND	0.10	0.07	ND	0.08	0.03	0.07	0.02 mg/L	Korean drinking water standard
	Fe	0.3 mg/L	0.05	0.05	0.25	0.12	0.07	0.06	0.07	0.08	0.05 mg/L	
	Mn	0.05 mg/L	0.021	ND	ND	0.005	0.016	ND	0.024	0.032	0.005 mg/L	
	Zn	3 mg/L	0.015	0.012	0.117	0.007	0.008	ND	0.006	ND	0.002 mg/L	
	Cr	0.05 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.02 mg/L	
	Cd	0.005 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.002 mg/L	
	Cu	1 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.008 mg/L	
	Pb	0.01 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.005 mg/L	
	As	0.01 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.005 mg/L	
	Se	0.01 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.005 mg/L	
	B	1 mg/L	ND	ND	ND	ND	0.01	0.04	0.02	0.04	0.01 mg/L	
	Hg	0.001 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Ba	2 mg/L	0.06	0.05	0.03	0.04	0.05	0.04	0.13	0.11	0.002 mg/L	EPA drinking water MCL

	Analytes	Standard (drinking water)	Monitoring Well								LOQ	Note
			B07-217MW	B07-218MW	B09-193MW	B03-466MW	B03-467MW	B03-464MW	B03-468MW	B03-465MW		
Herbicides (μg/L)	2,4-D	70 μg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.101 μg/L	EPA National primary drinking water regulations
		30 μg/L										WHO Guidelines for drinking water quality
	2,4,5-T	9 μg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.062 μg/L	WHO Guidelines for drinking water quality
Dioxins /Furans (pg/L)	2,3,7,8-TCDF		ND	ND	ND	ND	ND	ND	ND	ND	0.5 pg/L	EPA National primary drinking water regulations
	1,2,3,7,8-PeCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	2,3,4,7,8-PeCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,4,7,8-HxCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,6,7,8-HxCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,7,8,9-HxCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	2,3,4,6,7,8-HxCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,4,6,7,8-HpCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,4,7,8,9-HpCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	OCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	2,3,7,8-TCDD	30 pg/L	ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,7,8-PeCDD		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,4,7,8-HxCDD		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,6,7,8-HxCDD		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,7,8,9-HxCDD		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,4,6,7,8-HpCDD		ND	ND	ND	ND	ND	ND	ND	ND		
	OCDD		ND	ND	ND	ND	ND	ND	ND	ND		
	I-TEQ(pg-TEQ/L)		ND	ND	ND	ND	ND	ND	ND	ND		

4411

	Analytes	Standard (drinking water)	Monitoring Well								LOQ	Note
			B07-217MW	B07-218MW	B09-193MW	B03-466MW	B03-467MW	B03-464MW	B03-468MW	B03-465MW		
Chloriated pesticides (ng/L)	α-HCH	-	43.5	1.0	22.4	34.4	8.5	0.6	ND	3.2	0.5 ng/L	-
	β-HCH	-	0.5	18.5	244.8	749.8	64.7	2.7	1.8	27.4	0.5 ng/L	-
	γ-HCH(Lindane)	2000 ng/L	46.3	6.9	120.0	279.1	1.7	6.5	2.8	10.3	0.5 ng/L	WHO Guidelines for drinking water quality
	δ-HCH	-	4.1	0.9	48.5	211.7	341.4	2.3	1.1	7.4	0.5 ng/L	-
	HCB	-	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	Heptachlor	-	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	Heptachlor Epoxide	-	ND	9.0	8.4	10.0	6.4	ND	0.6	2.6	0.5 ng/L	-
	Aldrin	30 ng/L (Aldrin+ Dieldrin)	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	WHO Guidelines for drinking water quality
	Dieldrin		24.1	30.5	57.7	79.8	0.7	ND	ND	7.6	0.5 ng/L	
	Endrin	600 ng/L	ND	ND	ND	0.5	ND	ND	ND	ND	0.5 ng/L	
	Oxychlordane	-	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	trans-Chlordane	200 ng/L (*trans*+*cis*)	ND	3.2	ND	ND	ND	ND	ND	ND	0.5 ng/L	WHO Guidelines for drinking water quality
	cis-Chlordane		ND	4.1	1.7	1.0	ND	ND	ND	0.6	0.5 ng/L	
	trans-Nonachlor	-	ND	0.8	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	cis-Nonachlor	-	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	2,4-DDE	1000 ng/L	ND	0.8	ND	ND	ND	ND	ND	ND	0.5 ng/L	WHO Guidelines for drinking water quality
	4,4-DDE		ND	8.9	0.7	ND	ND	0.6	ND	ND	0.5 ng/L	
	2,4-DDD		ND	21.0	ND	9.7	ND	ND	ND	ND	0.5 ng/L	
	4,4-DDD		ND	49.9	ND	ND	ND	ND	ND	0.7	0.5 ng/L	
	2,4-DDT		ND	4.4	ND	ND	ND	ND	ND	ND	0.5 ng/L	
	4,4-DDT		ND	19.7	1.0	ND	ND	1.4	2.3	ND	0.5 ng/L	
	Mirex	-	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	Pentachlorobenzene		ND	ND	1.9	1.7	ND	ND	ND	ND	0.5 ng/L	

4412

	Analytes	Standard (drinking water)	Monitoring Well								LOQ	Note
			B07-217MW	B07-218MW	B09-193MW	B03-466MW	B03-467MW	B03-464MW	B03-468MW	B03-465MW		
	α-Endosulfan	600 ng/L	ND	8.2	3.3	ND	2.2	0.6	ND	ND	0.5 ng/L	
	β-Endosulfan		ND	ND	0.7	ND	1.3	1.0	0.6	ND	0.5 ng/L	
VOCs (mg/L)	1,1-Dichloroethene	0.03 mg/L	ND	ND	ND	ND	ND	ND	ND	0.007	0.001 mg/L	Korean drinking water standard
	Methylene chloride	0.02 mg/L	ND	ND	ND	ND	ND	ND	ND	0.001	0.002 mg/L	
	Chloroform	0.08 mg/L	0.005	ND	0.002	0.002	ND	ND	ND	ND	0.001 mg/L	
	1,1,1-Trichloroethane	0.1 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Carbon tetrachloride	0.002 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Benzene	0.01 mg/L	ND	ND	ND	ND	0.008	ND	ND	0.005	0.001 mg/L	
	Trichloroethene	0.03 mg/L	0.743	0.004	0.427	0.021	ND	0.016	ND	0.132	0.001 mg/L	
	Bromodichloromethane	0.03 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Toluene	0.7 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Dibromochloromethane	0.1 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Tetrachloroethene	0.01 mg/L	0.497	0.033	0.063	0.227	ND	0.031	0.034	0.025	0.001 mg/L	
	Ethylbenzene	0.3 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	o-Xylene	0.5 mg/L (o+m+p)	ND	ND	ND	ND	0.002	ND	ND	ND	0.001 mg/L	
	m-Xylene		ND	ND	ND	ND	0.001	ND	ND	0.001	0.001 mg/L	
	p-Xylene		ND	ND	ND	ND	0.002	ND	ND	0.001	0.001 mg/L	
	trans-1,2-Dichloroethene	0.1 mg/L	0.005	ND	0.001	ND	ND	ND	ND	0.042	0.0005 mg/L	EPA National

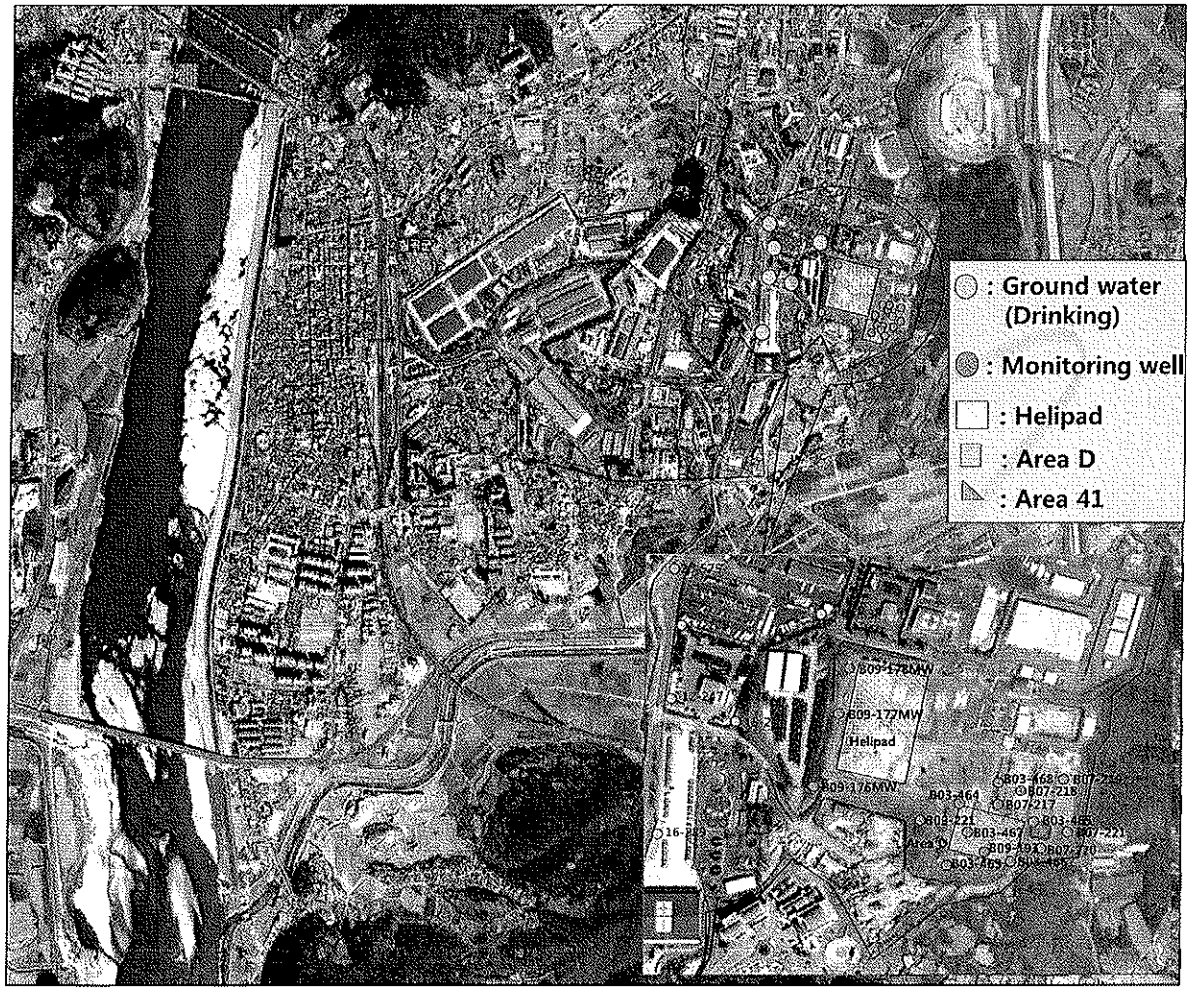
4413

	Analytes	Standard (drinking water)	Monitoring Well								LOQ	Note
			B07-217MW	B07-218MW	B09-193MW	B03-466MW	B03-467MW	B03-464MW	B03-468MW	B03-465MW		
	cis-1,2-Dichloroethene	0.07 mg/L	0.280	0.031	0.099	0.041	ND	ND	ND	1.346	0.0005 mg/L	primary drinking water regulations
	Bromoform	0.08 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
PAHs (ng/L)	Acenaphthylene	-	ND	-	-	-	ND	ND	ND	ND	0.017 ng/L	-
	Acenaphthene	-	ND	-	-	-	ND	ND	ND	ND	0.035 ng/L	
	Fluorene	-	ND	-	-	-	ND	ND	ND	ND	0.027 ng/L	
	Phenanthrene	-	ND	-	-	-	ND	ND	ND	ND	0.049 ng/L	
	Anthracene	-	ND	-	-	-	ND	ND	ND	ND	0.015 ng/L	
	Fluoranthene	-	ND	-	-	-	ND	ND	ND	ND	0.022 ng/L	
	Pyrene	-	ND	-	-	-	ND	ND	ND	ND	0.032 ng/L	
	Benzo(a)anthracene	-	ND	-	-	-	ND	ND	ND	ND	0.031 ng/L	
	Chrysene	-	ND	-	-	-	ND	ND	ND	ND	0.014 ng/L	
	Benzo(b)fluoranthene	-	ND	-	-	-	ND	ND	ND	ND	0.019 ng/L	
	Benzo(k)fluoranthene	-	ND	-	-	-	ND	ND	ND	ND	0.029 ng/L	
	Benzo(a)pyrene	200 ng/L	ND	-	-	-	ND	ND	ND	ND	0.023 ng/L	EPA National primary drinking water regulations
		700 ng/L										WHO Guidelines for drinking water quality
	Indeno(1,2,3)Pyrene	-	ND	-	-	-	ND	ND	ND	ND	0.022 ng/L	-
	Dibenz(a,h)anthracene	-	ND	-	-	-	ND	ND	ND	ND	0.019 ng/L	
	Benzo(g,h,i)perylene	-	ND	-	-	-	ND	ND	ND	ND	0.027 ng/L	
	Total-PAHs	-	ND			-	ND	ND	ND	ND	-	

	Analytes	Standard (drinking water)	Monitoring Well								LOQ	Note
			B07-217MW	B07-218MW	B09-195MW	B03-466MW	B03-467MW	B03-464MW	B03-468MW	B03-465MW		
TPHs (mg/L)	TPHs	1.5mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.2 mg/L	Groundwater remediation goal
Metals (mg/L)	Al	0.2 mg/L	ND	0.99	0.06	ND	ND	0.24	0.52	0.03	0.02 mg/L	Korean drinking water standard
	Fe	0.3 mg/L	0.06	0.07	0.08	ND	ND	0.11	ND	ND	0.05 mg/L	
	Mn	0.05 mg/L	0.015	0.113	0.101	0.601	6.457	0.008	0.007	0.299	0.005 mg/L	
	Zn	3 mg/L	0.007	0.009	0.011	0.004	0.003	0.014	ND	0.005	0.002 mg/L	
	Cr	0.05 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.02 mg/L	
	Cd	0.005 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.002 mg/L	
	Cu	1 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.008 mg/L	
	Pb	0.01 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.005 mg/L	
	As	0.01 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.005 mg/L	
	Se	0.01 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.005 mg/L	
	B	1 mg/L	ND	ND	ND	0.03	0.10	0.01	0.01	0.01	0.01 mg/L	
	Hg	0.001 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Ba	2 mg/L	0.06	0.08	0.06	0.07	0.08	0.12	0.01	0.19	0.002 mg/L	EPA drinking water MCL

4415

Appendix 1 | Sampling points



 4416

Appendix 2 Analytical Methods and Conditions

❑ Herbicides (2,4-D, 2,4,5-T)

○ Analytical method (Korean Official Testing Method for Drinking Water)

Funnel

- sample 200mL
- H_2SO_4 5mL
- Na_2SO_4 60g
- shaking
- Ether 25mL
- shaking
- transfer

Organic(Ether)

- dryness
- Trifluoroacetic anhydride 100㎕
- Trifluoroethanol 50㎕
- 80℃, 1hr
- cooling
- dryness
- adding ethyl acetate 100㎕

(containing phenanthrene-d10 10ppm ; ISTD)

GC/MSD

○ GC/MS condition

GC	Instrument	Agilent 7890A
	Injection mode	Splitless, 2㎕, 280℃ (purge time 0.75min)
	Separation column	DB5-MS (30m×0.25mm×250㎛ film thickness)
	Oven temperature	100℃ → 10℃/min → 300℃ (min), (21min)
	Carrier gas flow	Helium (99.9999%), 0.7㎖/min
MS	Instrument	Agilent 5975C
	Ion mode	SIM mode
	Resolution	above 1,000
	Ionization mode	Electron Ionization
	Ionization energy	70 eV
	Ion source temp.	200℃

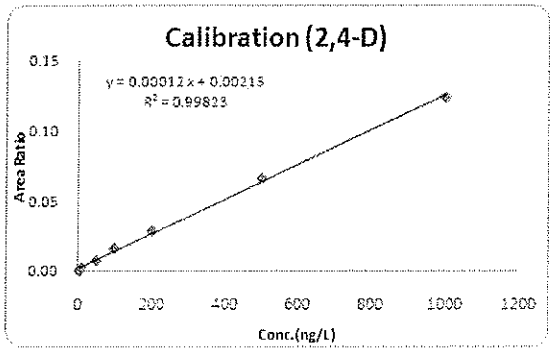
4417

❍ **Calibrations** : 5, 10, 50, 100, 200, 500, 1000 ng/L

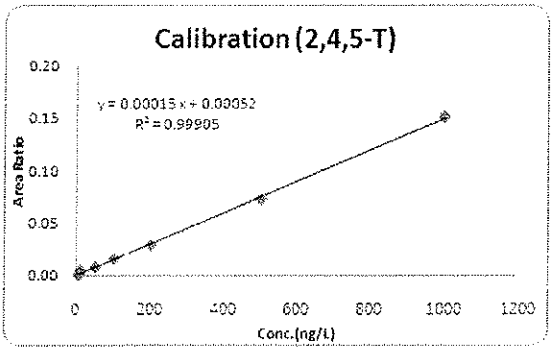
Compound	Calibration Curve	R^2	Recovery (%)
2,4-D	y=0.00012x + 0.00213	0.99823	89.8
2,4,5-T	y=0.00015x + 0.00052	0.99905	97.2

❍ Calibration curves

- 2,4-D



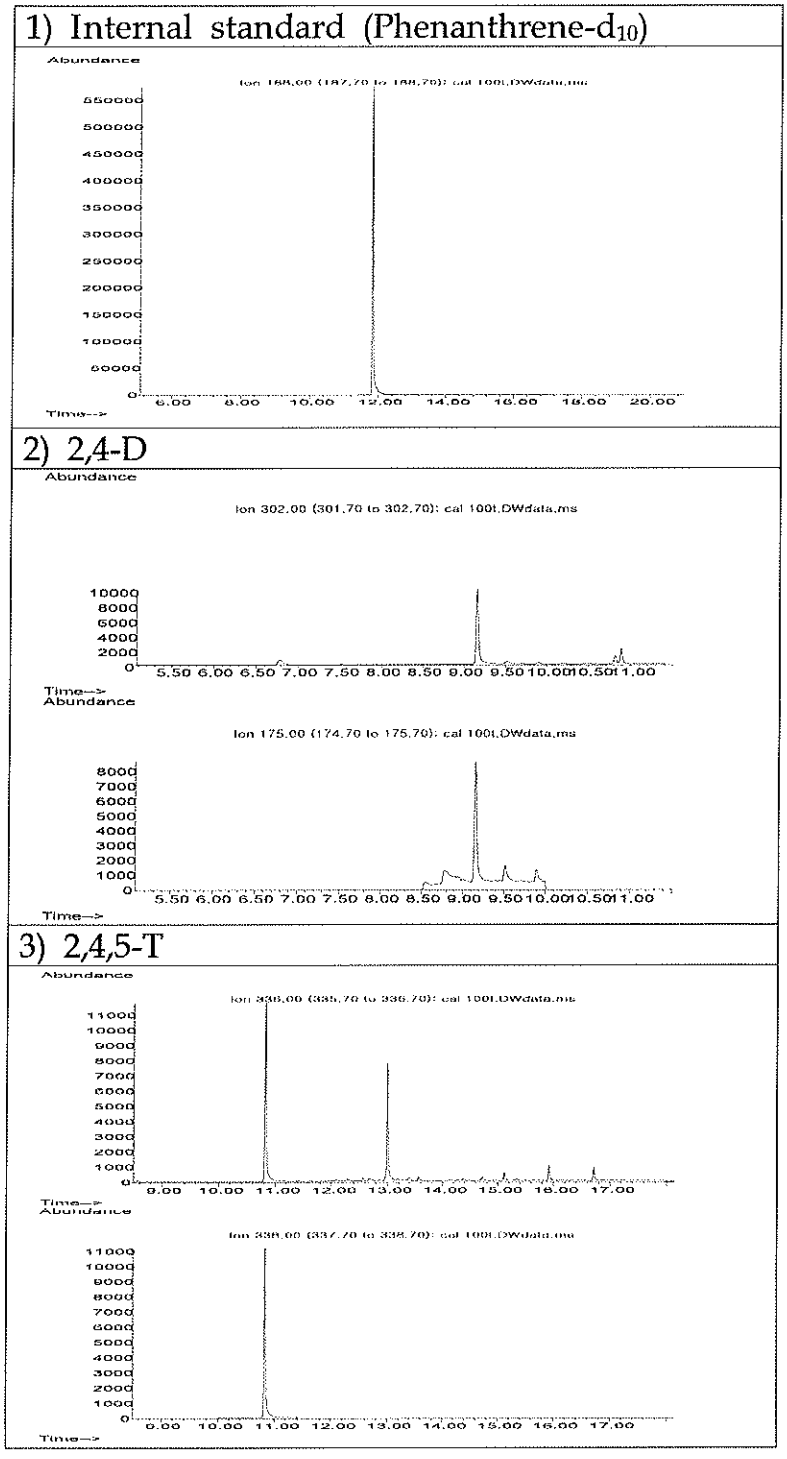
- 2,4,5-T



4418

❍ **Chromatogram** (100 ng/L)

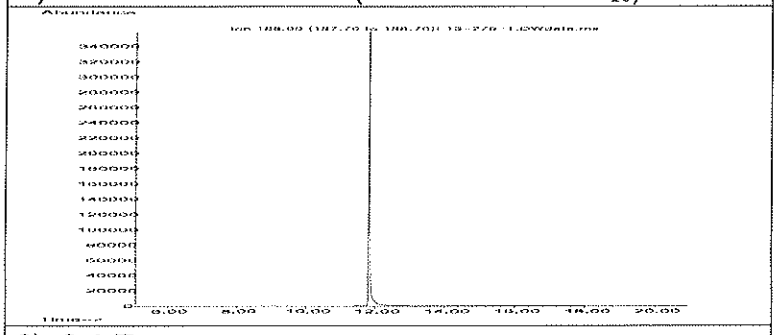
- Standards



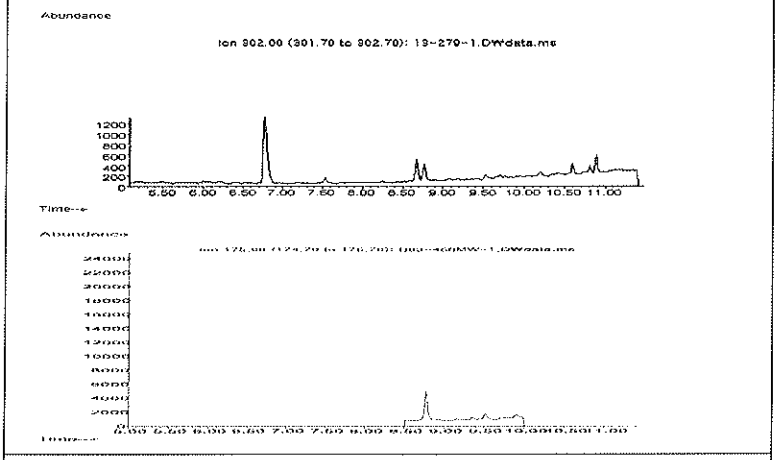
4919

- Samples : 13-279 (Drinking water well)

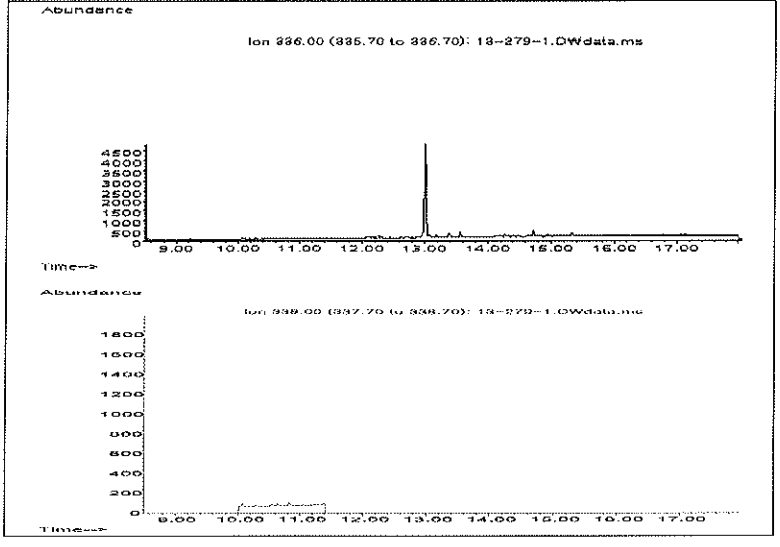
1) Internal standard (Phenanthrene-d_{10})



2) 2,4-D



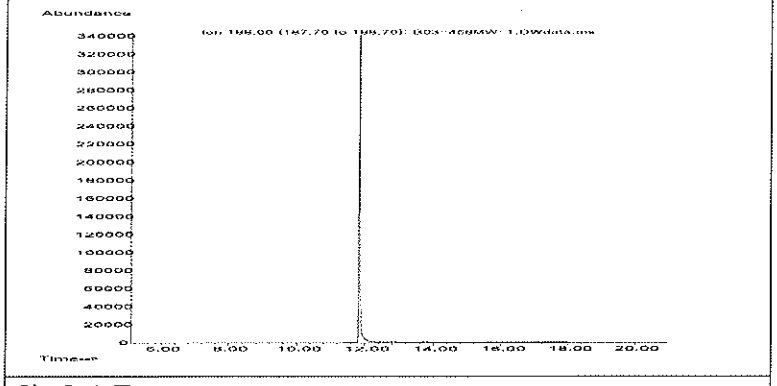
3) 2,4,5-T



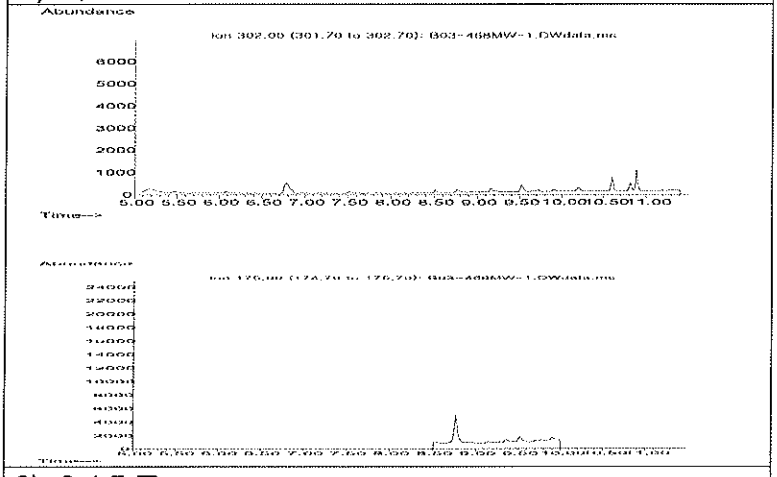
4420

- Samples : B03-468MW (Monitoring well)

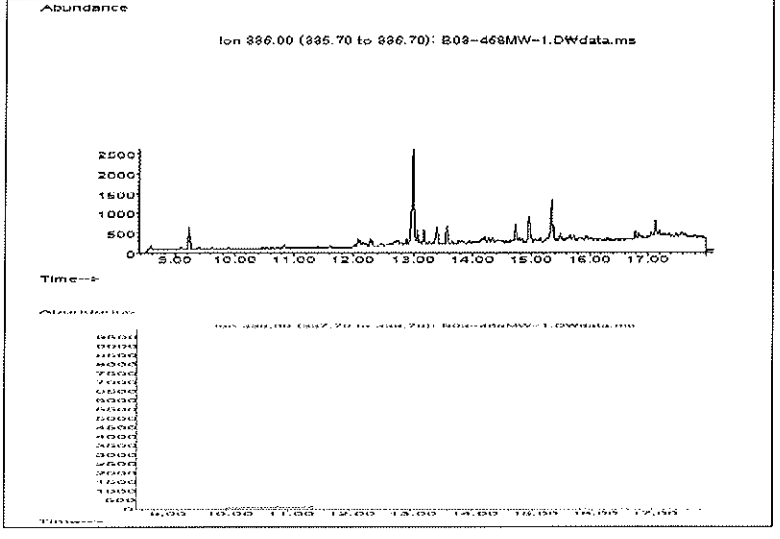
1) Internal standard (Phenanthrene-d_{10})



2) 2,4-D



3) 2,4,5-T



4421

❑ Dioxins/Furans (17 types of 2,3,7,8-congeners)

○ Analytical method (Korean Official Analytical Standards for Persistent Organic Pollutants (ES 10368.1))

Sample preparation
- Sample 10 L
- Surrogate STD (^{13}C-labeled 15 standards) 1 ng (^{13}C-OCDD 2 ng)

Extraction (separatory funnel)
- DCM 100 mL (X3)
- anhydrous sodium sulfate 50 g
- concentration (1 mL, rotary evaporator)
- concentration (100 μL, N_2)
- n-Hexane 2 mL

Multilayered Silicagel column (15mm I.D. x 30cm glass column)
- from top 6g Na_2SO_4, 3g 10%-$AgNO_3$ Impregnated silicagel, 0.9g Silicagel, 6g 22%-H_2SO_4 Impregnated silicagel, 4.5g 44%-H_2SO_4 Impregnated silicagel, 0.9g Silicagel, 3g 2%-KOH Impregnated silicagel, 0.9g Silicagel
- n-Hexane 150 mL
- concentration (5 mL, rotary evaporator)
- concentration (1 mL, N_2)

Alumina column (15mm I.D. x 30cm glass column)
- from top anhydrous sodium sulfate 2g, activated alumina 6g
- 2% dichloromethane in hexane 100 mL
- 50% dichloromethane in hexane 150 mL
- concentration (1 mL, rotary evaporator)
- concentration (100 μL, N_2)
- solvent transfer(toluene)
- Internal STD (^{13}C-1,2,3,4-TCDD, 1,2,3,7,8,9-HxDD) 1 ng
- final volumn 10~50 μL

HRGC/HRMS

○ GC/MS condition

HRGC	Instrument	HP 6890
	Injection mode	Splitless, 1㎕, 260℃ (purge time 6min)
	Separation column	SP2331 (60m×0.32mm×250㎛ film thickness)
	Oven temperature	120℃ (3min)→20℃/min→220℃ (5min)→3℃/min →260℃ (27min)
	Carrier gas flow	Helium (99.9999%), 1.0㎖/min
HRMS	Instrument	Autospec Ultima Premier
	Ion mode	SIM (M/M+2, M+2/M+4)
	Resolution	above 10,000 (10% Valley)
	Ionization mode	Electron Ionization Positive Mode (EI^+)
	Ionization energy	36 eV
	Ion source temp.	260℃

4/22

○ Calibrations

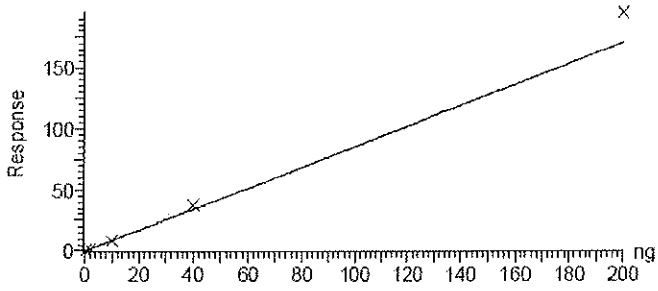
Calibration Standards (Unit : pg/μL)						Recovery
PCDDs/PCDFs	CS1	CS2	CS3	CS4	CS5	(%)
2,3,7,8-TeCDD	0.5	2.0	10	40	200	
2,3,7,8,-TeCDF	0.5	2.0	10	40	200	
1,2,3,7,8-PeCDD	2.5	10	50	200	1000	
1,2,3,7,8-PeCDF	2.5	10	50	200	1000	
2,3,4,7,8-PeCDF	2.5	10	50	200	1000	
1,2,3,4,7,8-HxCDD	2.5	10	50	200	1000	
1,2,3,6,7,8-HxCDD	2.5	10	50	200	1000	
1,2,3,7,8,9-HxCDD	2.5	10	50	200	1000	
1,2,3,4,7,8-HxCDF	2.5	10	50	200	1000	
1,2,3,6,7,8-HxCDF	2.5	10	50	200	1000	
1,2,3,7,8,9-HxCDF	2.5	10	50	200	1000	
2,3,4,6,7,8-HxCDF	2.5	10	50	200	1000	
1,2,3,4,6,7,8-HpCDD	2.5	10	50	200	1000	
1,2,3,4,6,7,8-HpCDF	2.5	10	50	200	1000	
1,2,3,4,7,8,9-HpCDF	2.5	10	50	200	1000	
1,2,3,4,6,7,8,9-OCDD	5.0	20	100	400	2000	
1,2,3,4,6,7,8,9-OCDF	5.0	20	100	400	2000	
$^{13}C_{12}$-1,2,3,4-TeCDD	100	100	100	100	100	-
$^{13}C_{12}$-2,3,7,8-TeCDD	100	100	100	100	100	74.7~99.0
^{37}Cl-2,3,7,8-TeCDD	0.5	2.0	10	40	200	-
$^{13}C_{12}$-2,3,7,8,-TeCDF	100	100	100	100	100	79.9~113.8
$^{13}C_{12}$-1,2,3,7,8-PeCDD	100	100	100	100	100	97.0~116.8
$^{13}C_{12}$-1,2,3,7,8-PeCD	100	100	100	100	100	-
$^{13}C_{12}$-2,3,4,7,8-PeCDF	100	100	100	100	100	84.5~106.6
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	100	100	100	100	100	80.4~100.3
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	100	100	100	100	100	69.7~92.5
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	100	100	100	100	100	-
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	100	100	100	100	100	71.0~95.8
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	100	100	100	100	100	70.3~101.7
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	100	100	100	100	100	62.2~102.2
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	100	100	100	100	100	63.3~106.0
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	100	100	100	100	100	79.4~104.2
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	100	100	100	100	100	67.7~93.0
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	100	100	100	100	100	56.4~80.1
$^{13}C_{12}$-1,2,3,4,6,7,8,9-OCDD	200	200	200	200	200	66.2~109.7

TeCDD = TetrachloroDibenzo-p-dioxin / TeCDF = Tetrachlorodibenzofuran
PeCDD = PentachloroDibenzo-p-dioxin / PeCDF = Pentachlorodibenzofuran
HxCDD = HexachloroDibenzo-p-dioxin / HxCDF = Hexachlorodibenzofuran
HpCDD = HeptachloroDibenzo-p-dioxin / HpCDF = Heptachlorodibenzofuran
OCDD = OctachloroDibenzo-p-dioxin / OCDF = Octachlorodibenzofuran

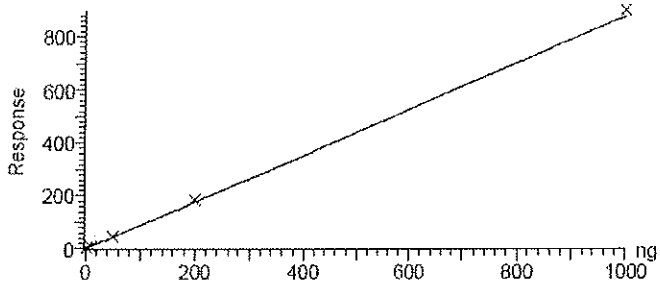
4423

○ Calibration curves

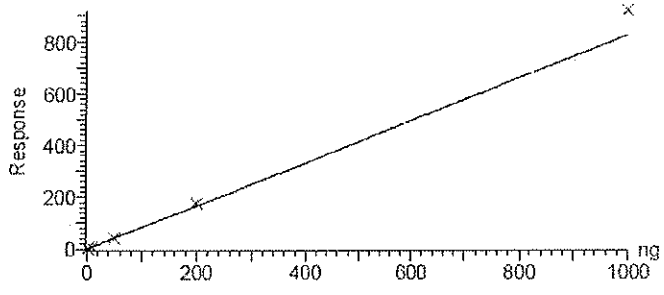
Compound name: 2378-TCDF
Response Factor: 0.850392
RRF SD: 0.106181, % Relative SD: 12.4861
Response type: Internal Std (Ref 18), Area * (IS Conc. / IS Area)
Curve type: RF



Compound name: 12378-PeCDF
Response Factor: 0.877089
RRF SD: 0.0510214, % Relative SD: 5.81713
Response type: Internal Std (Ref 19), Area * (IS Conc. / IS Area)
Curve type: RF

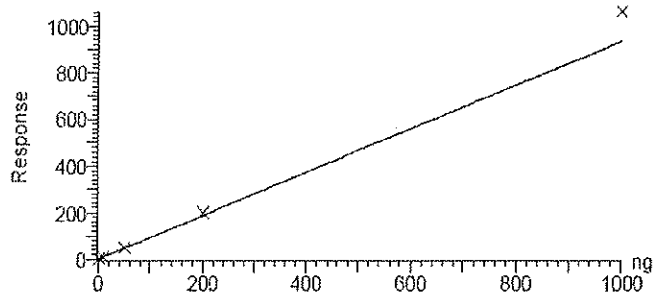


Compound name: 23478-PeCDF
Response Factor: 0.825018
RRF SD: 0.0886775, % Relative SD: 10.7485
Response type: Internal Std (Ref 20), Area * (IS Conc. / IS Area)
Curve type: RF

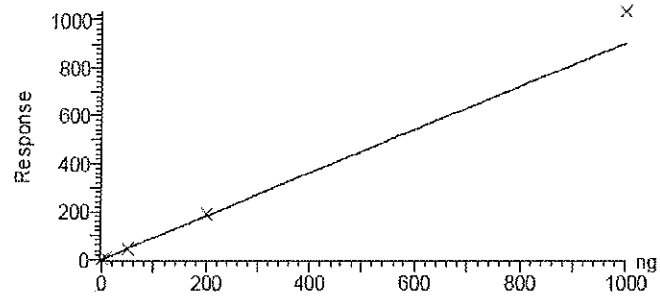


9424

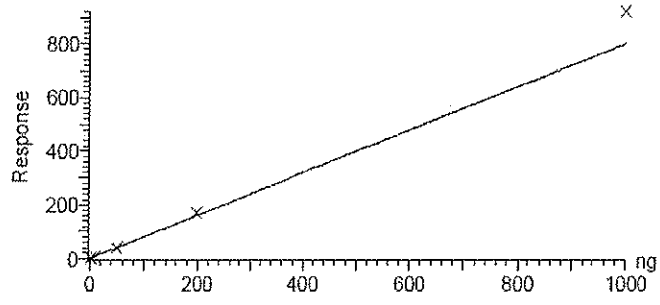
Compound name: 123478-HxCDF
Response Factor: 0.934887
RRF SD: 0.10656, % Relative SD: 11.3982
Response type: Internal Std (Ref 21), Area * (IS Conc. / IS Area)
Curve type: RF



Compound name: 123678-HxCDF
Response Factor: 0.904464
RRF SD: 0.0979612, % Relative SD: 10.8308
Response type: Internal Std (Ref 22), Area * (IS Conc. / IS Area)
Curve type: RF

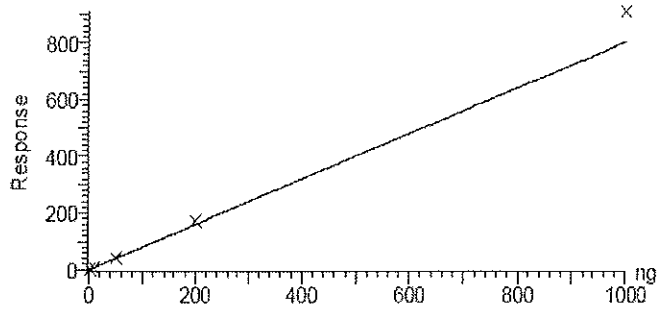


Compound name: 123789-HxCDF
Response Factor: 0.798906
RRF SD: 0.0930294, % Relative SD: 11.6446
Response type: Internal Std (Ref 23), Area * (IS Conc. / IS Area)
Curve type: RF

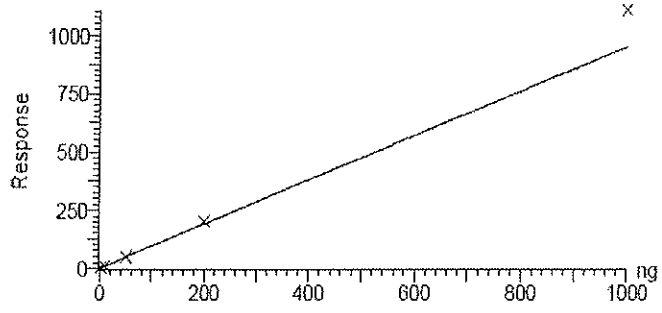


44 25

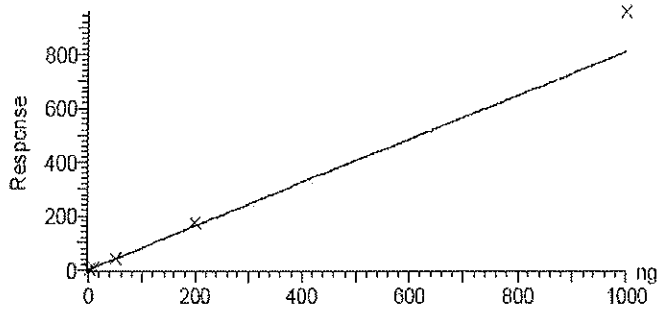
Compound name: 234678-HxCDF
Response Factor: 0.802589
RRF SD: 0.0935845, % Relative SD: 11.6603
Response type: Internal Std (Ref 24), Area * (IS Conc. / IS Area)
Curve type: RF



Compound name: 1234678-HpCDF
Response Factor: 0.949917
RRF SD: 0.1169, % Relative SD: 12.3063
Response type: Internal Std (Ref 25), Area * (IS Conc. / IS Area)
Curve type: RF

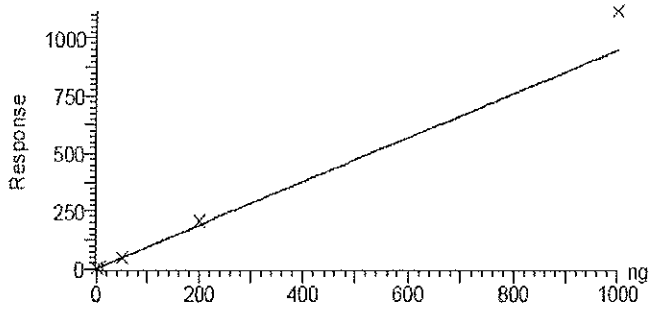


Compound name: 1234789-HpCDF
Response Factor: 0.809045
RRF SD: 0.112372, % Relative SD: 13.8894
Response type: Internal Std (Ref 26), Area * (IS Conc. / IS Area)
Curve type: RF

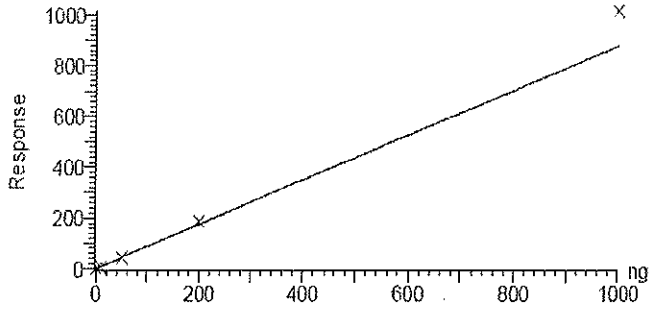


4486

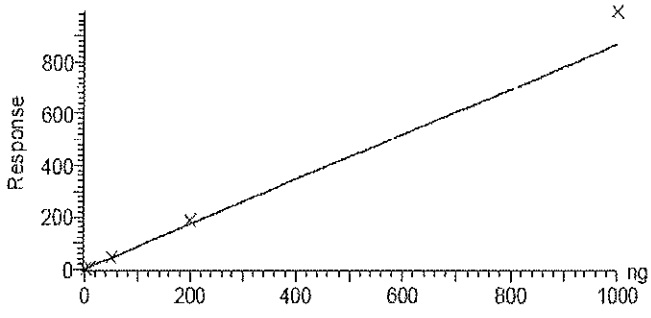
Compound name: 123478-HxCDD
Response Factor: 0.949809
RRF SD: 0.130455, % Relative SD: 13.7349
Response type: Internal Std (Ref 29), Area * (IS Conc. / IS Area)
Curve type: RF



Compound name: 123678-HxCDD
Response Factor: 0.878481
RRF SD: 0.110277, % Relative SD: 12.5531
Response type: Internal Std (Ref 30), Area * (IS Conc. / IS Area)
Curve type: RF

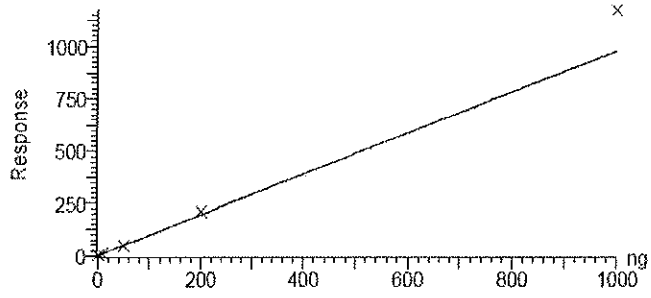


Compound name: 123789-HxCDD
Response Factor: 0.865829
RRF SD: 0.120217, % Relative SD: 13.8846
Response type: Internal Std (Ref 30), Area * (IS Conc. / IS Area)
Curve type: RF

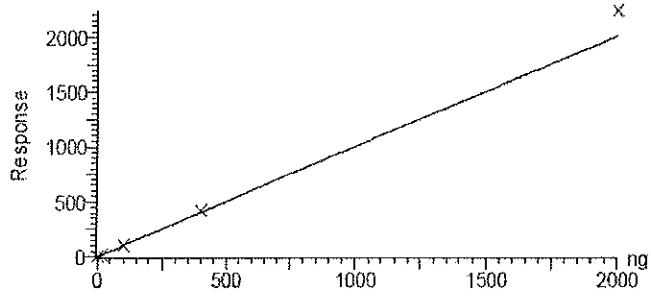


4927

Compound name: 1234678-HpCDD
Response Factor: 0.978146
RRF SD: 0.141371, % Relative SD: 14.4529
Response type: Internal Std (Ref 31), Area * (IS Conc. / IS Area)
Curve type: RF



Compound name: OCDD
Response Factor: 1.0059
RRF SD: 0.0872685, % Relative SD: 8.67569
Response type: Internal Std (Ref 32), Area * (IS Conc. / IS Area)
Curve type: RF



4428

○ Chromatogram

- 2,3,7,8-TCDD standard (CS1)

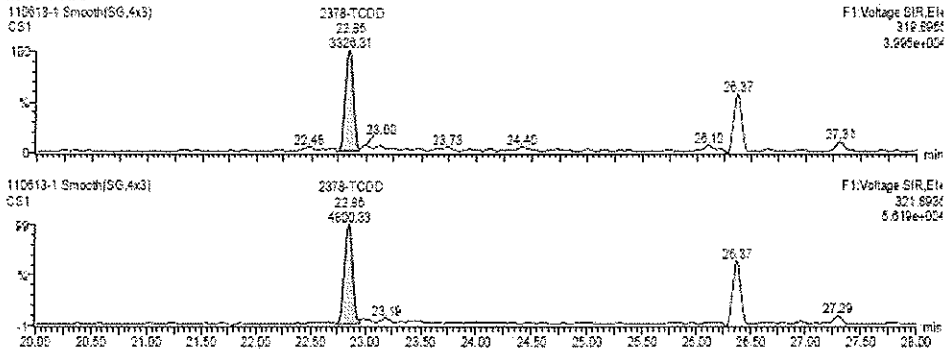
Quantify Sample Report **MassLynx 4.1**

Dataset: C:\MassLynx\DIOXIN11.PRO\Result\STD\110613_1-5.qld

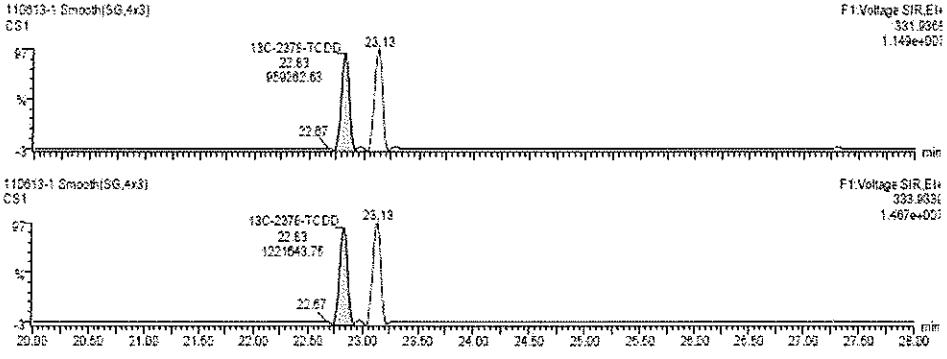
Last Altered: Monday, June 13, 2011 15:39:58 Korea Standard Time
Printed: Thursday, July 07, 2011 16:39:13 Korea Standard Time

Name: 110613-1, Date: 13-Jun-2011, Time: 09:45:52, ID: , Description: CS1

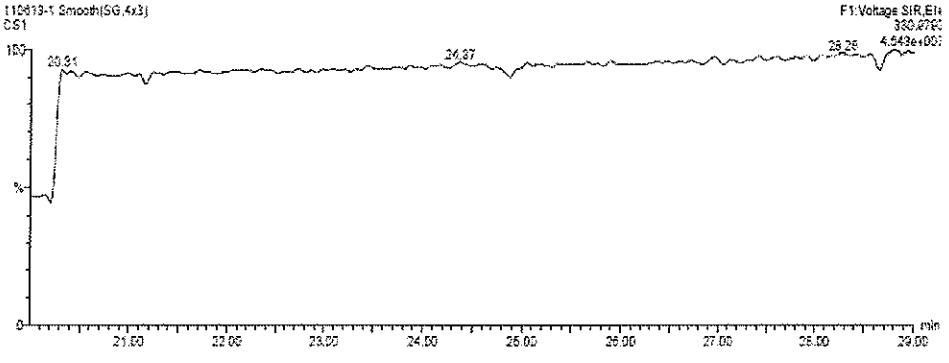
2378-TCDD



13C-2378-TCDD



LOCK MASS1



4/4 09

- OCDD standard (CS1)

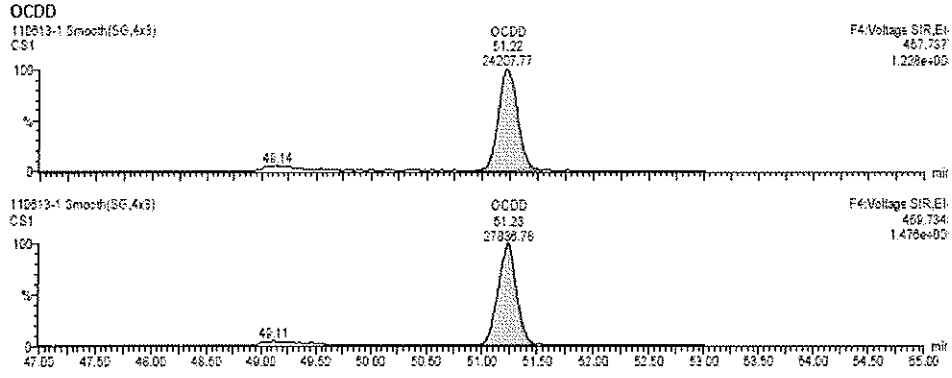
Quantify Sample Report **MassLynx 4.1**

Dataset: C:\MassLynx\DIOXIN11.PRO\Result\STD\110613_1-5.qld

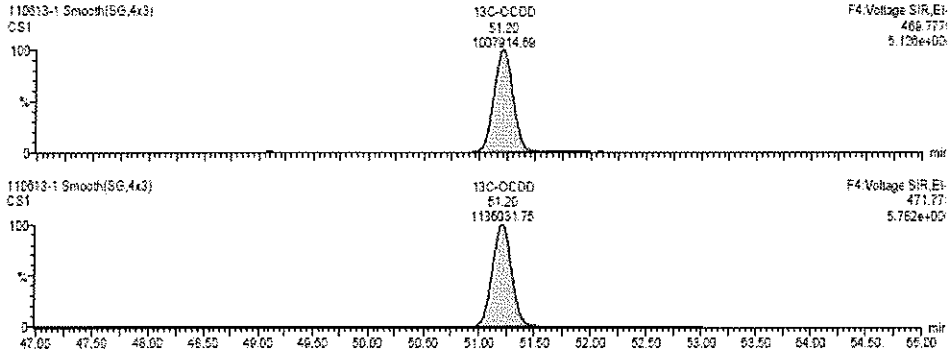
Last Altered: Monday, June 13, 2011 15:39:56 Korea Standard Time
Printed: Thursday, July 07, 2011 16:39:13 Korea Standard Time

Name: 110613-1, Date: 13-Jun-2011, Time: 09:45:52, ID: , Description: CS1

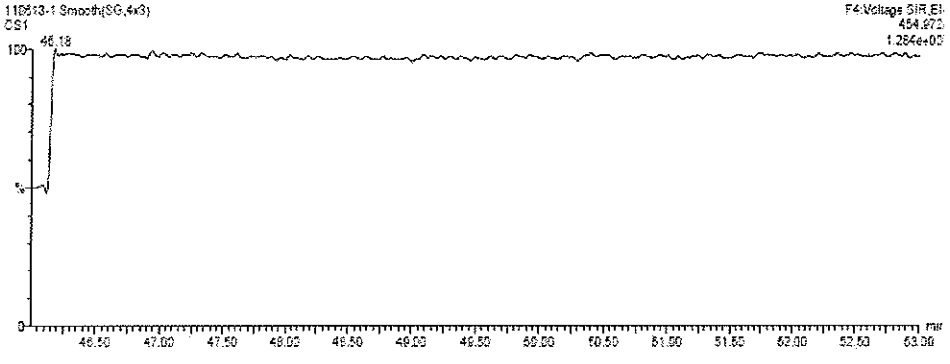
OCDD



13C-OCDD



LOCK MASS4



4430

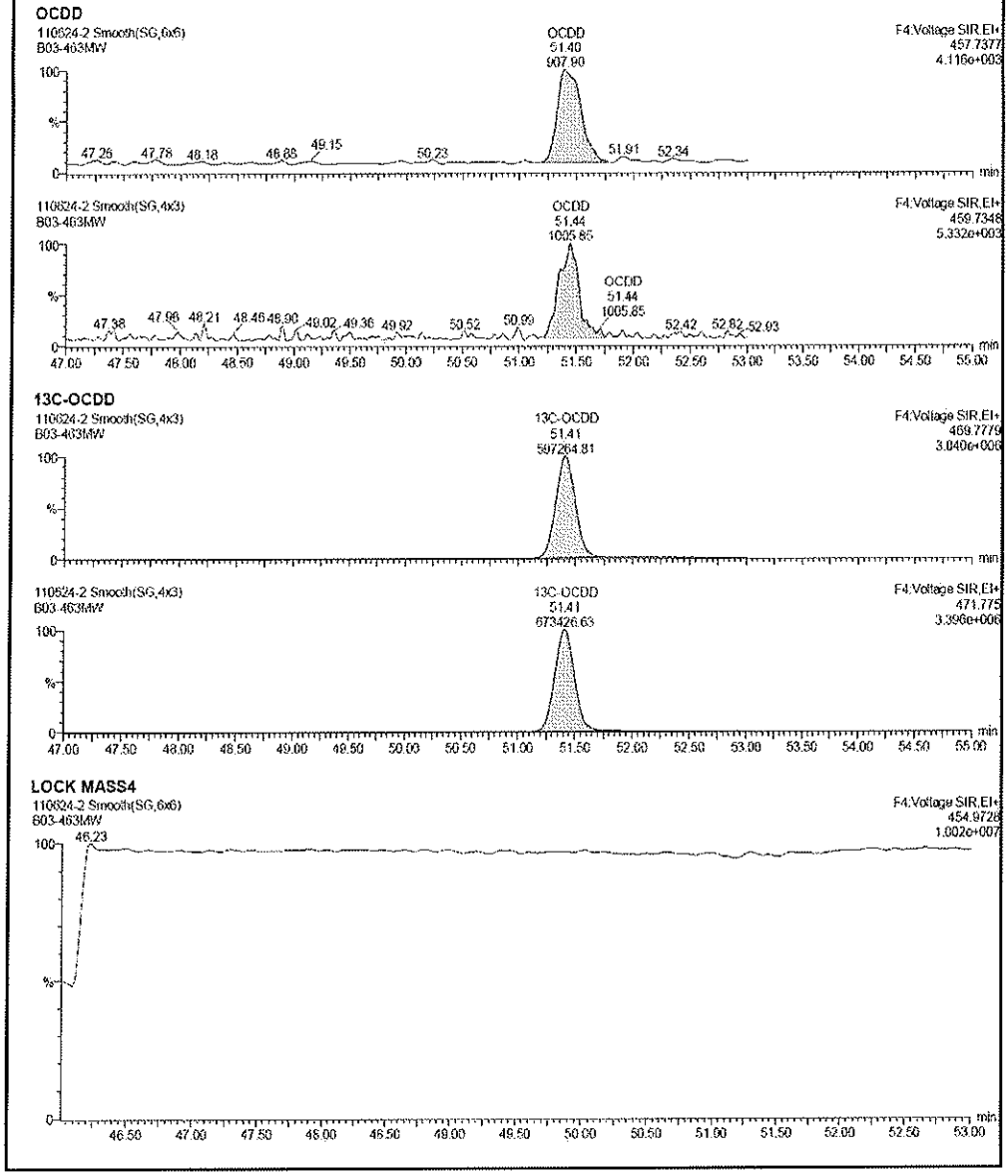
- Sample chromatogam of OCDD (B03-463MW)

Quantify Sample Report MassLynx 4.1

Dataset: C:\MassLynx\DIOXIN11.PRO\Result\sample\chilgok\110624_7-14_result.qld

Last Altered: Friday, July 01, 2011 13:35:57 Korea Standard Time
Printed: Friday, July 08, 2011 09:42:29 Korea Standard Time

Name: 110624-2, Date: 24-Jun-2011, Time: 18:19:44, ID: , Description: B03-463MW



44 31

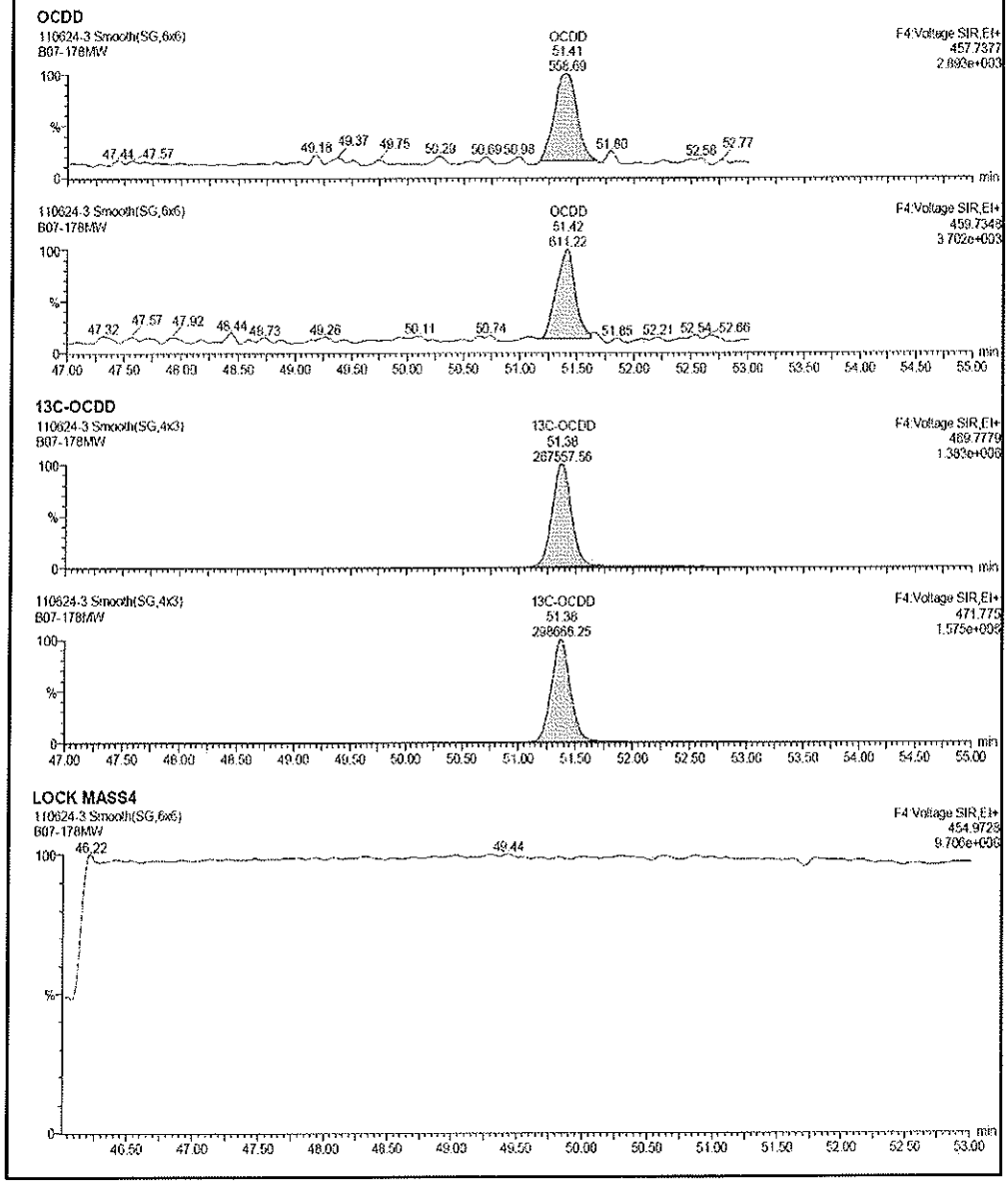
- Sample chromatogam of OCDD (B07-178MW)

Quantify Sample Report MassLynx 4.1

Dataset: C:\MassLynx\DIOXIN11.PRO\Result\sampfe\chilgok\110624_7-14_result.qld

Last Altered: Friday, July 01, 2011 13:35:57 Korea Standard Time
Printed: Friday, July 08, 2011 09:46:16 Korea Standard Time

Name: 110624-3, Date: 24-Jun-2011, Time: 19:17:31, ID: , Description: B07-178MW



4432

- Sample chromatogam of OCDD (B07-220MW)

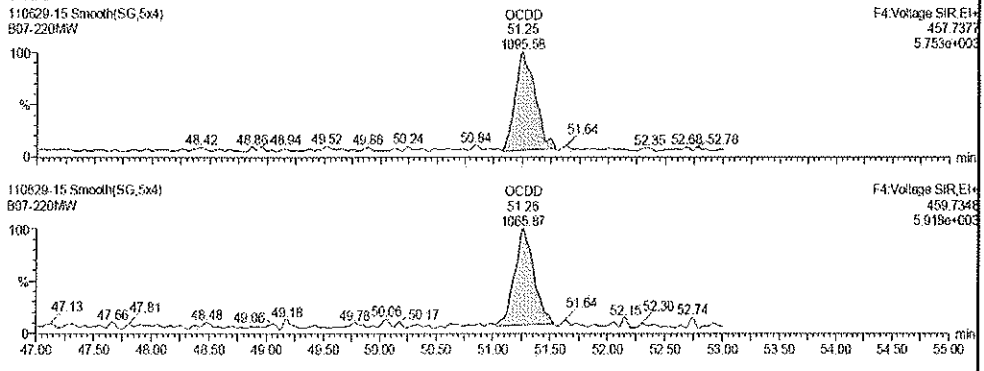
Quantify Sample Report MassLynx 4.1

Dataset: C:\MassLynx\DIOXIN11.PRO\Result\sample\chitgok\110629_9-18_result.qld

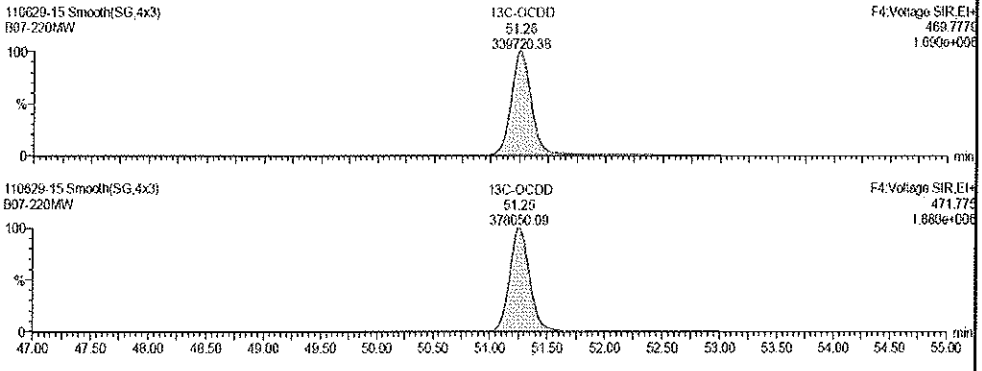
Last Altered: Friday, July 08, 2011 10:02:41 Korea Standard Time
Printed: Friday, July 08, 2011 10:03:28 Korea Standard Time

Name: 110629-15, Date: 30-Jun-2011, Time: 16:39:18, ID: , Description: B07-220MW

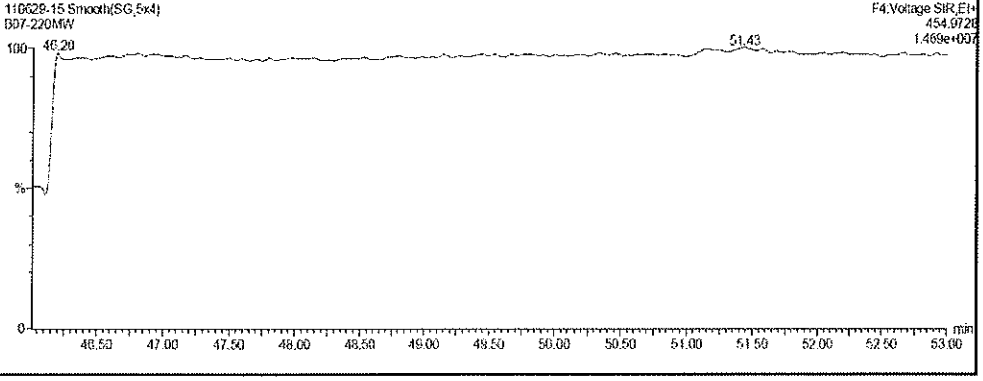
OCDD



13C-OCDD



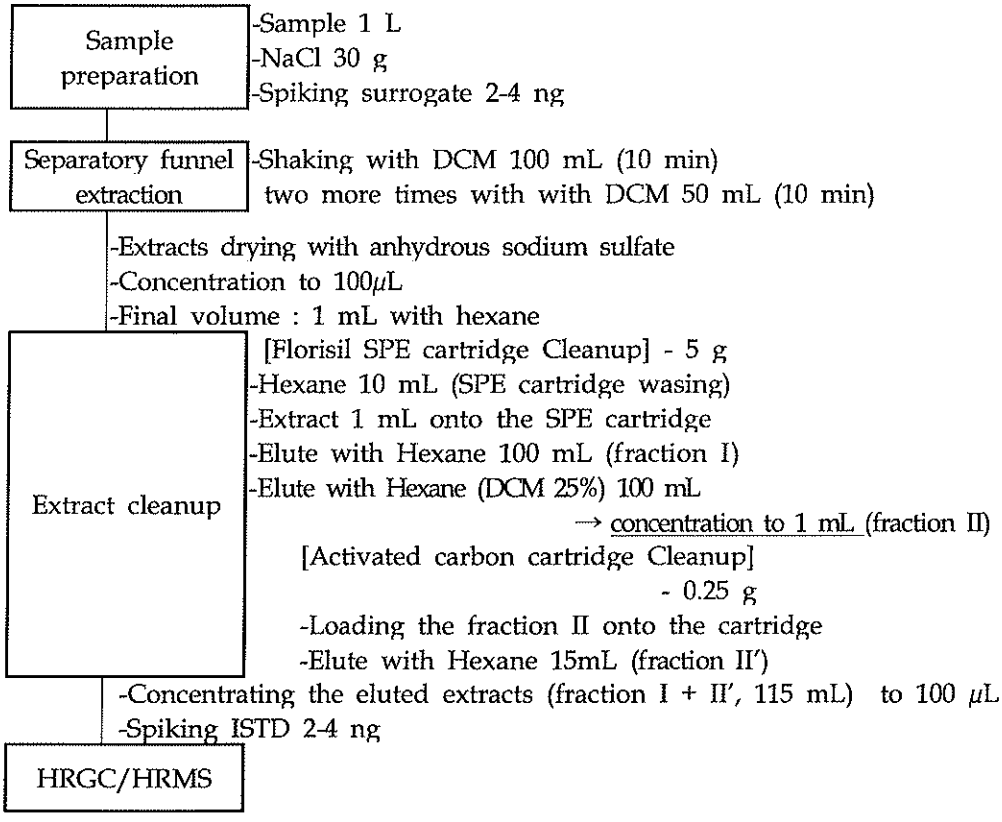
LOCK MASS4



4433

❑ OCPs

○ Analytical method (Korean Official Testing Method for Persistent Organic Pollutants Official Test Method (ES 10903.1a))



○ GC/MS condition

HRGC	Instrument	HP 6890N
	Injection mode	Splitless, 1㎕, 200℃ (purge time 6min)
	Separation column	ZB-Multiresidue-2 (30m×0.25mm×0.20㎛ film thickness)
	Oven temperature	100℃ (5min)→5℃/min→200℃ (5min)→2℃/min→220℃ (20min)→50℃/min→300℃
	Carrier gas flow	Helium (99.9999%), 1.0㎖/min
HRMS	Instrument	Micromass Autospec Ultima NT
	Ion mode	SIM (M/M+2, M+2/M+4)
	Resolution	above 10,000 (10% Valley)
	Ionization mode	Electron Ionization Positive Mode (EI^+)
	Ionization energy	36 eV
	Ion source temp.	260℃

4434

○ **Calibrations** : 2, 10, 40, 200, 800 ng/mL

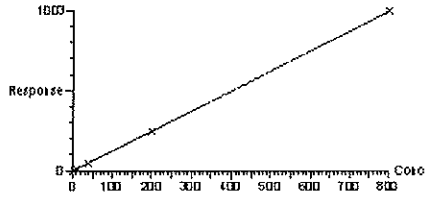
(Surrogates and Internal Standards : 20 ng/mL)

Compound	Response Factor	% RSD
α-HCH	1.249	3.389
β-HCH	1.149	3.008
γ-HCH(Lindane)	1.236	4.428
δ-HCH	1.242	3.841
HCB	0.998	1.404
Heptachlor	1.102	7.398
c-Heptachlor Epoxide	0.920	9.496
t-Heptachlor Epoxide	0.208	5.619
Aldrin	1.001	5.483
Dieldrin	0.898	2.008
Endrin	0.950	4.307
Oxychlordane	0.964	9.193
t-Chlordane	0.955	10.561
c-Chlordane	0.989	7.301
t-Nonachlor	0.793	4.395
c-Nonachlor	0.973	4.294
2,4-DDE	1.022	2.664
4,4-DDE	1.038	1.279
2,4-DDD	0.947	4.174
4,4-DDD	1.037	3.747
2,4-DDT	1.011	4.559
4,4-DDT	1.064	3.251
Mirex	1.001	3.408
Pentachlorobenzene	0.998	1.425

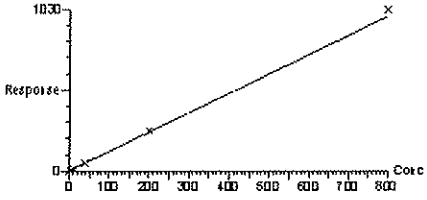
4435

○ Calibration curves

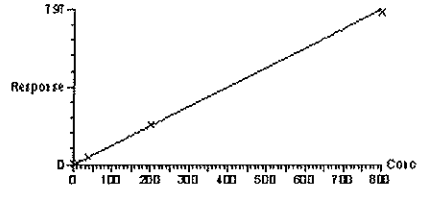
Compound name: alph-HCH
Response Factor: 1.24932
RRF SD: 0.0423409, % Relative SD: 3.38912
Response type: Internal Std (Ref 45), Area * (IS Conc. / IS Area)
Curve type: RF



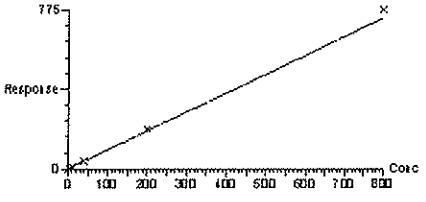
Compound name: gamma-HCH
Response Factor: 1.23623
RRF SD: 0.0547425, % Relative SD: 4.42819
Response type: Internal Std (Ref 45), Area * (IS Conc. / IS Area)
Curve type: RF



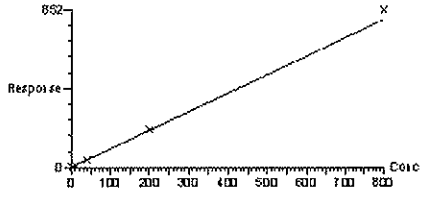
Compound name: HCB
Response Factor: 0.99756
RRF SD: 0.0140076, % Relative SD: 1.40419
Response type: Internal Std (Ref 27), Area * (IS Conc. / IS Area)
Curve type: RF



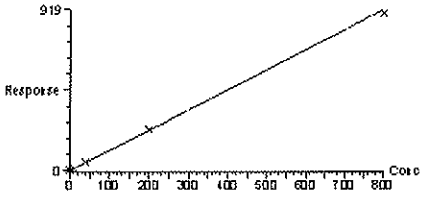
Compound name: cis-Haptachlor epoxide
Response Factor: 0.919989
RRF SD: 0.0873577, % Relative SD: 9.49551
Response type: Internal Std (Ref 43), Area * (IS Conc. / IS Area)
Curve type: RF



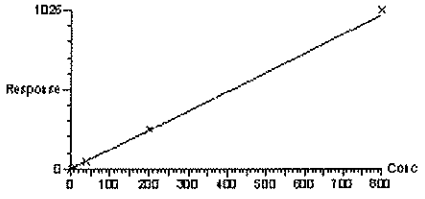
Compound name: Aldrin
Response Factor: 1.00102
RRF SD: 0.0548826, % Relative SD: 5.48269
Response type: Internal Std (Ref 29), Area * (IS Conc. / IS Area)
Curve type: RF



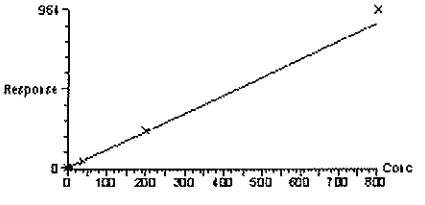
Compound name: beta-HCH
Response Factor: 1.14928
RRF SD: 0.0345727, % Relative SD: 3.00819
Response type: Internal Std (Ref 47), Area * (IS Conc. / IS Area)
Curve type: RF



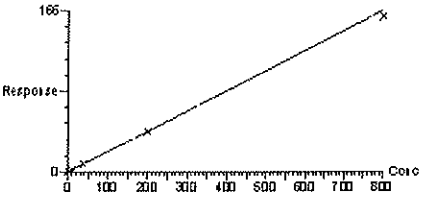
Compound name: delta-HCH
Response Factor: 1.24187
RRF SD: 0.0476998, % Relative SD: 3.84097
Response type: Internal Std (Ref 48), Area * (IS Conc. / IS Area)
Curve type: RF



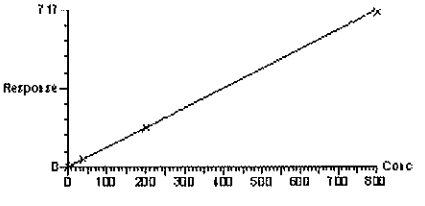
Compound name: Haptachlor
Response Factor: 1.1017
RRF SD: 0.0815082, % Relative SD: 7.39843
Response type: Internal Std (Ref 42), Area * (IS Conc. / IS Area)
Curve type: RF



Compound name: t-Haptachlor epoxide
Response Factor: 0.207911
RRF SD: 0.0116827, % Relative SD: 5.61909
Response type: Internal Std (Ref 43), Area * (IS Conc. / IS Area)
Curve type: RF



Compound name: Dieldrin
Response Factor: 0.897561
RRF SD: 0.0180258, % Relative SD: 2.00829
Response type: Internal Std (Ref 30), Area * (IS Conc. / IS Area)
Curve type: RF



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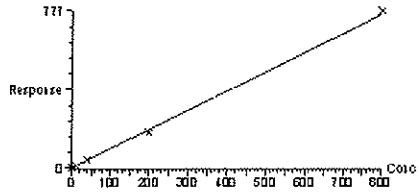
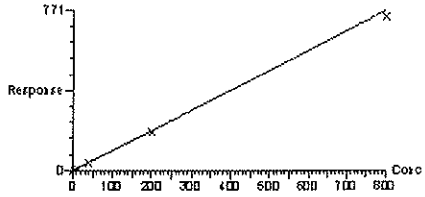
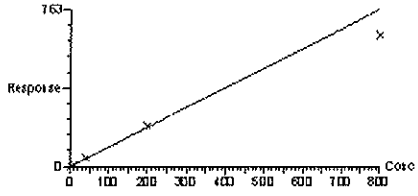
Compound name: Endrin
Response Factor: 0.960102
RRF SD: 0.0409211, % Relative SD: 4.30702
Response type: Internal Std (Ref 31), Area * (IS Conc. / IS Area)
Curve type: RF



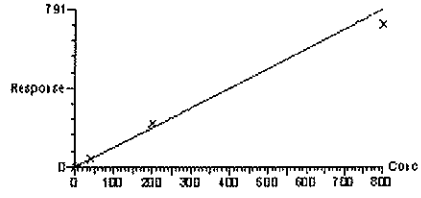
Compound name: Oxychlordane
Response Factor: 0.964486
RRF SD: 0.0886652, % Relative SD: 9.19291
Response type: Internal Std (Ref 41), Area * (IS Conc. / IS Area)
Curve type: RF



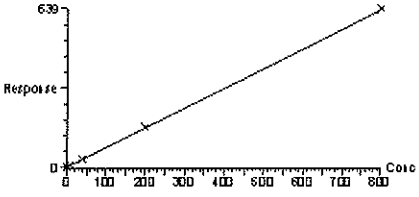
Compound name: trans-Chlordane
Response Factor: 0.955043
RRF SD: 0.100863, % Relative SD: 10.5611
Response type: Internal Std (Ref 38), Area * (IS Conc. / IS Area)
Curve type: RF



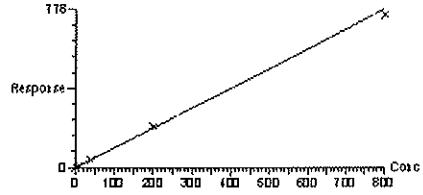
Compound name: cis-Chlordane
Response Factor: 0.989336
RRF SD: 0.0722347, % Relative SD: 7.30134
Response type: Internal Std (Ref 38), Area * (IS Conc. / IS Area)
Curve type: RF



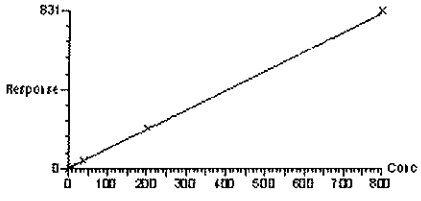
Compound name: t-nonachlor
Response Factor: 0.793355
RRF SD: 0.034865, % Relative SD: 4.39462
Response type: Internal Std (Ref 39), Area * (IS Conc. / IS Area)
Curve type: RF



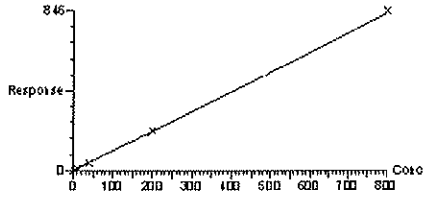
Compound name: cis-nonachlor
Response Factor: 0.97287
RRF SD: 0.0417784, % Relative SD: 4.29435
Response type: Internal Std (Ref 40), Area * (IS Conc. / IS Area)
Curve type: RF



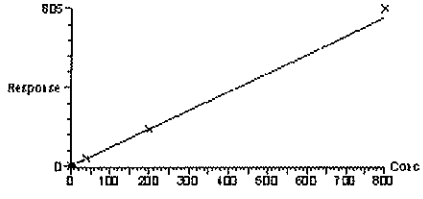
Compound name: 2,4-DDE
Response Factor: 1.02189
RRF SD: 0.027225, % Relative SD: 2.66419
Response type: Internal Std (Ref 36), Area * (IS Conc. / IS Area)
Curve type: RF



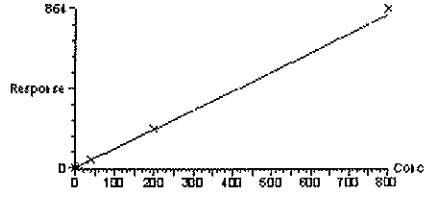
Compound name: 4,4-DDE
Response Factor: 1.03776
RRF SD: 0.0132753, % Relative SD: 1.27923
Response type: Internal Std (Ref 33), Area * (IS Conc. / IS Area)
Curve type: RF



Compound name: 2,4-DDD
Response Factor: 0.94736
RRF SD: 0.0395392, % Relative SD: 4.17362
Response type: Internal Std (Ref 37), Area * (IS Conc. / IS Area)
Curve type: RF

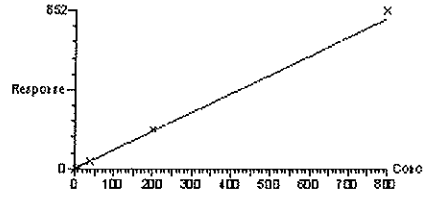


Compound name: 4,4-DDD
Response Factor: 1.03749
RRF SD: 0.038871, % Relative SD: 3.74664
Response type: Internal Std (Ref 34), Area * (IS Conc. / IS Area)
Curve type: RF

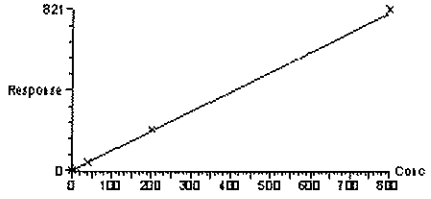


4432

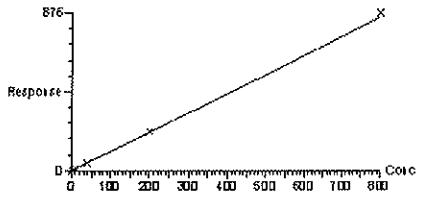
Compound name: 2,4-DDT
Response Factor: 1.01111
RRF SD: 0.0460947, % Relative SD: 4.55883
Response type: Internal Std (Ref 35), Area * (IS Conc. / IS Area)
Curve type: RF



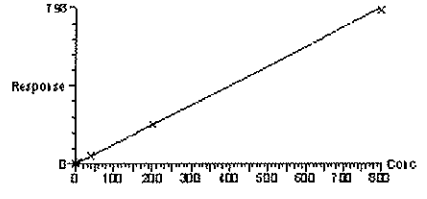
Compound name: Mirex
Response Factor: 1.00126
RRF SD: 0.0341203, % Relative SD: 3.40775
Response type: Internal Std (Ref 44), Area * (IS Conc. / IS Area)
Curve type: RF



Compound name: 4,4-DDT
Response Factor: 1.06391
RRF SD: 0.0345848, % Relative SD: 3.25073
Response type: Internal Std (Ref 32), Area * (IS Conc. / IS Area)
Curve type: RF



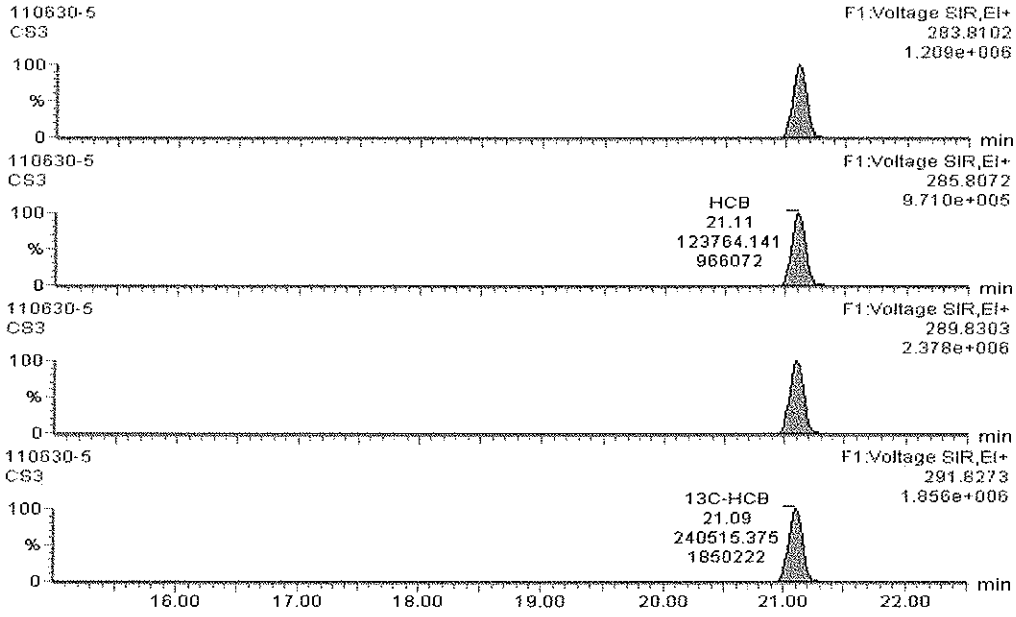
Compound name: PCBz
Response Factor: 0.998144
RRF SD: 0.0142202, % Relative SD: 1.42466
Response type: Internal Std (Ref 28), Area * (IS Conc. / IS Area)
Curve type: RF



9438

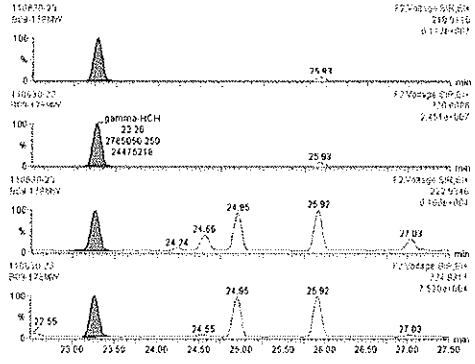
❍ Chromatogram

- HCB standard

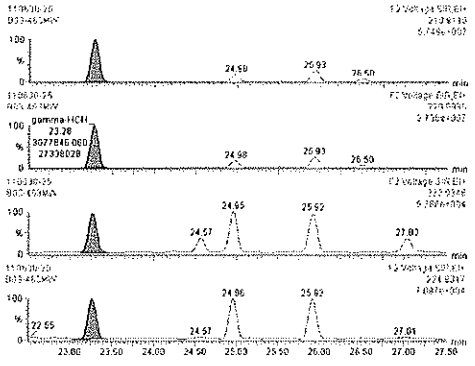


- Samples

(B09-178MW)

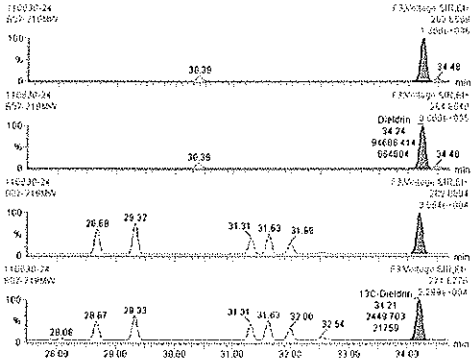


(B03-463MW)

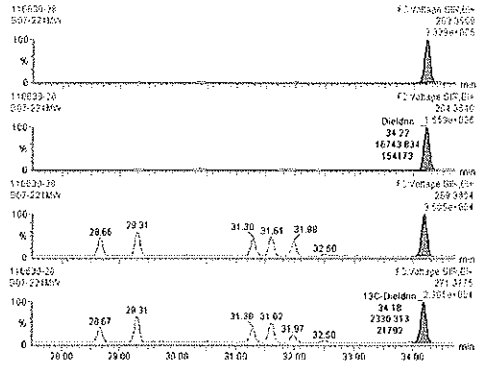


4439

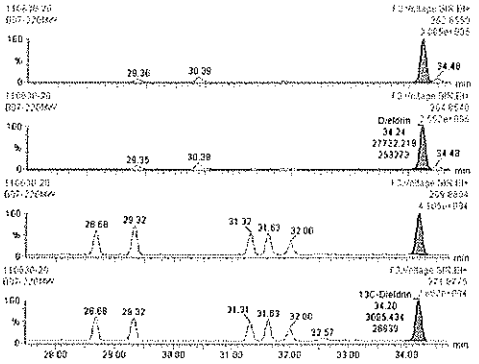
(B07-219MW)



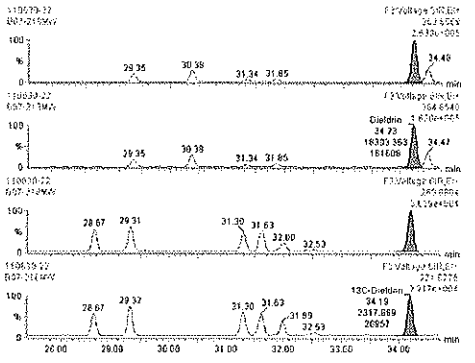
(B07-221MW)



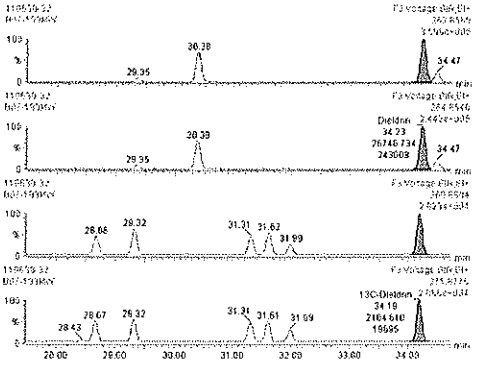
(B07-220MW)



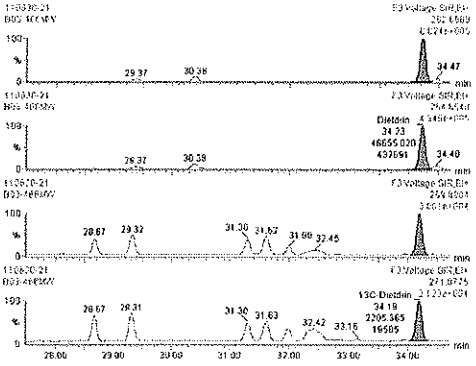
(B07-218MW)



(B09-193MW)



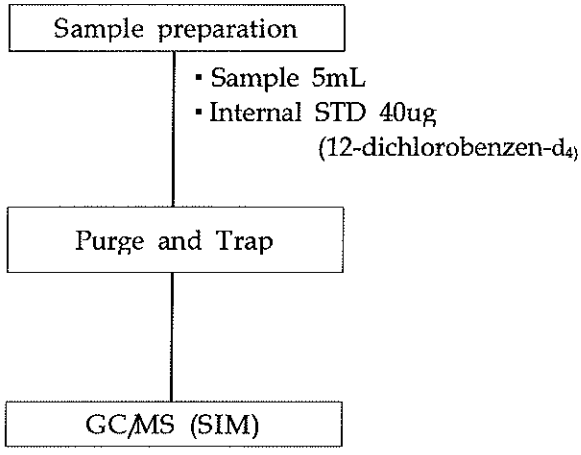
(B03-466MW)



9440

❑ VOCs

○ Analytical method (Korean Official Testing Method for Drinking Water (ES 056011Aa))



○ GC/MS condition

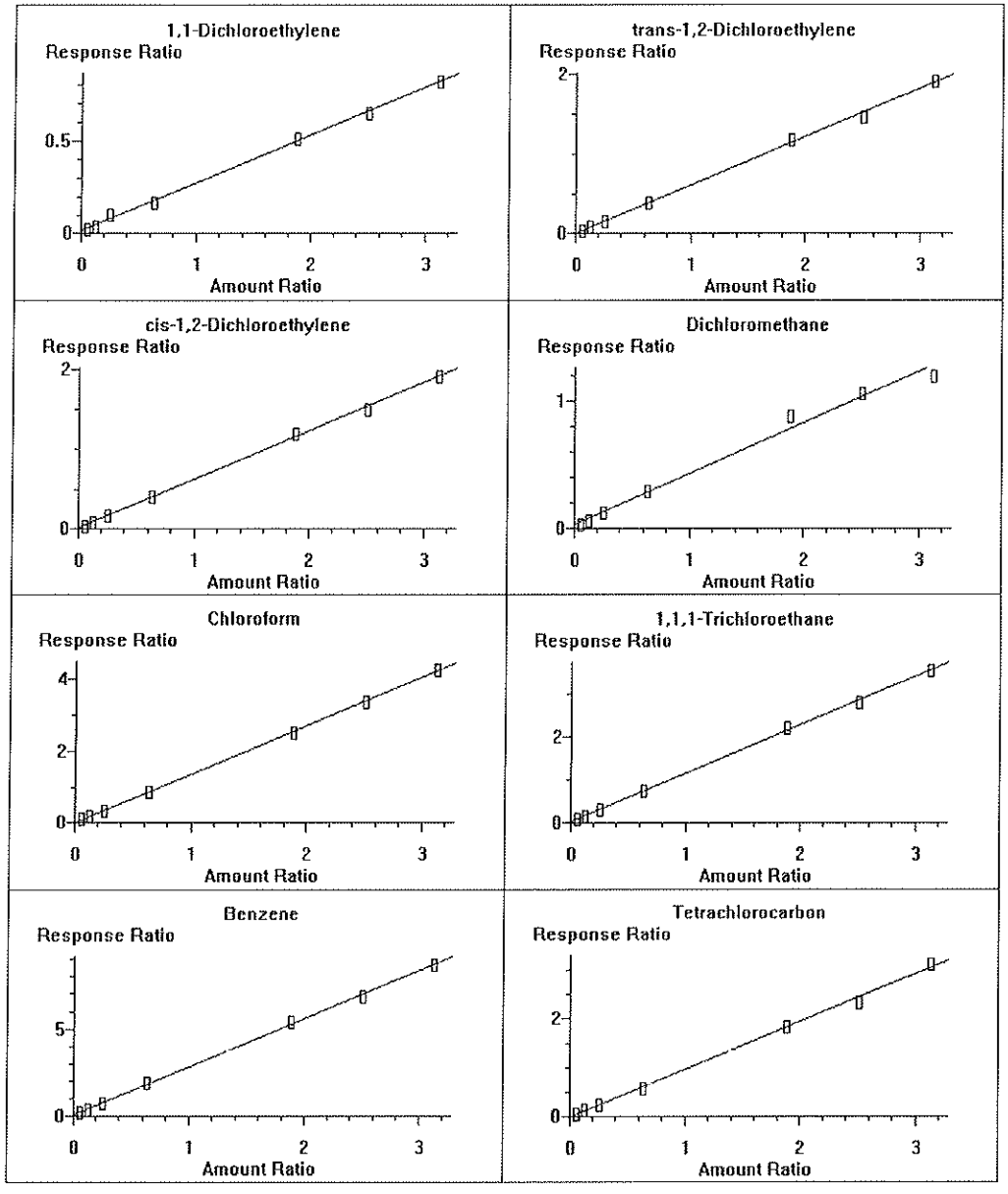
GC	Instrument	Agilent Technologies 6890N
	Injection mode	Split, 10 : 1, (purge time 11min)
	Separation column	DB-5MS (30m×0.32mm×250㎛ film thickness)
	Oven temperature	30℃ (7min)→3℃/min→60℃ (3min)→15℃/min →80℃ (0min)→10℃/min→100℃ (0min) →20℃/min→200℃ (0min)
	Carrier gas flow	Helium (99.999%), 1.5 ㎖/min
MS	Instrument	Agilent Technologies 5975B
	Ion mode	SIM (M/M+2, M+2/M+4)
	Resolution	above 10,000 (10% Valley)
	Ionization mode	Electron Ionization
	Ionization energy	70 eV
	Ion source temp.	230℃

44 41

❍ **Calibrations** : 0.5, 1, 2, 5, 15, 20, 25 μg/L

Compound	Calibration Curve	Response Factor	% RSD	Recovery
1,1-Dichloroethylene	y=0.259x+0.0119	0.998	5.83	97.08%
trans-1,2-Dichloroethylene	y=0.603x+0.00598	0.999	10.61	95.85%
cis-1,2-Dichloroethylene	y=0.607x+0.0121	0.999	4.70	102.50%
Dichloromethane	y=0.400x+0.0341	0.987	3.59	102.85%
Chloroform	y=1.34x+0.0107	1.000	6.22	93.83%
1,1,1-Trichloroethane	y=1.13x+0.0289	1.000	2.25	114.43%
Benzene	y=2.75x+0.0913	0.999	1.45	105.23%
Tetrachlorocarbon	y=0.978x-0.0114	0.998	3.25	109.95%
Trichloroethylene	y=0.840x+0.0265	0.999	5.33	97.03%
Bromodichloromethane	y=1.28x+0.0282	0.999	3.44	100.05%
Toluene	y=3.10x+0.122	0.999	2.33	92.15%
Dibromochloromethane	y=1.80x+0.0139	0.999	2.27	99.28%
Tetrachloroethylene	y=1.10x+0.00733	0.999	3.51	96.48%
Ethylbenzene	y=3.81x-0.362	0.995	18.52	79.85%
p-Xylene	y=3.10x-0.549	0.991	0.37	81.78%
m-Xylene	y=3.35x-0.527	0.994	0.45	80.28%
o-Xylene	y=1.73x-0.297	0.992	0.57	84.43%
Bromoform	y=0.938x-0.0652	0.999	1.96	92.35%

○ Calibration curves



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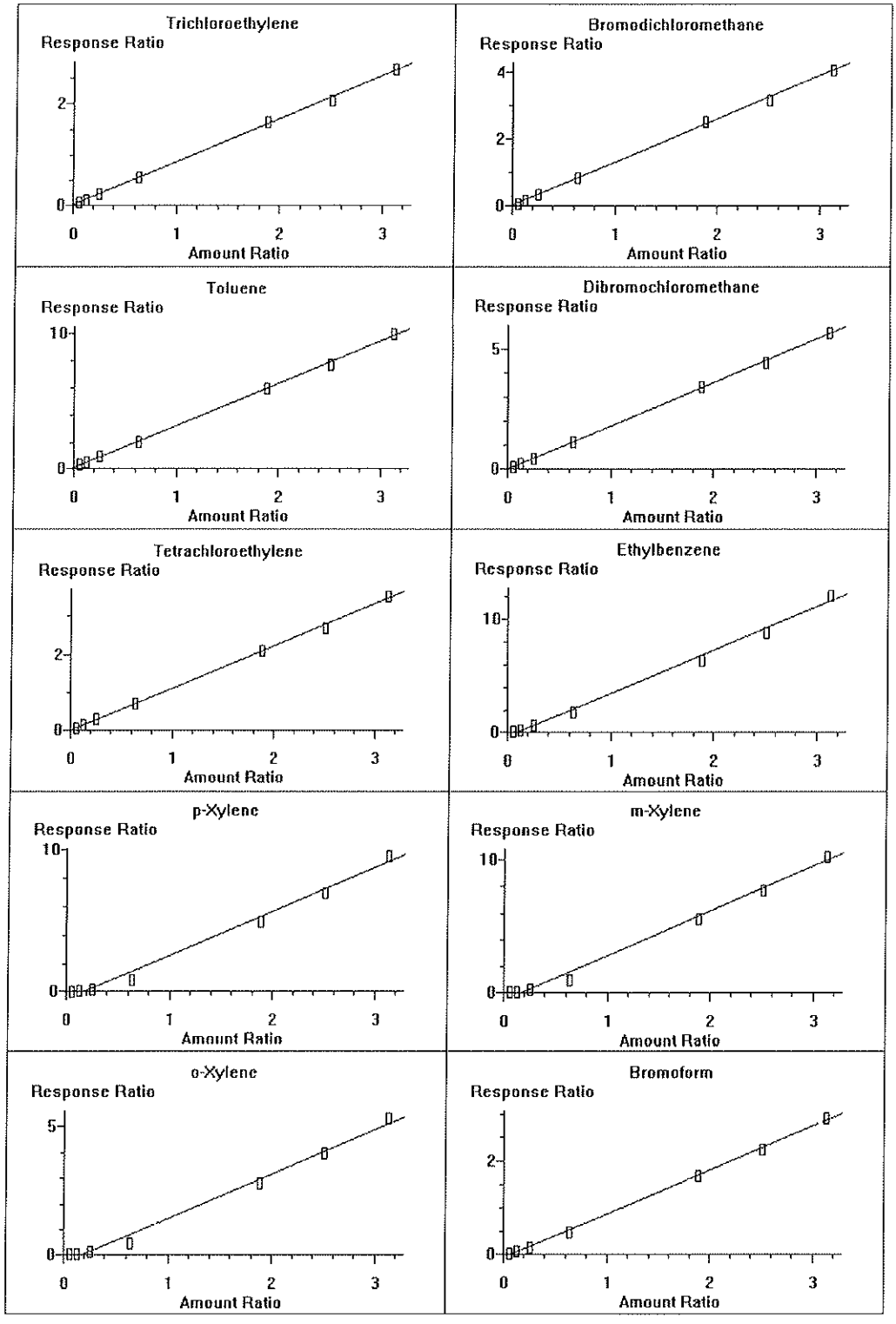
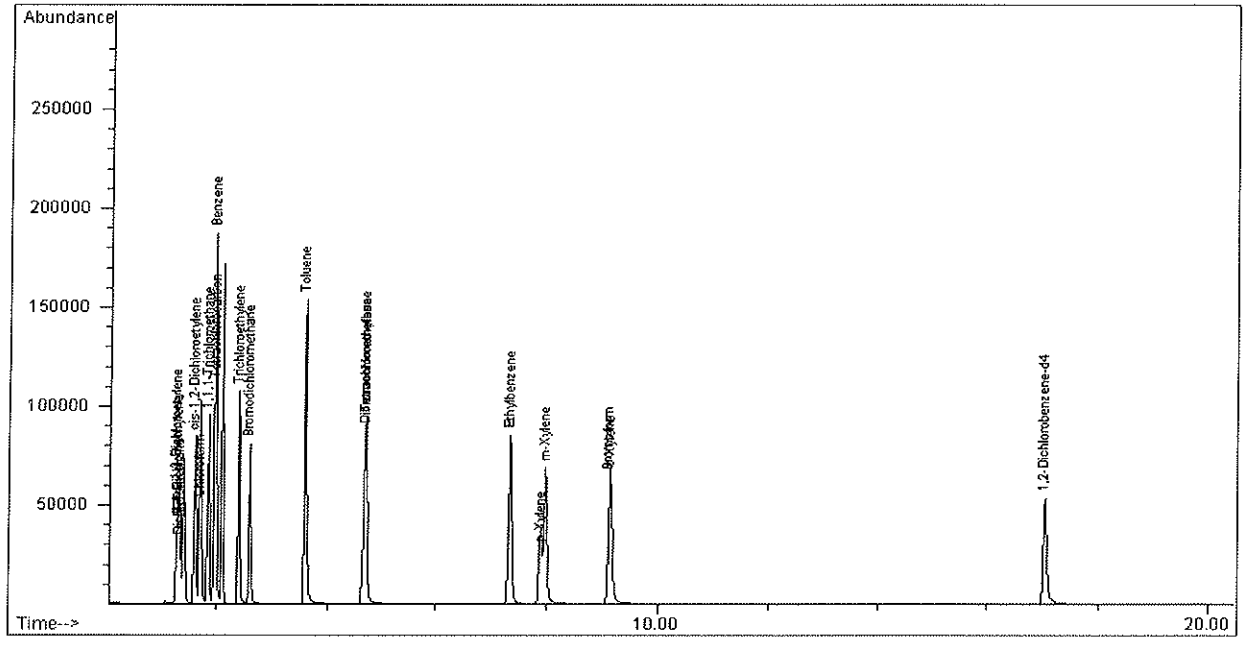

Trichloroethylene
Response Ratio
2
0
0
1
2
3
Amount Ratio
Bromodichloromethane
Response Ratio
4
2
0
0
1
2
3
Amount Ratio
Toluene
Response Ratio
10
0
0
1
2
3
Amount Ratio
Dibromochloromethane
Response Ratio
5
0
0
1
2
3
Amount Ratio
Tetrachloroethylene
Response Ratio
2
0
0
1
2
3
Amount Ratio
Ethylbenzene
Response Ratio
10
0
0
1
2
3
Amount Ratio
p-Xylene
Response Ratio
10
0
0
1
2
3
Amount Ratio
m-Xylene
Response Ratio
10
0
0
1
2
3
Amount Ratio
o-Xylene
Response Ratio
5
0
0
1
2
3
Amount Ratio
Bromoform
Response Ratio
2
0
0
1
2
3
Amount Ratio

4444

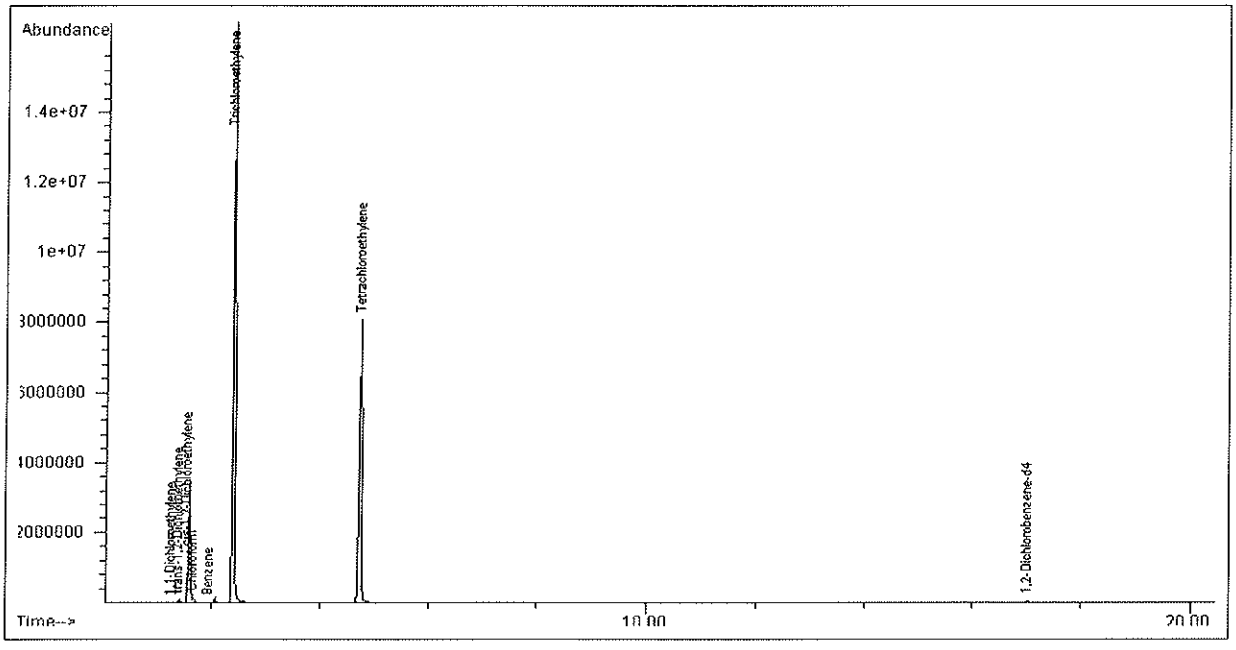
○ Chromatogram

• Standard 5 μg/L



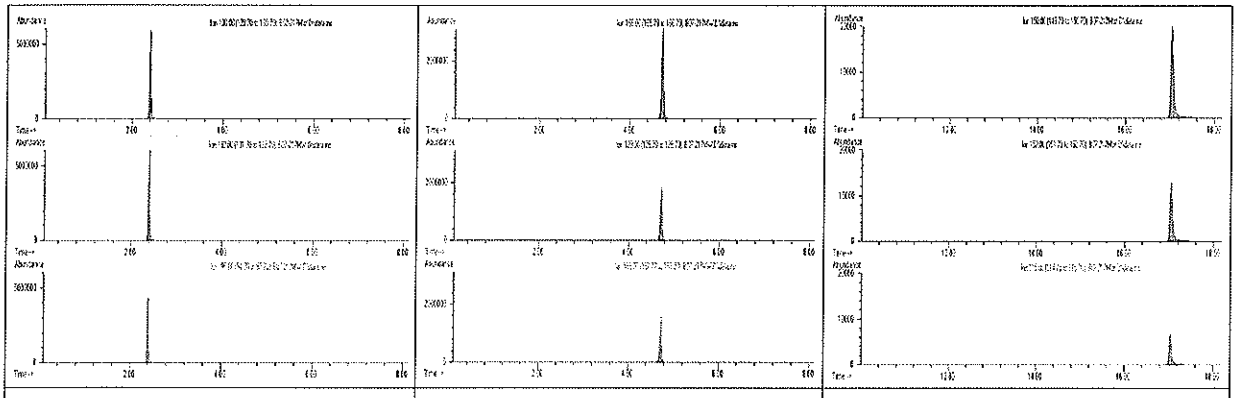
9445

▪ B07-217MW (TIC)



4446

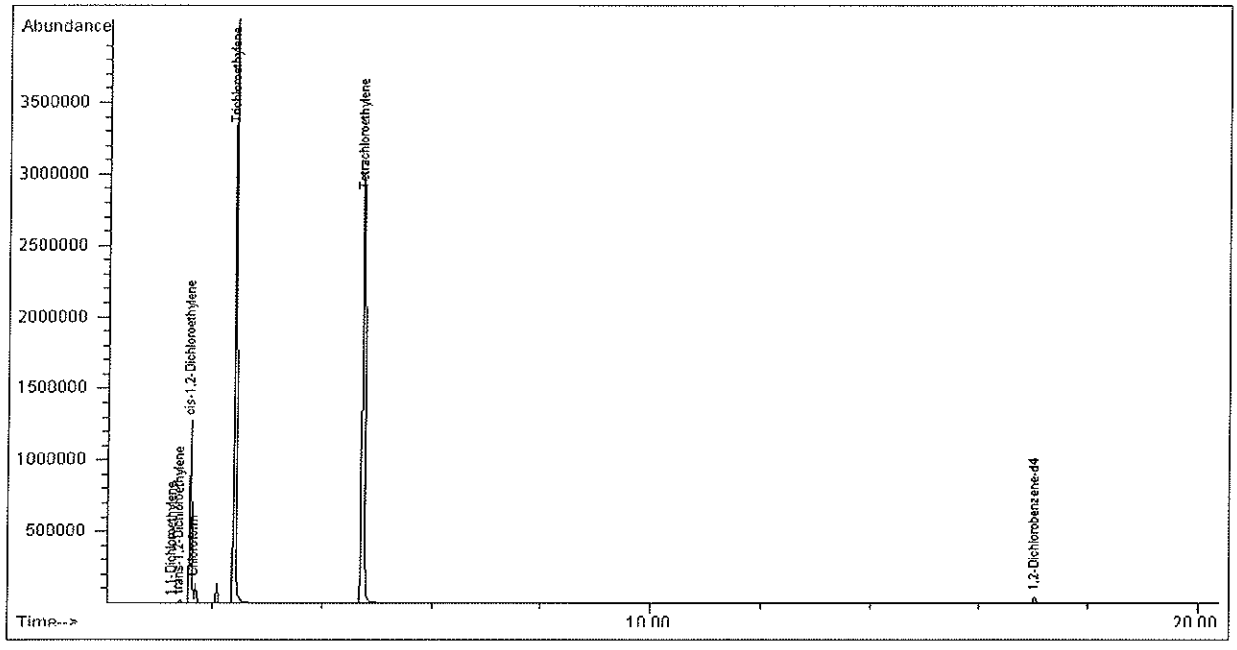
- B07-217MW (Quantitation Ions)



Trichloroethylene	Tetrachloroethylene	ISTD (1,2-Dichlorobenzene-d_4)

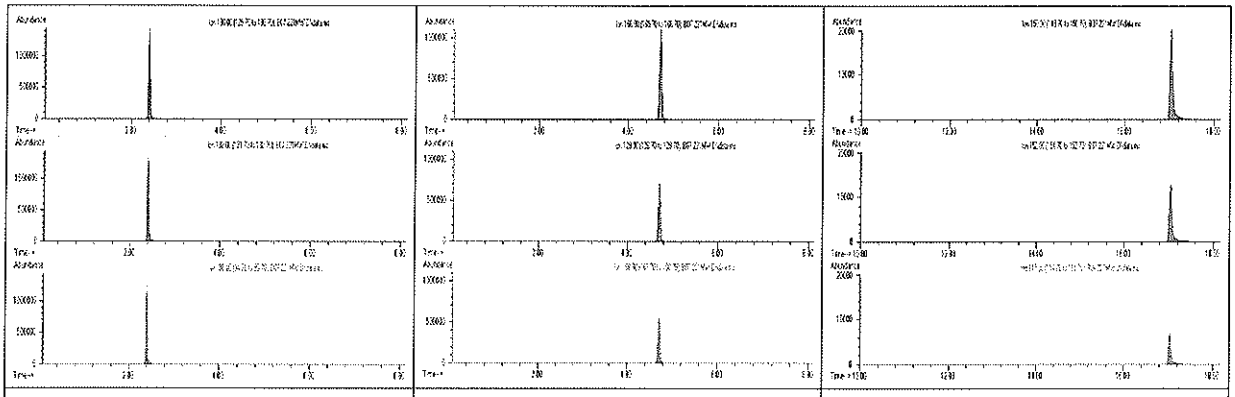
4447

▪ B07-221MW (TIC)



44 48

▪ B07-221MW (Quantitation Ions)

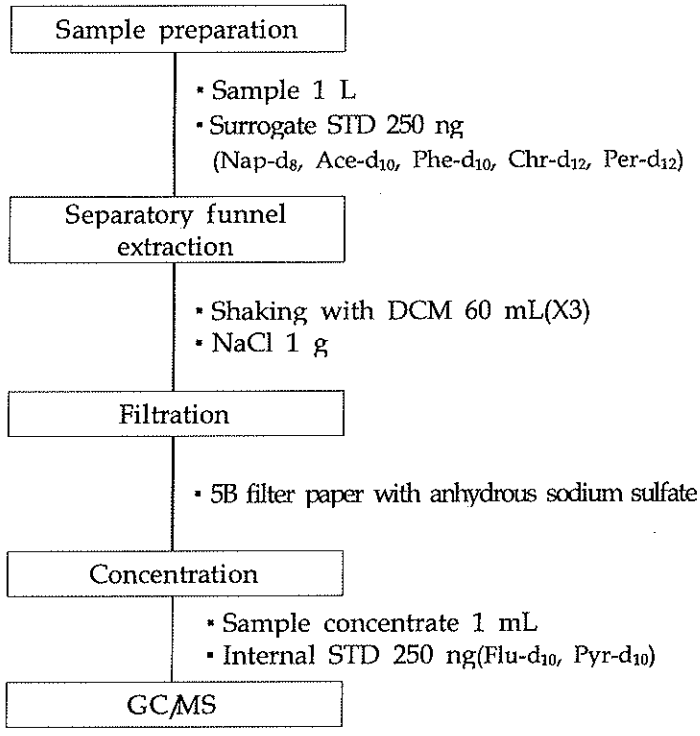


Trichloroethylene	Tetrachloroethylene	ISTD (1,2-Dichlorobenzene-d_4)

4449

❑ PAHs

○ Analytical method (EPA method 3510C and EPA method 8270D)



○ GC/MS condition

Instrument	(GC) Agilent 6890N (MS) Agilent 5975B inert XL MSD
Separation column	HP5-MS 5% Phenyl methyl siloxane (30m×250um×0.25um)
Oven temperature	70℃ (4min) ›10℃/min→300℃ (15min)
Injection temperature	250℃
Detector temperature	280℃
Splitless injection	1 uL
Carrier gas flow	1.2 mL/min (He)
Ionization	EI (70 eV)
Data Aquisition	SIM mode

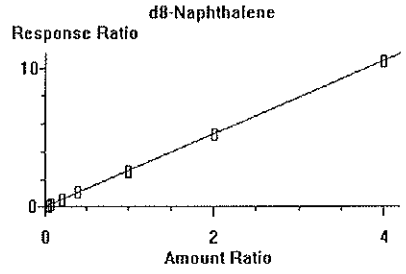
4450

❍ **Calibrations** : 10, 20, 50, 100, 250, 500, 1000 pg

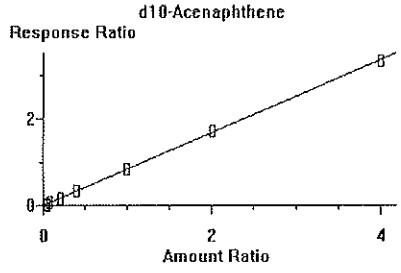
Compound		Calibration Curve	Response Factor	Recovery (%)
d8-Naphthalene (S1)		y=2.62x+0.0158	1.000	50.5~74.2
d10-Acenaphthene (S2)		y=0.836x+0.0124	1.000	52.0~82.8
d10-Phenanthrene (S3)		y=1.33x-0.000862	1.000	56.1~117.2
d12-Chrysene (S4)		y=0.962x+0.0137	1.000	55.2~93.1
d12-Perylene (S5)		y=0.876x+0.00613	1.000	52.4~88.6
S1	Acenaphthylene	y=1.45x+0.0151	1.000	-
S2	Acenaphthene	y=0.894x+0.000747	1.000	-
	Fluorene	y=1.06x-0.00577	1.000	-
S3	Phenanthrene	y=1.44x-0.00836	1.000	-
	Anthracene	y=1.18x-0.0145	0.999	-
	Fluoranthene	y=1.24x+0.0092	0.999	-
	Pyrene	y=1.23x+0.00637	0.999	-
	Benzo(a)anthrathene	y=0.846x+0.0194	1.000	-
S4	Chrysene	y=0.879x+0.00668	1.000	-
	Benzo(b)fluoranthene	y=0.86x-0.00558	1.000	-
	Benzo(k)fluoranthene	y=0.812x+0.00479	0.999	-
	Benzo(a)pyrene	y=0.66x+0.00978	0.999	-
S5	Indeno(1,2,3-c,d)pyrene	y=0.651x-0.00633	0.999	-
	Dibenz(a,h)anthracene	y=0.683x+0.0135	0.999	-
	Benzo(g,h,i)perylene	y=0.728x+0.00784	0.999	-

○ Calibration curves

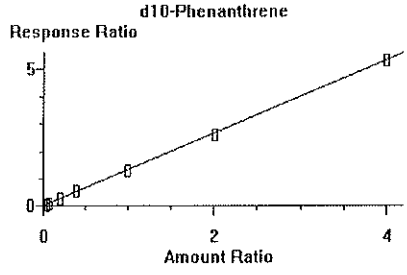
d8-Naphthalene



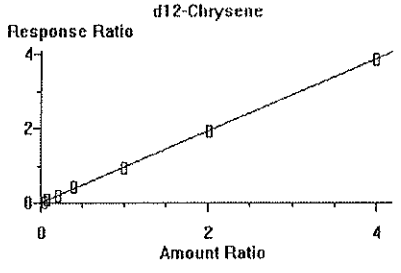
d10-Acenaphthene



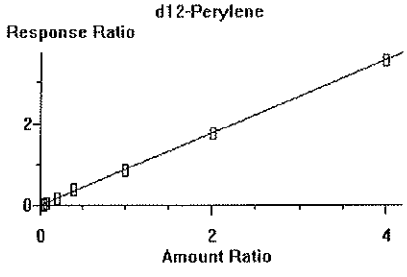
d10-Phenanthrene



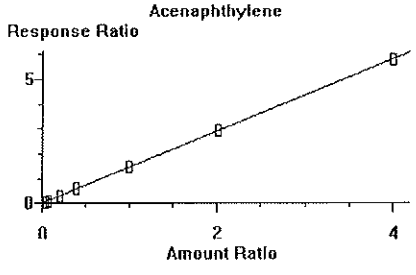
d12-Chrysene



d12-Perylene



Acenaphthylene



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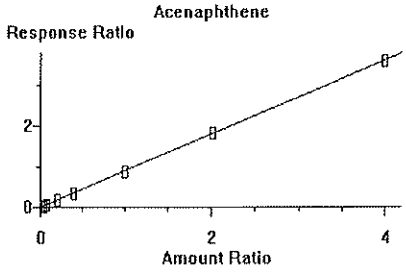
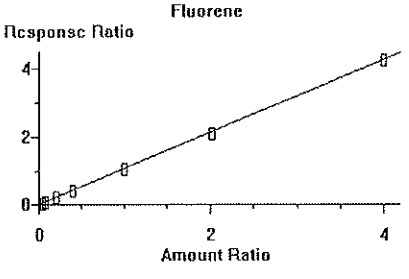
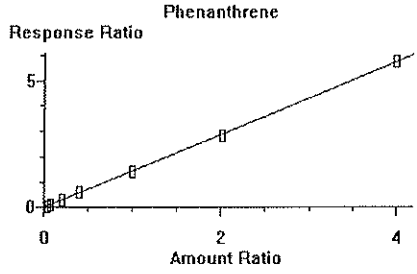


Fluorene

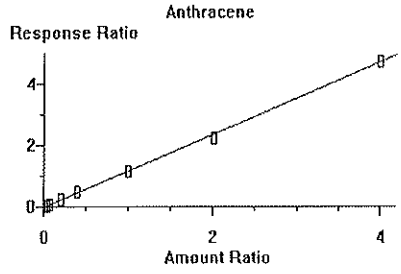


4452

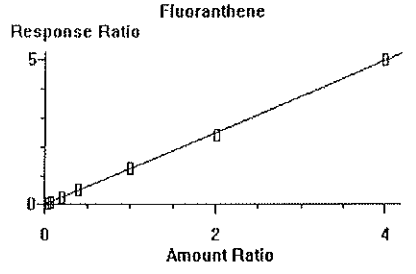
Phenanthrene



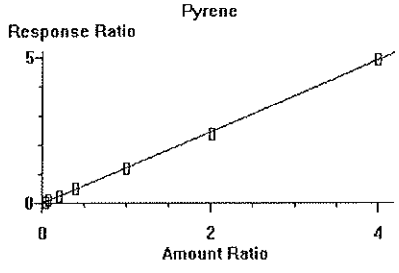
Anthracene



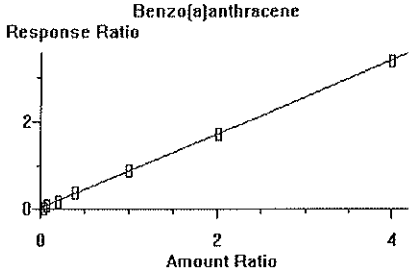
Fluoranthene



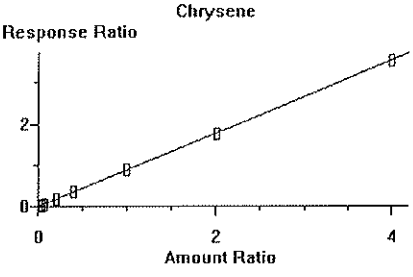
Pyrene



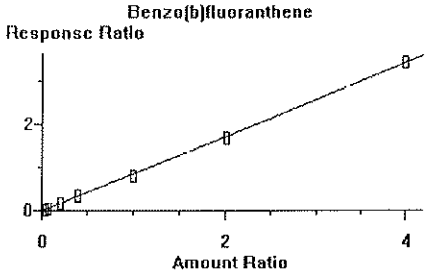
Benzo(a)anthrathene



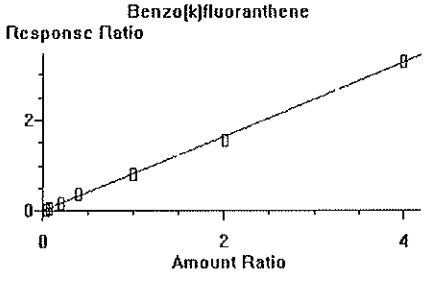
Chrysene



Benzo(b)fluoranthene

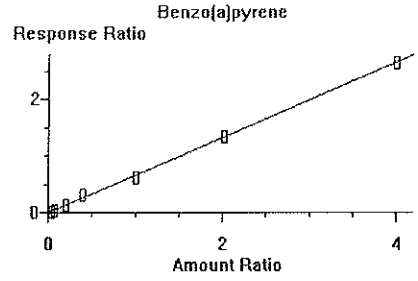


Benzo(k)fluoranthene

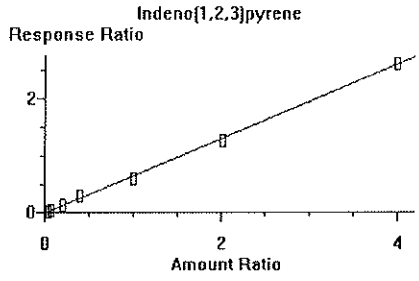


44 53

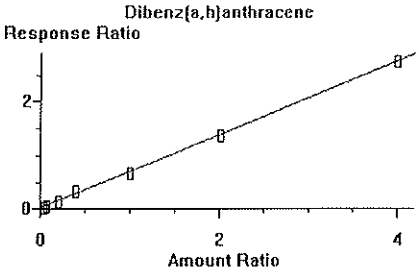
Benzo(a)pyrene



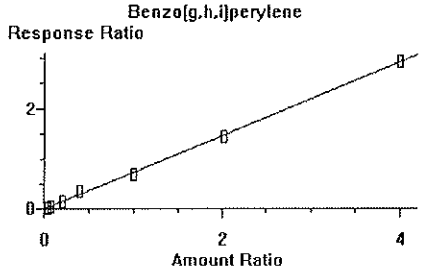
Indeno(1,2,3-c,d)pyrene



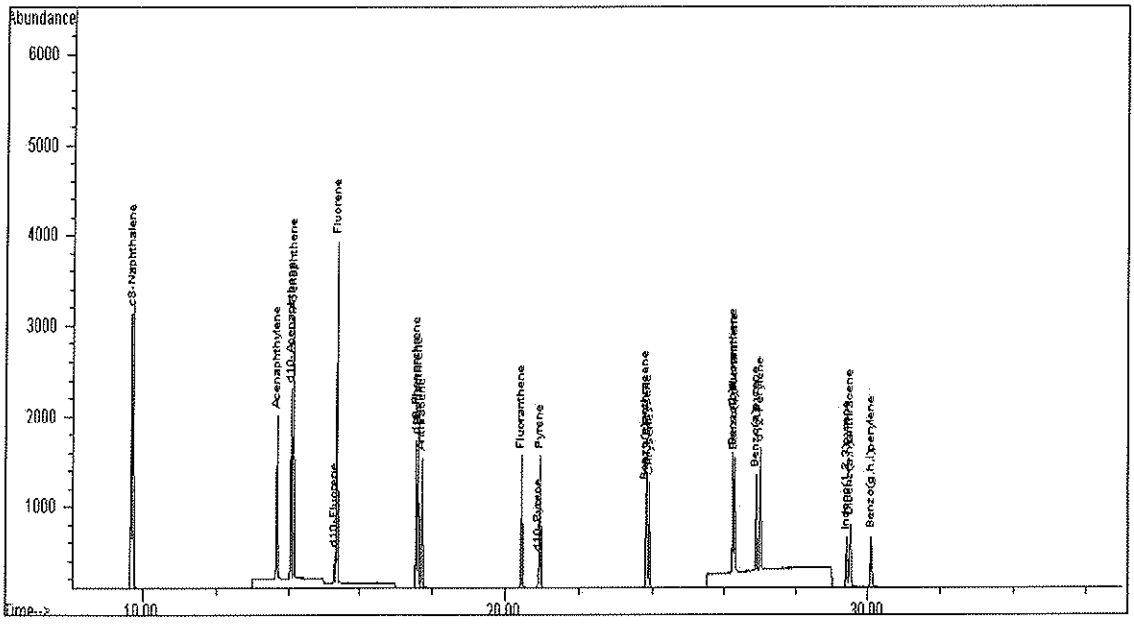
Dibenz(a,h)anthracene



Benzo(g,h,i)perylene



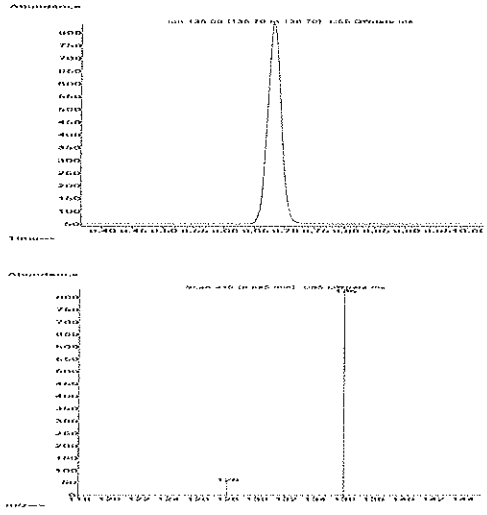
○ Chromatogram



4454

- Surrogate Standard

<d8-Naphthalene>



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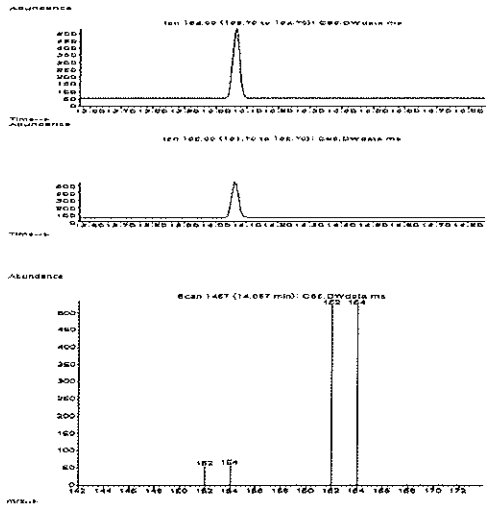

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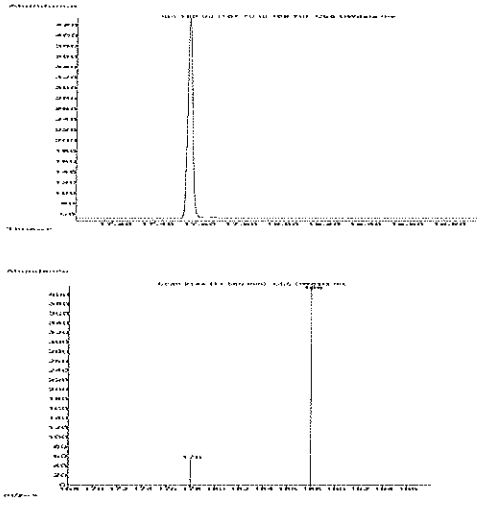
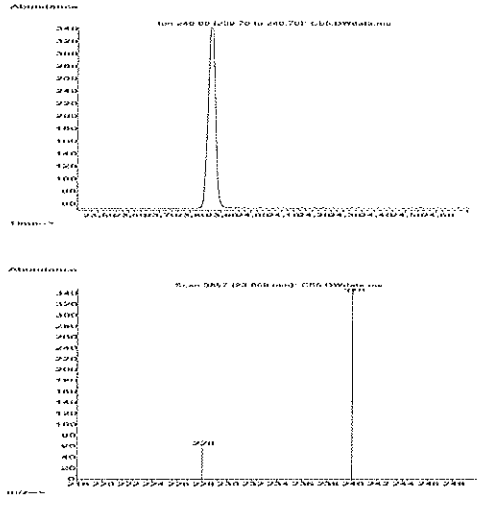


<d12-Chrysene>



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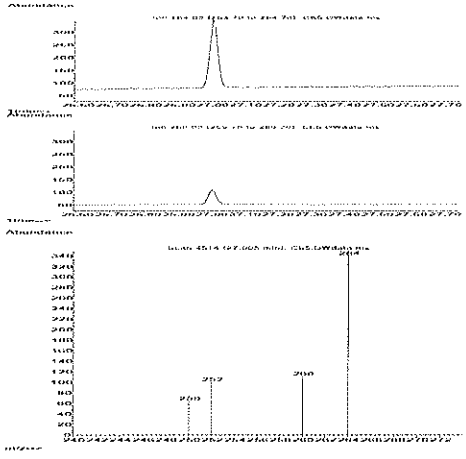
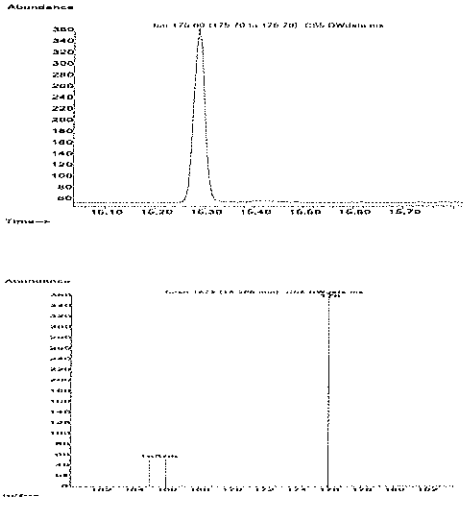


- Internal Standard

<d10-Fluorene>



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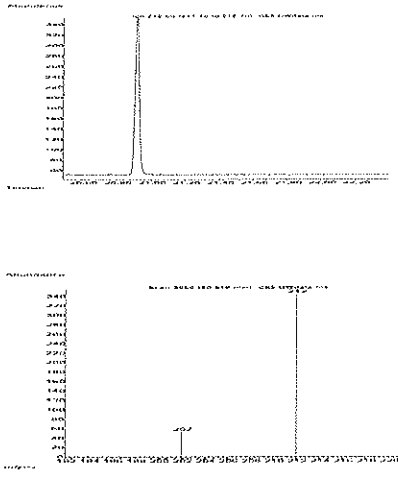
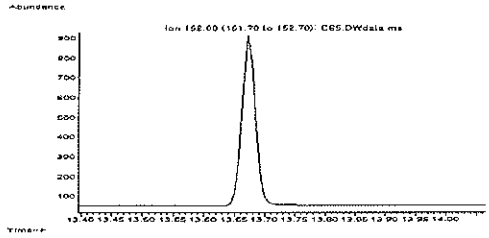
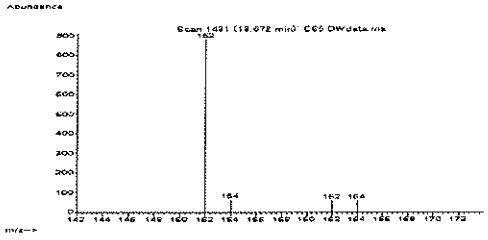


4456

- Target Standard

<Acenaphthylene>





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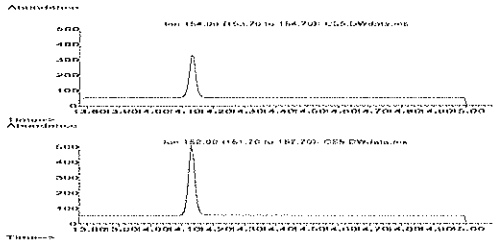

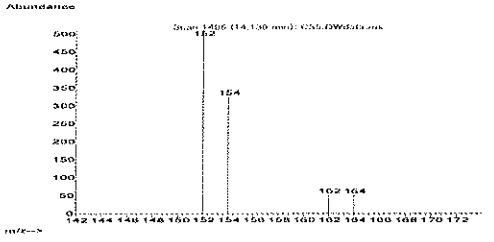

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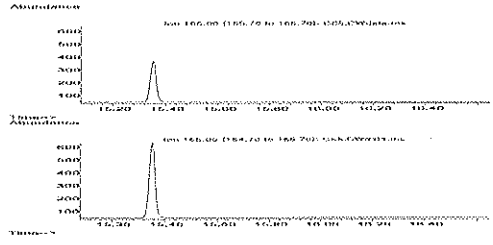

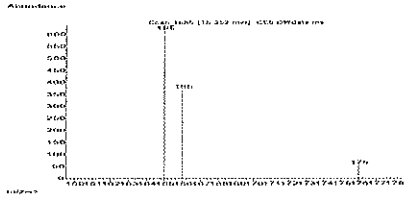

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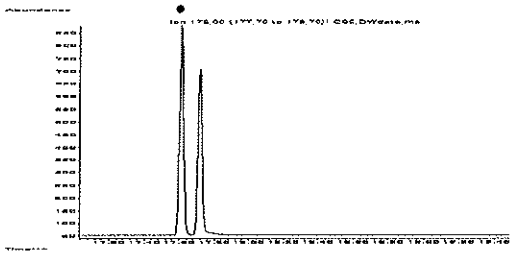
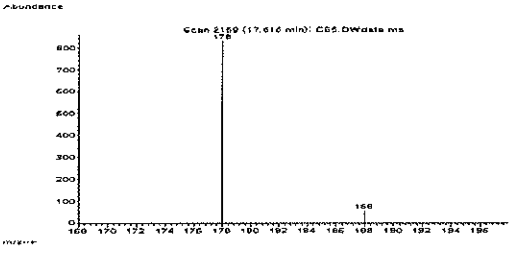
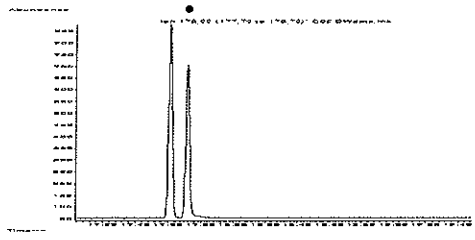
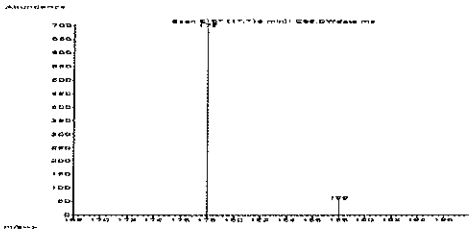




94 57

<Anthracene>





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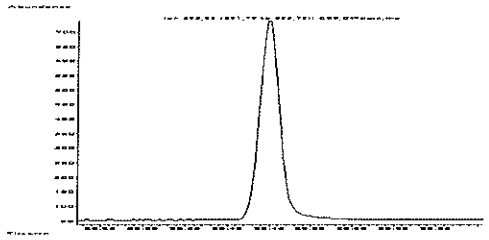

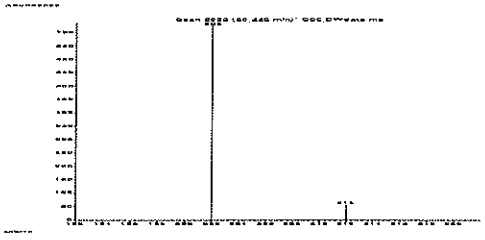

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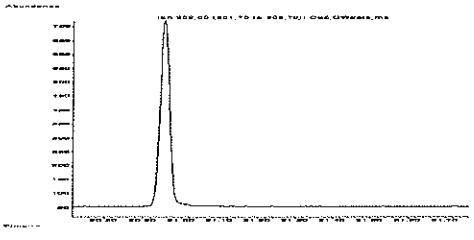
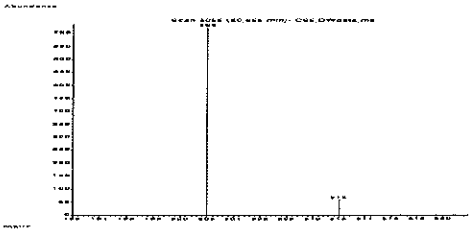
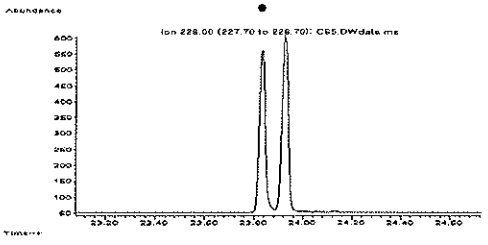
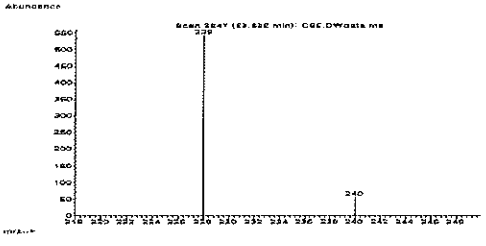




<Benz(a)anthracene>





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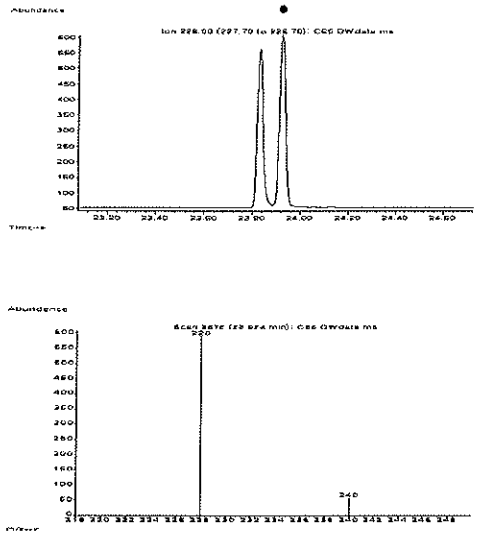
<Chrysene>



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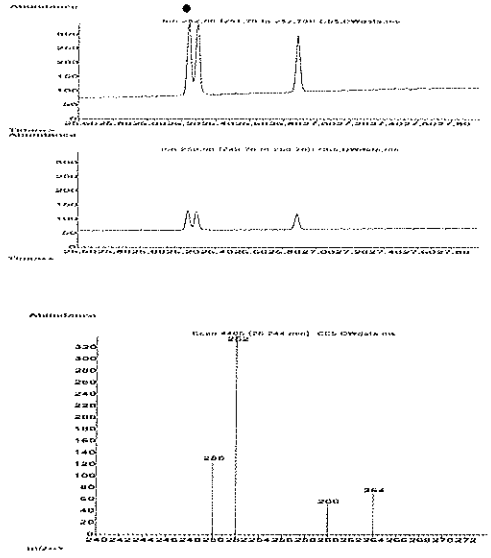

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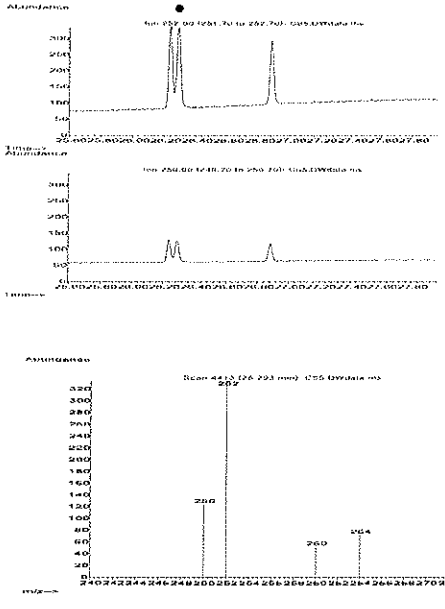

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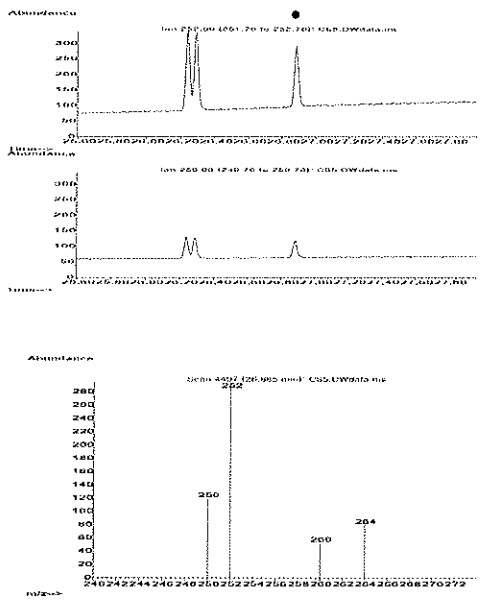
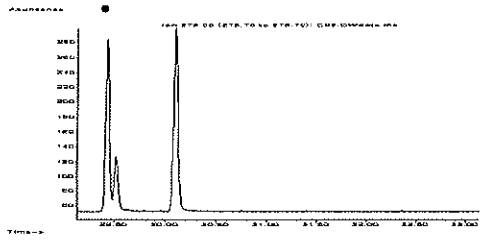
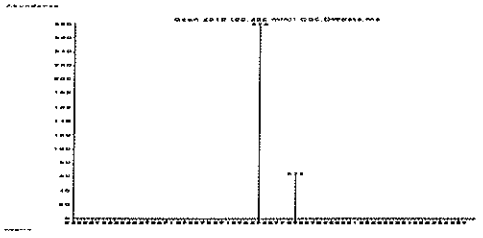


4459

<Indeno(1,2,3-c,d)pyrene>





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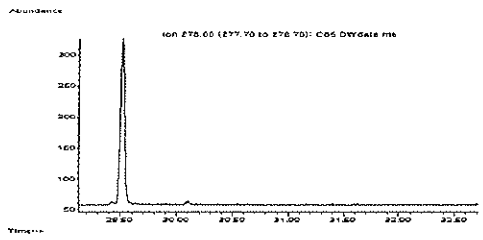
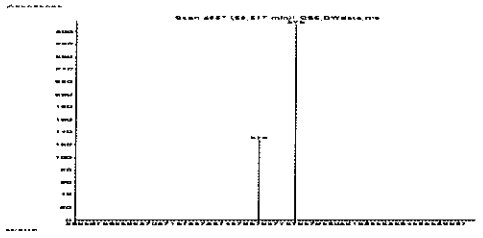
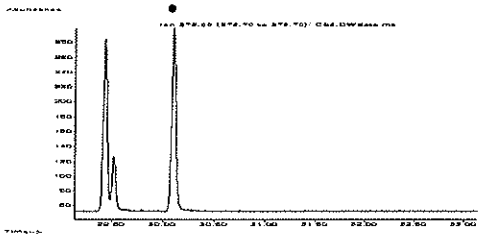
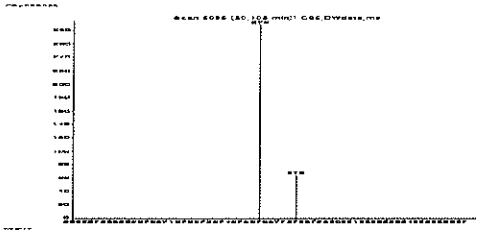




<Benzo(g,h,i)perylene>

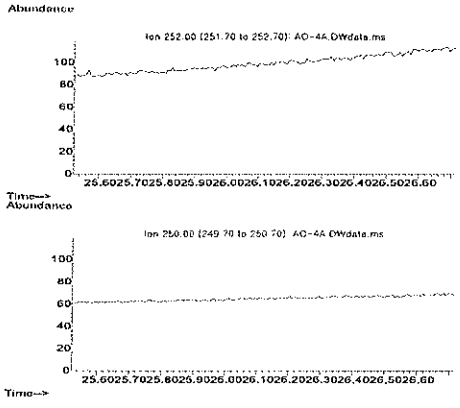




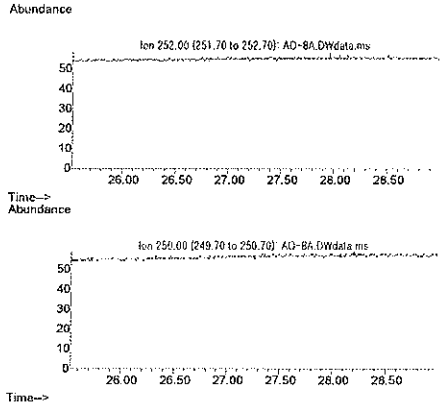
4460

<Benzo(a)pyrene>

- Drinking water well : 15-286



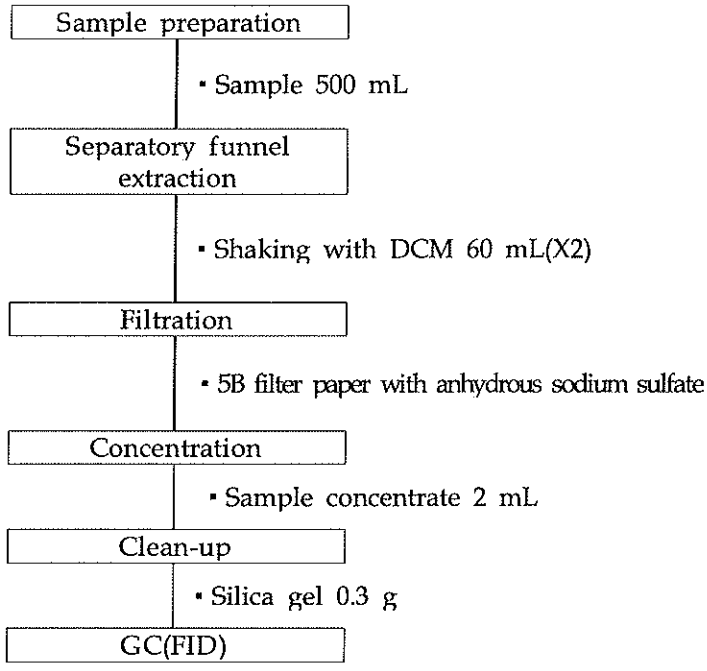
- Monitoring Well : B09-177MW



4461

❑ TPHs

○ Analytical method (Korean Official Testing Method for Water)



○ GC/FID condition

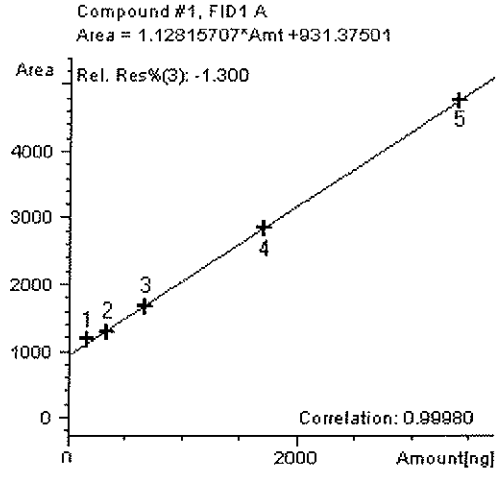
Separation column	HP5 5% Phenyl methyl siloxane (30m×320um×0.25um)
Oven temperature program	50℃, 1min 15℃/min to 200℃, 5℃/min to 310℃ 310℃, 15min
Injection temperature	280℃
Split injection(1:20)	2 uL
Carrier gas flow	1.5 mL/min(N_2)

4462

❍ **Calibrations** : 170, 340, 680, 1,700, 3,400 ng

Compound	Calibration Curve	Response Factor	Recovery(%)
TPHs	y=1.12815707*x+931.37501	1.000	73.0±3.55

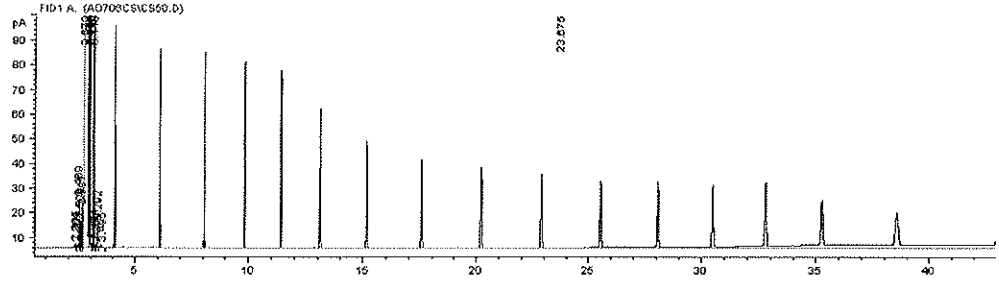
❍ **Calibration curves**



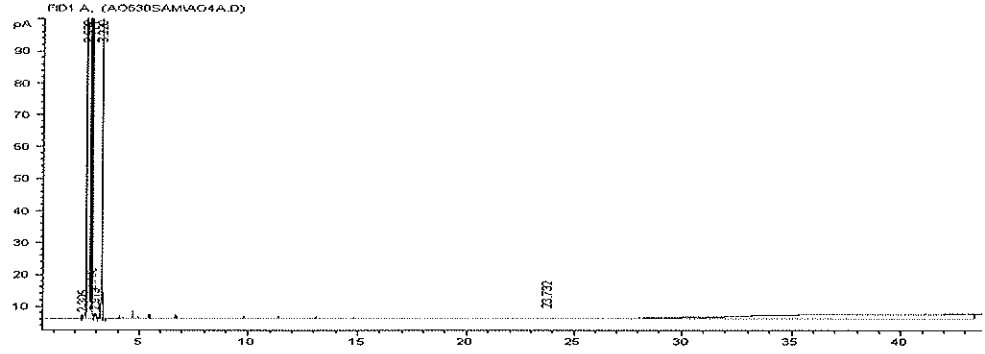
4463

○ Chromatogram

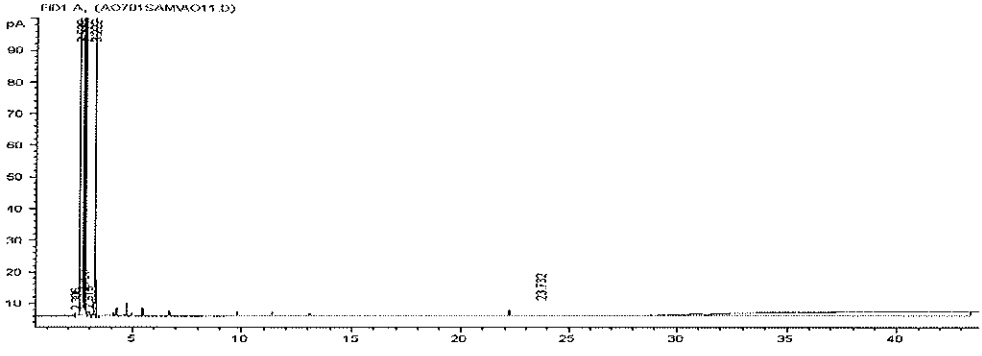
- Standard 1,700 ng



- Drinking water well : 15-286



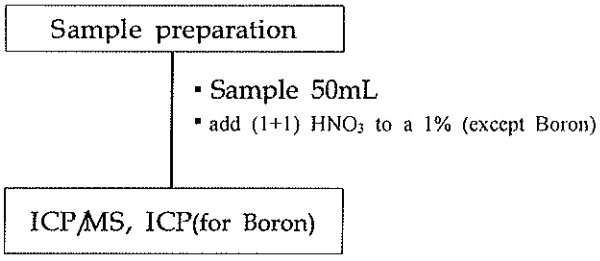
- Monitoring Well : B03-463MW



4464

❑ Metals

○ Analytical method (Korean Official Testing Method for Drinking Water (ES 15400 3a and 05400 2a))



○ ICP/MS and ICP conditions

	ICP/MS	ICP
RF Power	1.2 KW	1.0
Nebulizer gas flow	0.96 L/min	1.2 L/min
Plasma gas flow	16.0 L/min	12.0 L/min

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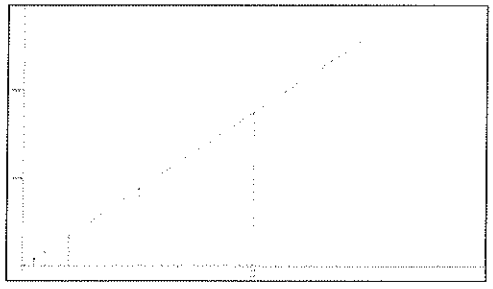
○ **Calibrations** : (Ba, Al, Cr, Mn, Fe, Cu, Zn, As, Se, Cd, Pb) 1, 5, 10, 20, 50, 100 μg/L
(B) 0.005, 0.02, 0.05, 0.1, 0.2 mg/L (Hg) 0.1, 0.2, 0.5, 1.0 μg/L

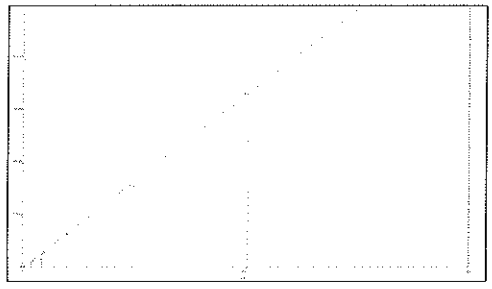
Compound	Calibration Curve	Response Factor
Barium (Ba)	y= 17497.3x	0.99999
Aluminium (Al)	y= 3244.06x	0.99963
Chromium (Cr)	y= 2453.04x	0.99988
Manganese (Mn)	y= 7741.69x	0.99999
Iron (Fe)	y= 109.455x	0.99988
Copper (Cu)	y= 2078.92	0.99999
Zinc (Zn)	y= 791.076x	0.99922
Arsenic (As)	y= 1026.63x	0.99999
Selenium (Se)	y= 84.8246x	0.99993
Cadmium (Cd)	y= 1980.25x	0.99999
Lead (Pb)	y= 15991.6x	0.99999
Boron (B)	y= 79806x+97.68	0.99986
Mercury (Hg)	y= 6410.62x	0.99822

4466

❍ Calibration curves



Ba



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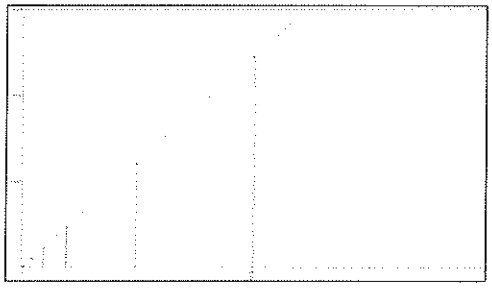

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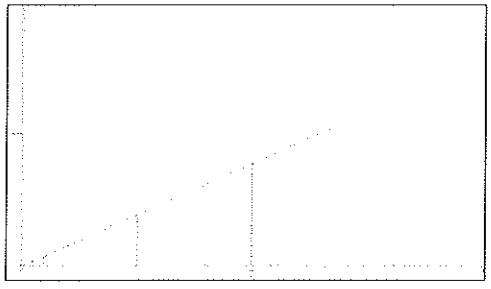
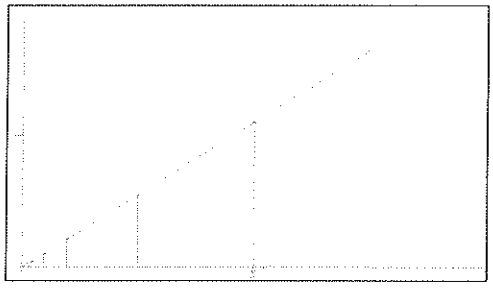
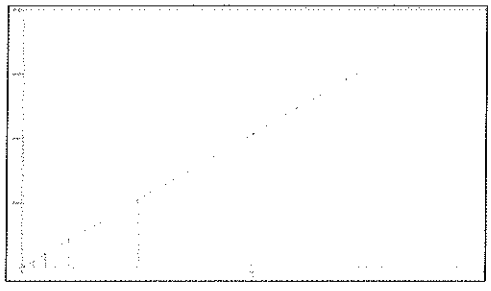


Mn



Fe



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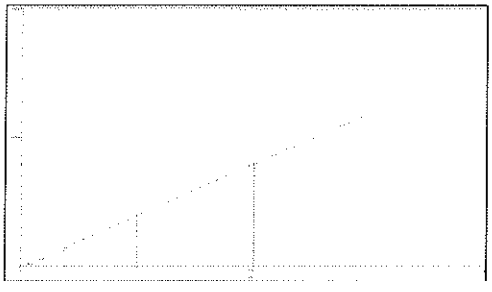
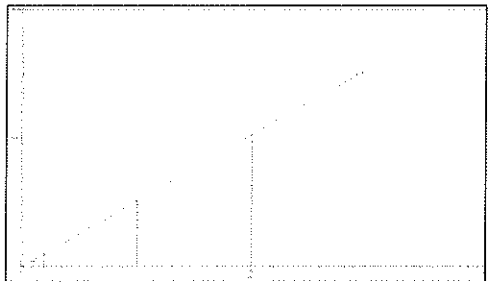
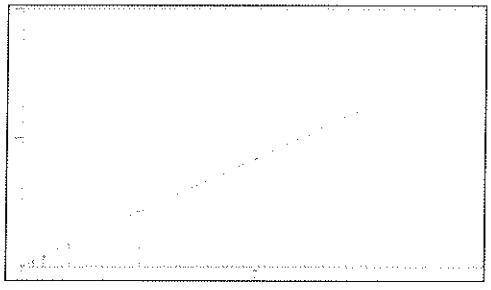


Zn



As

4462



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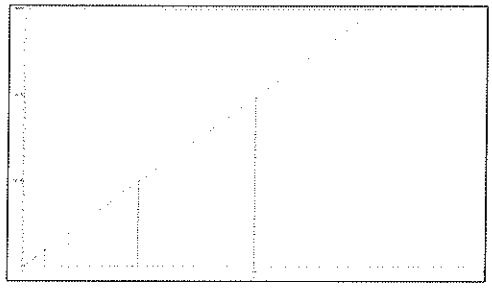

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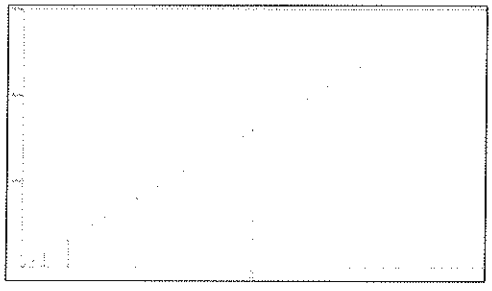
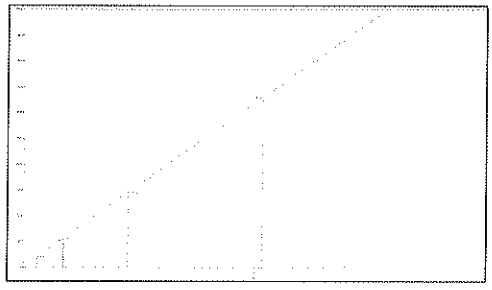
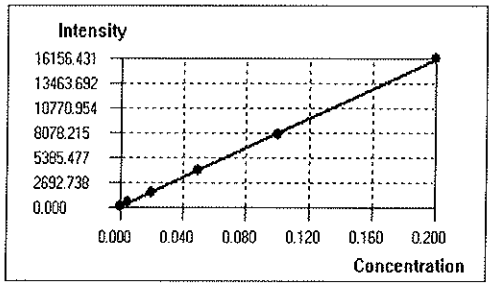


Pb



Hg



B

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NIER Camp Carroll Task Force
Technical Committee Meeting (July 13th, 2011)

Camp Carroll Site Investigation Results

- Groundwaters and Monitoring Wells -

July 2011

National Institute of Environmental Research

Ministry of Environment

Republic of Korea

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Executive Summary

The purpose of this investigation is to evaluate the contamination status associated with Camp Carroll. Twenty two groundwater (drinking water well samples (6), monitoring well samples (16)) near Helipad and area D were analyzed for 91 contaminants.

Table 1. Lists of analyzed contaminants

	Total	Herbicides (2,4-D, 2,4,5-T)	Dioxins /Furans	OCPs	VOCs	Metals	PAHs	TPHs
analytes	91	2	17	25	18	13	15	1

※ OCPs : Organochlorine Pesticides, VOCs : Volatile Organic Compounds, PAHs : Polycyclic Aromatic Hydrocarbons, TPHs : Total Petroleum Hydrocarbons

Herbicides were not detected in all samples. **Dioxins/furans** were not detected in drinking water well samples but trace amounts of **dioxins/furans** were detected in three monitoring well samples (0.001 pg-TEQ/L). For **γ-HCH** and **dieldrin**, concentrations of two samples (2,726~3,649 ng/L) and six samples (30.5~211.0 ng/L) from monitoring wells were higher than WHO drinking water guidelines (γ-HCH : 2,000 ng/L, dieldrin : 30 ng/L), respectively.

For **trichloroethene (TCE)**, concentrations of five samples (0.038~0.090 mg/L) from drinking water wells and seven samples (0.077~0.743 mg/L) from monitoring wells were higher than Korean Drinking Water Standard (0.03 mg/L). In addition, for **tetrachloroethene (PCE)**, concentrations of two samples (0.030~0.046 mg/L) from drinking water wells and twelve samples (0.025~0.497 mg/L) from monitoring wells were higher than Korean Drinking Water Standard (0.01 mg/L). For ***cis*-1,2-Dichloroethene**, concentrations of seven samples (0.076~1.346 mg/L) were higher than EPA Maximum Contaminant Level (0.07 mg/L).

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I Overview

❑ On-Site Investigation performed by NIER

- ❍ Establishment of NIER Task Force : 22 specialists (June 3rd, 2011)
- ❍ Analytes : Herbicide (2,4-D, 2,4,5-T), Dioxins/Furans (17 types of 2,3,7,8-congeners), OCPs (25 analytes), VOCs (18 analytes), PAHs (15 analytes), TPHs, heavy metals (13 analytes)

※ OCPs : Organochlorine Pesticides, VOCs : Volatile Organic Compounds, PAHs : Polycyclic Aromatic Hydrocarbons, TPHs : Total Petroleum Hydrocarbons

❑ Site Sampling Points

- ❍ Twenty two (22) groundwater samples (near Helipad and Area D)
  - Six (6) samples from drinking water wells
  - Sixteen (16) samples from monitoring wells
- ❍ Sampling points are shown in the Appendix 1.

II Analytical Methods

❑ Herbicides (2,4-D, 2,4,5-T)

- ❍ Groundwater samples were analyzed in accordance with **Korean Official Testing Method for Drinking Water.**
  - Each sample (**200 mL**) was extracted with diethyl ether, followed by estrification with trifluoroacetic anhydride (TFAA) and trifluoroethanol (TFE)
  - The internal standard (Phenanthrene-d_{10}) was added to extracts (100 μL) immediately prior to instrumental analysis with GC/MS above 1,000 resolution (SIM, 70 eV).

※ SIM : Selective Ion Monitoring

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❑ Dioxins/Furans (17 types of 2,3,7,8-congeners)

○ Samples were analyzed in accordance with **Korean Official Testing Method for Persistent Organic Pollutants (ES 10368.1).**

- After surrogate standards (15 ^{13}C-labeled standards) were added in each sample (**10 L**), it was extracted with dichloromethane.
- Extracts were cleaned up using silicagel column, followed by alumina column.
- Internal standards (^{13}C-1,2,3,4-TCDD, 1,2,3,7,8,9-HxCDD) were added to extracts (10 ~ 50 μL) immediately prior to instrumental analysis with HRGC/HRMS above 10,000 resolution (SIM, 36 eV).
- **TEQs** (Toxic equivalents) were evaluated with **I-TEF** (international toxic equivalency factor) using OPUS quantification programme.

❑ Organochlorine Pesticides (OCPs, 25 analytes)

○ Samples were analyzed in accordance with **Korean Official Testing Method for Persistent Organic Pollutants (ES 10903.1a).**

- After twenty five surrogate standards (^{13}C-labeled) were added in each sample (**1 L**), it was extracted with dichloromethane, followed by clean up using florisil-based SPE cartridge and activated-carbon-based cartridge.
- Internal standard (^{13}C-labeled dichlorinated biphenyl) was added to extracts (100 μL) immediately prior to instrumental analysis with HRGC/HRMS above 10,000 resolution (SIM, 36 eV).

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❑ Volatile Organic Compounds (VOCs, 18 analytes)

○ Samples were analyzed in accordance with **Korean Official Testing Method for Drinking Water (ES 05601 1a).**

- After internal standard (1,2-dichlorobenzene-d_4) was added in each sample (**5 mL**), it was analyzed with purge & trap GC/MS above 1,000 resolution (SIM, 70 eV).

❑ Polycyclic Aromatic Hydrocarbons (PAHs, 15 analytes)

○ Samples were analyzed in accordance with **EPA Method 3510C and 8270D.**

- After five surrogate standards (Naphthalene-d_8, Acenaphthene-d_{10}, Chrysene-d_{12}, Phenanthrene-d_{10}, Perylene-d_{12}) were added in each sample (**1 L**), it was extracted with dichloromethane.
- The two internal standards (Fluorene-d_{10}, Pyrene-d_{10}) were added to extracts (1,000 μL) immediately prior to instrumental analysis with GC/MS above 1,000 resolution (SIM, 70 eV).

❑ Total Petroleum Hydrocarbons (TPHs)

○ Samples were analyzed in accordance with **Korean Official Testing Method for Water.**

- Each sample (**500 mL**) was extracted with dichloromethane.
- Concentrated extracts (2,000 μL) were cleaned up using silica gel and analyzed with GC/FID

※ FID : Flame Ionization Detector

❑ Metals including heavy metals (13 analytes)

○ Samples were analyzed in accordance with **Korean Official Testing Method for Drinking Water (ES 15400 3a and 05400 2a).**

- After groundwater sample (**50 mL**) was digested with nitric acid (50 volume %), samples were analyzed with ICP/MS and ICP.

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Ⅲ Summary of Results

❑ Herbicides (2,4-D, 2,4,5-T)

○ Herbicides were not detected in all samples.

❑ Dioxins/Furans (17 types of 2,3,7,8-congeners)

○ Dioxins/furans were not detected in **drinking water well** samples

○ Dioxins/furans were detected in three **monitoring well** samples.

- The concentration measured from three samples was 0.001 pg-TEQ/L
- 2,3,7,8-TCDD was not detected and the major congener was OCDD.

Table Ⅲ-1. Concentrations of detected Dioxins/Furans from monitoring well

Dioxins/Furans	MCL*	Monitoring Well			LOQ
		Helipad	Area D		
		B09-178MW	B03-463MW	B07-220MW	
2,3,7,8-congeners I-TEQ(pg-TEQ/L)	30 pg/L (2,3,7,8-TCDD)	0.001	0.001	0.001	0.5 pg/L

※ EPA drinking water MCL (Maximum Contaminant Level)

❑ Organochlorine Pesticides (OCPs, 25 analytes)

○ Eight compounds among OCPs were detected in six **drinking water well** samples.

Table Ⅲ-2. Concentrations of detected OCPs from drinking water well

Pesticides	WHO drinking water guideline	Drinking Water Well						LOQ
		20-575	14-283	16-289	15-286	12-247	13-279	
α-HCH	-	ND	4.9	ND	2.1	2.3	ND	0.5 ng/L
β-HCH	-	ND	11.6	ND	7.5	5.9	ND	0.5 ng/L
γ-HCH(Lindane)	2000 ng/L	0.9	21.3	0.5	4.6	10.2	0.9	0.5 ng/L
δ-HCH	-	ND	10.5	ND	4.8	5.4	ND	0.5 ng/L
Heptachlor Epoxide	-	ND	0.6	ND	0.6	ND	ND	0.5 ng/L
Dieldrin	30 ng/L (Aldrin+Dieldrin)	ND	1.3	ND	1.2	0.7	ND	0.5 ng/L
2,4-DDD	1000 ng/L	ND	0.7	ND	ND	ND	ND	0.5 ng/L
β-Endosulfan		ND	ND	ND	ND	ND	0.6	0.5 ng/L

○ Nineteen compounds among OCPs were detected in sixteen **monitoring well** samples.

- **γ-HCH (Lindane)** : Concentrations of two samples (2,726~3,649 ng/L) were higher than WHO drinking water guideline (2,000 ng/L).
- **Dieldrin** : Concentrations of six samples (30.5~211.0 ng/L) were higher than WHO drinking water guideline (30 ng/L).

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Table Ⅲ-3. Concentrations of detected OCPs from monitoring well

Pesticides	WHO drinking water guideline	Monitoring Well																LOQ
		Helipad			Area D													
		B09-176 MW	B09-177 MW	B09-178 MW	B09-221 MW	B03-463 MW	B07-219 MW	B07-221 MW	B07-220 MW	B07-217 MW	B07-218 MW	B09-193 MW	B03-466 MW	B03-467 MW	B03-464 MW	B03-468 MW	B03-465MW	
α-HCH	-	1.4	0.6	69.8	ND	373.9	27.0	31.7	12.1	43.5	1.0	22.4	34.4	8.5	0.6	ND	3.2	0.5 ng/L
β-HCH	-	ND	1.4	0.8	ND	627.8	186.1	8.0	181.0	0.5	18.5	244.8	749.8	64.7	2.7	1.8	27.4	0.5 ng/L
γ-HCH(Lindane)	2000 ng/L	31.2	1.1	**2726.0**	20.2	**3648.8**	83.4	20.8	100.4	46.3	6.9	120.0	279.1	1.7	6.5	2.8	10.3	0.5 ng/L
δ-HCH	-	ND	ND	290.0	ND	1148.4	35.8	39.3	12.1	4.1	0.9	48.5	211.7	341.4	2.3	1.1	7.4	0.5 ng/L
Heptachlor Epoxide	-	1.4	ND	ND	ND	1.0	1.2	ND	4.3	ND	9.0	8.4	10.0	6.4	ND	0.6	2.6	0.5 ng/L
Dieldrin	30 ng/L (Aldrin+ Dieldrin)	3.2	1.0	3.4	ND	5.4	**211.0**	**30.9**	**42.2**	24.1	**30.5**	**57.7**	**79.8**	0.7	ND	ND	7.6	0.5 ng/L
Endrin	600 ng/L	1.2	2.2	ND	ND	ND	3.4	ND	0.6	ND	ND	ND	0.5	ND	ND	ND	ND	0.5 ng/L
trans-Chlordane	200 ng/L (t+c-Chlordane)	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.2	ND	ND	ND	ND	ND	ND	0.5 ng/L
cis-Chlordane		ND	ND	ND	ND	0.8	0.9	ND	0.6	ND	4.1	1.7	1.0	ND	ND	ND	0.6	0.5 ng/L
trans-Nonachlor	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.8	ND	ND	ND	ND	ND	ND	0.5 ng/L
2,4-DDE	1000 ng/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.8	ND	ND	ND	ND	ND	ND	0.5 ng/L
4,4'-DDE		ND	ND	ND	ND	ND	ND	ND	4.3	ND	8.9	0.7	ND	ND	0.6	ND	ND	0.5 ng/L
2,4-DDD		ND	ND	ND	ND	ND	0.6	ND	1.5	ND	21.0	ND	9.7	ND	ND	ND	ND	0.5 ng/L
4,4'-DDD		ND	ND	ND	ND	ND	0.5	1.1	2.7	ND	49.9	ND	ND	ND	ND	ND	0.7	0.5 ng/L
2,4-DDT		ND	ND	ND	ND	ND	0.5	ND	4.3	ND	4.4	ND	ND	ND	ND	ND	ND	0.5 ng/L
4,4'-DDT		ND	ND	ND	ND	ND	1.1	1.2	42.5	ND	19.7	1.0	ND	ND	1.4	2.3	ND	0.5 ng/L
Pentachlorobenzene		ND	ND	ND	ND	ND	ND	ND	3.3	ND	ND	1.9	1.7	ND	ND	ND	ND	0.5 ng/L
α-Endosulfan		1.9	ND	ND	ND	ND	ND	0.6	1.2	ND	8.2	3.3	ND	2.2	0.6	ND	ND	0.5 ng/L
β-Endosulfan		3.5	1.9	ND	ND	ND	ND	ND	ND	ND	ND	0.7	ND	1.3	1.0	0.6	ND	0.5 ng/L

※ ND : not detected

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❑ Volatile Organic Compounds (VOCs, 18 analytes)

○ Seven compounds of VOCs were detected in **six drinking water well** samples.

- **TCE** : Concentrations of five samples (0.038~0.090 mg/L) were higher than KDWS (0.03 mg/L).
- **PCE** : Concentrations of two samples (0.030~0.046 mg/L) were higher than KDWS (0.01 mg/L).

Table Ⅲ-4. Concentrations of detected VOCs from drinking water well

VOCs	Korean drinking water standard	Drinking Water Well						LOQ
		20-575	14-283	16-289	15-286	12-247	13-279	
1,1-Dichloroethene	0.03 mg/L	ND	0.001	0.012	0.001	0.008	0.002	0.001 mg/L
Chloroform	0.08 mg/L	0.001	ND	ND	ND	ND	ND	0.001 mg/L
1,1,1-Trichloroethane	0.1 mg/L	ND	ND	0.003	ND	0.002	ND	0.001 mg/L
Trichloroethene (TCE)	0.03 mg/L	**0.090**	**0.038**	**0.038**	0.025	**0.071**	**0.042**	0.001 mg/L
Tetrachloroethene (PCE)	0.01 mg/L	0.002	0.002	**0.046**	0.007	**0.030**	0.004	0.001 mg/L
trans-1,2-Dichloroethene	0.1 mg/L*	ND	ND	ND	ND	0.001	ND	0.0005 mg/L
cis-1,2-Dichloroethene	0.07 mg/L*	0.008	0.006	0.048	0.010	0.046	0.007	0.0005 mg/L

※ * EPA drinking water MCL (Maximum Contaminant Level)

※ ND : not detected

○ Eleven compounds of VOCs were detected in **sixteen monitoring well** samples.

- **TCE** : Concentrations of seven samples (0.077~0.743 mg/L) were higher than KDWS (0.03 mg/L).
- **PCE** : Concentrations of twelve samples (0.025~0.497 mg/L) were higher than KDWS (0.01 mg/L).
- **cis-1,2-Dichloroethene** : Concentrations of seven samples (0.076~1.346 mg/L) were higher than EPA MCL (0.07 mg/L).

※ KDWS : Korean Drinking Water Standard

Table Ⅲ-5. Concentrations of detected VOCs from monitoring well

VOCs	Korean drinking water standard	Monitoring Well																LOQ
		Helipad			Area D													
		B09-176 MW	B09-177 MW	B09-178 MW	B09-221 MW	B03-463 MW	B07-219 MW	B07-221 MW	B07-220 MW	B07-217 MW	B07-218 MW	B09-193 MW	B03-466 MW	B03-467 MW	B03-464 MW	B03-468 MW	B03-46 5MW	
1,1-Dichloroethene	0.03 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.007	0.001 mg/L
Methylene chloride	0.02 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.001	0.002 mg/L
Chloroform	0.08 mg/L	ND	ND	ND	ND	0.001	ND	0.006	0.002	0.005	ND	0.002	0.002	ND	ND	ND	ND	0.001 mg/L
Benzene	0.01 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.008	ND	ND	0.005	0.001 mg/L
Trichloroethene (TCE)	0.03 mg/L	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 mg/L
Tetrachloroethene (PCE)	0.01 mg/L	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 mg/L
o-Xylene	0.5 mg/L (o+m+p -xylene)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.002	ND	ND	ND	0.001 mg/L
m-Xylene		ND	ND	ND	ND	ND	0.001	ND	ND	ND	ND	ND	ND	0.001	ND	ND	0.001	0.001 mg/L
p-Xylene		ND	ND	ND	ND	ND	0.001	ND	ND	ND	ND	ND	ND	0.002	ND	ND	0.001	0.001 mg/L
trans-1,2-Dichloroethene	0.1 mg/L*	ND	ND	ND	ND	ND	0.003	0.001	0.001	0.005	ND	0.001	ND	ND	ND	ND	0.042	0.0005 mg/L
cis-1,2-Dichloroethene	0.07 mg/L*	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 mg/L

※ * EPA drinking water MCL (Maximum Contaminant Level)

※ ND : not detected

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❑ Polycyclic Aromatic Hydrocarbons (PAHs, 15 analytes)

○ PAHs were not detected in all the groundwater samples.

❑ Total Petroleum Hydrocarbons (TPHs)

○ TPHs were not detected in all the groundwater samples.

❑ Metals including heavy metals (13 analytes)

○ Seven compounds of metals were detected in **six drinking water well** samples.

- **Fe** : Concentrations of four samples (1.45~2.35 mg/L) were higher than KDWS (0.3 mg/L).
- **Zn** : The concentration of one sample (3.879 mg/L) was higher than KDWS (3 mg/L).
- **Se** : Concentrations of three samples (0.01~0.063 mg/L) were higher than KDWS (0.01 mg/L).
- **Mn** : The concentration of one sample (0.067 mg/L) was higher than KDWS (0.05 mg/L).

Table Ⅲ-6. Concentrations of detected metals from drinking water well

Metals	Korean drinking water standard	Drinking Water Well						LOQ
		20-575	14-283	16-289	15-286	12-247	13-279	
Al	0.2 mg/L	ND	0.02	ND	ND	ND	ND	0.02 mg/L
Fe	0.3 mg/L	0.06	1.54	0.10	2.24	2.35	1.45	0.05 mg/L
Mn	0.05 mg/L	ND	0.018	ND	0.067	0.04	0.016	0.005 mg/L
Zn	3 mg/L	ND	0.604	ND	3.879	2.960	0.305	0.002 mg/L
Se	0.01 mg/L	ND	0.010	ND	0.063	0.047	0.006	0.005 mg/L
B	1 mg/L	0.07	0.13	0.03	0.06	0.06	0.14	0.01 mg/L
Ba*	2 mg/L	0.04	0.02	0.04	0.02	0.03	0.02	0.002 mg/L

※ * EPA drinking water MCL (Maximum Contaminant Level)

※ KDWS : Korean Drinking Water Standard

※ ND : not detected

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○ Six compounds of metals were detected in **sixteen monitoring well** samples.

- Al : Concentrations of three samples (0.24～0.99 mg/L) were higher than KDWS (0.2 mg/L).
- Mn : Concentrations of five samples (0.101～6.457 mg/L) were higher than KDWS (0.05 mg/L).

Table Ⅲ-7. Concentrations of detected metals from monitoring well

Metals	Korean drinking water standard	Monitoring Well																LOQ
		Helipad			Area D													
		B09-1 76MW	B09-1 77MW	B09-1 78MW	B09-2 21MW	B03-4 63MW	B07-2 19MW	B07-2 21MW	B07-2 20MW	B07-2 17MW	B07-2 18MW	B09-1 93MW	B03-4 66MW	B03-4 67MW	B03-4 64MW	B03-4 68MW	B03-4 65MW	
Al	0.2 mg/L	0.18	ND	0.10	0.07	ND	0.08	0.03	0.07	ND	0.99	0.06	ND	ND	0.24	0.52	0.03	0.02 mg/L
Fe	0.3 mg/L	0.05	0.05	0.25	0.12	0.07	0.06	0.07	0.08	0.06	0.07	0.08	ND	ND	0.11	ND	ND	0.05 mg/L
Mn	0.05 mg/L	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 mg/L
Zn	3 mg/L	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	ND	0.005	0.002 mg/L
B	1 mg/L	ND	ND	ND	ND	0.01	0.04	0.02	0.04	ND	ND	ND	0.03	0.10	0.01	0.01	0.01	0.005 mg/L
Ba*	2 mg/L	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	0.01 mg/L

※ * EPA drinking water MCL (Maximum Contaminant Level)

※ KDWS : Korean Drinking Water Standard

※ ND : not detected

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Ⅳ Results

❑ Table Ⅳ-1. Concentrations of analyzed contaminants from drinking water well

	Analytes	Standard (drinking water)	Drinking Water Well						LOQ	Notes
			20-575	14-283	16-289	15-286	12-247	13-279		
Herbicides (μg/L)	2,4-D	70 μg/L	ND	ND	ND	ND	ND	ND	0.101 μg/L	EPA National primary drinking water regulations
		30 μg/L								WHO Guidelines for drinking water quality
	2,4,5-T	9 μg/L	ND	ND	ND	ND	ND	ND	0.062 μg/L	WHO Guidelines for drinking water quality
Dioxins /Furans (pg/L)	2,3,7,8-TCDF		ND	ND	ND	ND	ND	ND	0.5 pg/L	EPA National primary drinking water regulations
	1,2,3,7,8-PeCDF		ND	ND	ND	ND	ND	ND		
	2,3,4,7,8-PeCDF		ND	ND	ND	ND	ND	ND		
	1,2,3,4,7,8-HxCDF		ND	ND	ND	ND	ND	ND		
	1,2,3,6,7,8-HxCDF		ND	ND	ND	ND	ND	ND		
	1,2,3,7,8,9-HxCDF		ND	ND	ND	ND	ND	ND		
	2,3,4,6,7,8-HxCDF		ND	ND	ND	ND	ND	ND		
	1,2,3,4,6,7,8-HpCDF		ND	ND	ND	ND	ND	ND		
	1,2,3,4,7,8,9-HpCDF		ND	ND	ND	ND	ND	ND		
	OCDF		ND	ND	ND	ND	ND	ND		
	2,3,7,8-TCDD	30 pg/L	ND	ND	ND	ND	ND	ND		
	1,2,3,7,8-PeCDD		ND	ND	ND	ND	ND	ND		
	1,2,3,4,7,8-HxCDD		ND	ND	ND	ND	ND	ND		
	1,2,3,6,7,8-HxCDD		ND	ND	ND	ND	ND	ND		

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	Analytes	Standard (drinking water)	Drinking Water Well						LOQ	Notes
			20-575	14-283	16-289	15-286	12-247	13-279		
	1,2,3,7,8,9-HxCDD		ND	ND	ND	ND	ND	ND		
	1,2,3,4,6,7,8-HpCDD		ND	ND	ND	ND	ND	ND		
	OCDD		ND	ND	ND	ND	ND	ND		
	I-TEQ(pg-TEQ/L)		ND	ND	ND	ND	ND	ND		
Chloriated pesticides (ng/L)	α-HCH	-	ND	4.9	ND	2.1	2.3	ND	0.5 ng/L	-
	β-HCH	-	ND	11.6	ND	7.5	5.9	ND	0.5 ng/L	-
	γ-HCH(Lindane)	2000 ng/L	0.9	21.3	0.5	4.6	10.2	0.9	0.5 ng/L	WHO Guidelines for drinking water quality
	δ-HCH	-	ND	10.5	ND	4.8	5.4	ND	0.5 ng/L	-
	HCB	-	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	Heptachlor	-	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	Heptachlor Epoxide	-	ND	0.6	ND	0.6	ND	ND	0.5 ng/L	-
	Aldrin	30 ng/L (Aldrin+ Dieldrin)	ND	ND	ND	ND	ND	ND	0.5 ng/L	WHO Guidelines for drinking water quality
	Dieldrin		ND	1.3	ND	1.2	0.7	ND	0.5 ng/L	
	Endrin	600 ng/L	ND	ND	ND	ND	ND	ND	0.5 ng/L	
	Oxychlordane	-	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	trans-Chlordane	200 ng/L (*trans*+*cis*)	ND	ND	ND	ND	ND	ND	0.5 ng/L	WHO Guidelines for drinking water quality
	cis-Chlordane		ND	ND	ND	ND	ND	ND	0.5 ng/L	
	trans-Nonachlor	-	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	cis-Nonachlor	-	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	2,4-DDE	1000 ng/L	ND	ND	ND	ND	ND	ND	0.5 ng/L	WHO Guidelines for drinking water quality
	4,4-DDE		ND	ND	ND	ND	ND	ND	0.5 ng/L	

	Analytes	Standard (drinking water)	Drinking Water Well						LOQ	Notes
			20-575	14-283	16-289	15-286	12-247	13-279		
	2,4-DDD		ND	0.7	ND	ND	ND	ND	0.5 ng/L	
	4,4-DDD		ND	ND	ND	ND	ND	ND	0.5 ng/L	
	2,4-DDT		ND	ND	ND	ND	ND	ND	0.5 ng/L	
	4,4-DDT		ND	ND	ND	ND	ND	ND	0.5 ng/L	
	Mirex	-	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	Pentachlorobenzene		ND	ND	ND	ND	ND	ND	0.5 ng/L	
	α-Endosulfan	600 ng/L	ND	ND	ND	ND	ND	ND	0.5 ng/L	
	β-Endosulfan		ND	ND	ND	ND	ND	0.6	0.5 ng/L	
VOCs (mg/L)	1,1-Dichloroethene	0.03 mg/L	ND	0.001	0.012	0.001	0.008	0.002	0.001 mg/L	Korean drinking water standard
	Methylene chloride	0.02 mg/L	ND	ND	ND	ND	ND	ND	0.002 mg/L	
	Chloroform	0.08 mg/L	0.001	ND	ND	ND	ND	ND	0.001 mg/L	
	1,1,1-Trichloroethane	0.1 mg/L	ND	ND	0.003	ND	0.002	ND	0.001 mg/L	
	Carbon tetrachloride	0.002 mg/L	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Benzene	0.01 mg/L	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Trichloroethene	0.03 mg/L	0.090	0.038	0.038	0.025	0.071	0.042	0.001 mg/L	
	Bromodichloromethane	0.03 mg/L	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Toluene	0.7 mg/L	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Dibromochloromethane	0.1 mg/L	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Tetrachloroethene	0.01 mg/L	0.002	0.002	0.046	0.007	0.030	0.004	0.001 mg/L	
	Ethylbenzene	0.3 mg/L	ND	ND	ND	ND	ND	ND	0.001 mg/L	

	Analytes	Standard (drinking water)	Drinking Water Well						LOQ	Notes
			20-575	14-283	16-289	15-286	12-247	13-279		
	o-Xylene	0.5 mg/L (o+m+p)	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	m-Xylene		ND	ND	ND	ND	ND	ND	0.001 mg/L	
	p-Xylene		ND	ND	ND	ND	ND	ND	0.001 mg/L	
	trans-1,2-Dichloroethene	0.1 mg/L	ND	ND	ND	ND	0.001	ND	0.0005 mg/L	EPA National primary drinking water regulations
	cis-1,2-Dichloroethene	0.07 mg/L	0.008	0.006	0.048	0.010	0.046	0.007	0.0005 mg/L	
	Bromoform	0.08 mg/L	ND	ND	ND	ND	ND	ND	0.001 mg/L	
PAHs (ng/L)	Acenaphthylene	-	ND	ND	ND	ND	ND	ND	0.017 ng/L	-
	Acenaphthene	-	ND	ND	ND	ND	ND	ND	0.035 ng/L	
	Fluorene	-	ND	ND	ND	ND	ND	ND	0.027 ng/L	
	Phenanthrene	-	ND	ND	ND	ND	ND	ND	0.049 ng/L	
	Anthracene	-	ND	ND	ND	ND	ND	ND	0.015 ng/L	
	Fluoranthene	-	ND	ND	ND	ND	ND	ND	0.022 ng/L	
	Pyrene	-	ND	ND	ND	ND	ND	ND	0.032 ng/L	
	Benzo(a)anthracene	-	ND	ND	ND	ND	ND	ND	0.031 ng/L	
	Chrysene	-	ND	ND	ND	ND	ND	ND	0.014 ng/L	
	Benzo(b)fluoranthene	-	ND	ND	ND	ND	ND	ND	0.019 ng/L	
	Benzo(k)fluoranthene	-	ND	ND	ND	ND	ND	ND	0.029 ng/L	
	Benzo(a)pyrene	200ng/L	ND	ND	ND	ND	ND	ND	0.023 ng/L	EPA National primary drinking water regulations
		700ng/L								WHO Guidelines for drinking water quality
	Indeno(1,2,3)Pyrene	-	ND	ND	ND	ND	ND	ND	0.022 ng/L	-

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	Analytes	Standard (drinking water)	Drinking Water Well						LOQ	Notes
			20-575	14-283	16-289	15-286	12-247	13-279		
	Dibenz(a,h)anthracene	-	ND	ND	ND	ND	ND	ND	0.019 ng/L	
	Benzo(g,h,i)perylene	-	ND	ND	ND	ND	ND	ND	0.027 ng/L	
	Total-PAHs	-	ND	ND	ND	ND	ND	ND	-	
TPHs (mg/L)	TPHs	1.5mg/L	ND	ND	ND	ND	ND	ND	0.2 mg/L	Groundwater remediation goal
Metals (mg/L)	Al	0.2 mg/L	ND	0.02	ND	ND	ND	ND	0.02 mg/L	Korean drinking water standard
	Fe	0.3 mg/L	0.06	1.54	0.10	2.24	2.35	1.45	0.05 mg/L	
	Mn	0.05 mg/L	ND	0.018	ND	0.067	0.04	0.016	0.005 mg/L	
	Zn	3 mg/L	ND	0.604	ND	3.879	2.960	0.305	0.002 mg/L	
	Cr	0.05 mg/L	ND	ND	ND	ND	ND	ND	0.02 mg/L	
	Cd	0.005 mg/L	ND	ND	ND	ND	ND	ND	0.002 mg/L	
	Cu	1 mg/L	ND	ND	ND	ND	ND	ND	0.008 mg/L	
	Pb	0.01 mg/L	ND	ND	ND	ND	ND	ND	0.005 mg/L	
	As	0.01 mg/L	ND	ND	ND	ND	ND	ND	0.005 mg/L	
	Se	0.01 mg/L	ND	0.010	ND	0.063	0.047	0.006	0.005 mg/L	
	B	1 mg/L	0.07	0.13	0.03	0.06	0.06	0.14	0.01 mg/L	
	Hg	0.001 mg/L	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Ba	2 mg/L	0.04	0.02	0.04	0.02	0.03	0.02	0.002 mg/L	EPA drinking water MCL

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❑ Table Ⅳ-2. Concentrations of analyzed contaminants from monitoring well

	Analytes	Standard (drinking water)	Monitoring Well								LOQ	Notes
			B09-176MW	B09-177MW	B09-178MW	B09-221MW	B03-463MW	B07-219MW	B07-221MW	B07-220MW		
Herbicides (μg/L)	2,4-D	70 μg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.101 μg/L	EPA National primary drinking water regulations
		30 μg/L										WHO Guidelines for drinking water quality
	2,4,5-T	9 μg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.062 μg/L	WHO Guidelines for drinking water quality
Dioxins /Furans (pg/L)	2,3,7,8-TCDF		ND	ND	ND	ND	ND	ND	ND	ND	0.5 pg/L	EPA National primary drinking water regulations
	1,2,3,7,8-PeCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	2,3,4,7,8-PeCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,4,7,8-HxCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,6,7,8-HxCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,7,8,9-HxCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	2,3,4,6,7,8-HxCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,4,6,7,8-HpCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,4,7,8,9-HpCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	OCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	2,3,7,8-TCDD	30 pg/L	ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,7,8-PeCDD		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,4,7,8-HxCDD		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,6,7,8-HxCDD		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,7,8,9-HxCDD		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,4,6,7,8-HpCDD		ND	ND	ND	ND	ND	ND	ND	ND		
	OCDD		ND	ND	**0.8**	ND	**0.621**	ND	ND	**1.308**		
	I-TEQ(pg-TEQ/L)				**0.001**	ND	**0.001**	ND	ND	**0.001**		

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	Analytes	Standard (drinking water)	Monitoring Well								LOQ	Notes
			B09-176MW	B09-177MW	B09-178MW	B09-221MW	B03-463MW	B07-219MW	B07-221MW	B07-220MW		
Chloriated pesticides (ng/L)	α-HCH	-	1.4	0.6	69.8	ND	373.9	27.0	31.7	12.1	0.5 ng/L	-
	β-HCH	-	ND	1.4	0.8	ND	627.8	186.1	8.0	181.0	0.5 ng/L	-
	γ-HCH(Lindane)	2000 ng/L	31.2	1.1	2726.0	20.2	3648.8	83.4	20.8	100.4	0.5 ng/L	WHO Guidelines for drinking water quality
	δ-HCH	-	ND	ND	290.0	ND	1148.4	35.8	39.3	12.1	0.5 ng/L	-
	HCB	-	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	Heptachlor	-	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	Heptachlor Epoxide	-	1.4	ND	ND	ND	1.0	1.2	ND	4.3	0.5 ng/L	-
	Aldrin	30 ng/L (Aldrin+ Dieldrin)	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	WHO Guidelines for drinking water quality
	Dieldrin		3.2	1.0	3.4	ND	5.4	211.0	30.9	42.2	0.5 ng/L	
	Endrin	600 ng/L	1.2	2.2	ND	ND	ND	3.4	ND	0.6	0.5 ng/L	
	Oxychlordane	-	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	trans-Chlordane	200 ng/L (*trans*+*cis*)	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	WHO Guidelines for drinking water quality
	cis-Chlordane		ND	ND	ND	ND	0.8	0.9	ND	0.6	0.5 ng/L	
	trans-Nonachlor	-	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	cis-Nonachlor	-	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	2,4-DDE	1000 ng/L	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	WHO Guidelines for drinking water quality
	4,4-DDE		ND	ND	ND	ND	ND	ND	ND	4.3	0.5 ng/L	
	2,4-DDD		ND	ND	ND	ND	ND	0.6	ND	1.5	0.5 ng/L	
	4,4-DDD		ND	ND	ND	ND	ND	0.5	1.1	2.7	0.5 ng/L	
	2,4-DDT		ND	ND	ND	ND	ND	0.5	ND	4.3	0.5 ng/L	
	4,4-DDT		ND	ND	ND	ND	ND	1.1	1.2	42.5	0.5 ng/L	

	Analytes	Standard (drinking water)	Monitoring Well								LOQ	Notes
			B09-176MW	B09-177MW	B09-178MW	B09-221MW	B03-463MW	B07-219MW	B07-221MW	B07-220MW		
	Mirex	-	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	Pentachlorobenzene		ND	ND	ND	ND	ND	ND	ND	3.3	0.5 ng/L	
	α-Endosulfan	600 ng/L	1.9	ND	ND	ND	ND	ND	0.6	1.2	0.5 ng/L	
	β-Endosulfan		3.5	1.9	ND	ND	ND	ND	ND	ND	0.5 ng/L	
VOCs (mg/L)	1,1-Dichloroethene	0.03 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	Korean drinking water standard
	Methylene chloride	0.02 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.002 mg/L	
	Chloroform	0.08 mg/L	ND	ND	ND	ND	0.001	ND	0.006	0.002	0.001 mg/L	
	1,1,1-Trichloroethane	0.1 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Carbon tetrachloride	0.002 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Benzene	0.01 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Trichloroethene	0.03 mg/L	0.001	ND	ND	ND	0.077	0.102	0.201	0.238	0.001 mg/L	
	Bromodichloromethane	0.03 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Toluene	0.7 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Dibromochloromethane	0.1 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Tetrachloroethene	0.01 mg/L	0.002	ND	0.211	ND	0.241	0.415	0.198	0.125	0.001 mg/L	
	Ethylbenzene	0.3 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	o-Xylene	0.5 mg/L (o+m+p)	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	m-Xylene		ND	ND	ND	ND	ND	0.001	ND	ND	0.001 mg/L	
	p-Xylene		ND	ND	ND	ND	ND	0.001	ND	ND	0.001 mg/L	
	trans-1,2-Dichloroethene	0.1 mg/L	ND	ND	ND	ND	ND	0.003	0.001	0.001	0.0005 mg/L	EPA National

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	Analytes	Standard (drinking water)	Monitoring Well								LOQ	Notes
			B09-176MW	B09-177MW	B09-178MW	B09-221MW	B03-463MW	B07-219MW	B07-221MW	B07-220MW		
	cis-1,2-Dichloroethene	0.07 mg/L	ND	ND	ND	0.001	0.129	0.076	0.099	0.089	0.0005 mg/L	primary drinking water regulations
	Bromoform	0.08 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
PAHs (ng/L)	Acenaphthylene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.017 ng/L	-
	Acenaphthene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.035 ng/L	
	Fluorene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.027 ng/L	
	Phenanthrene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.049 ng/L	
	Anthracene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.015 ng/L	
	Fluoranthene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.022 ng/L	
	Pyrene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.032 ng/L	
	Benzo(a)anthracene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.031 ng/L	
	Chrysene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.014 ng/L	
	Benzo(b)fluoranthene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.019 ng/L	
	Benzo(k)fluoranthene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.029 ng/L	
	Benzo(a)pyrene	200 ng/L	ND	ND	ND	ND	ND	ND	ND	ND	0.023 ng/L	EPA National primary drinking water regulations
		700 ng/L										WHO Guidelines for drinking water quality
	Indeno(1,2,3)Pyrene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.022 ng/L	-
	Dibenz(a,h)anthracene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.019 ng/L	
	Benzo(g,h,i)perylene	-	ND	ND	ND	ND	ND	ND	ND	ND	0.027 ng/L	
	Total-PAHs	-	ND	ND	ND	ND	ND	ND	ND	ND	-	
TPHs (mg/L)	TPHs	1.5mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.2 mg/L	Groundwater remediation goal

	Analytes	Standard (drinking water)	Monitoring Well								LOQ	Notes
			B09-176MW	B09-177MW	B09-178MW	B09-221MW	B03-463MW	B07-219MW	B07-221MW	B07-220MW		
Metals (mg/L)	Al	0.2 mg/L	0.18	ND	0.10	0.07	ND	0.08	0.03	0.07	0.02 mg/L	Korean drinking water standard
	Fe	0.3 mg/L	0.05	0.05	0.25	0.12	0.07	0.06	0.07	0.08	0.05 mg/L	
	Mn	0.05 mg/L	0.021	ND	ND	0.005	0.016	ND	0.024	0.032	0.005 mg/L	
	Zn	3 mg/L	0.015	0.012	0.117	0.007	0.008	ND	0.006	ND	0.002 mg/L	
	Cr	0.05 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.02 mg/L	
	Cd	0.005 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.002 mg/L	
	Cu	1 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.008 mg/L	
	Pb	0.01 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.005 mg/L	
	As	0.01 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.005 mg/L	
	Se	0.01 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.005 mg/L	
	B	1 mg/L	ND	ND	ND	ND	0.01	0.04	0.02	0.04	0.01 mg/L	
	Hg	0.001 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Ba	2 mg/L	0.06	0.05	0.03	0.04	0.05	0.04	0.13	0.11	0.002 mg/L	EPA drinking water MCL

	Analytes	Standard (drinking water)	Monitoring Well								LOQ	Note
			B07-217MW	B07-218MW	B09-193MW	B03-466MW	B03-467MW	B03-464MW	B03-468MW	B03-465MW		
Herbicides (μg/L)	2,4-D	70 μg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.101 μg/L	EPA National primary drinking water regulations
		30 μg/L										WHO Guidelines for drinking water quality
	2,4,5-T	9 μg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.062 μg/L	WHO Guidelines for drinking water quality
Dioxins /Furans (pg/L)	2,3,7,8-TCDF		ND	ND	ND	ND	ND	ND	ND	ND	0.5 pg/L	EPA National primary drinking water regulations
	1,2,3,7,8-PeCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	2,3,4,7,8-PeCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,4,7,8-HxCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,6,7,8-HxCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,7,8,9-HxCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	2,3,4,6,7,8-HxCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,4,6,7,8-HpCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,4,7,8,9-HpCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	OCDF		ND	ND	ND	ND	ND	ND	ND	ND		
	2,3,7,8-TCDD	30 pg/L	ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,7,8-PeCDD		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,4,7,8-HxCDD		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,6,7,8-HxCDD		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,7,8,9-HxCDD		ND	ND	ND	ND	ND	ND	ND	ND		
	1,2,3,4,6,7,8-HpCDD		ND	ND	ND	ND	ND	ND	ND	ND		
	OCDD		ND	ND	ND	ND	ND	ND	ND	ND		
	I-TEQ(pg-TEQ/L)		ND	ND	ND	ND	ND	ND	ND	ND		

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	Analytes	Standard (drinking water)	Monitoring Well								LOQ	Note
			B07-217MW	B07-218MW	B09-193MW	B03-466MW	B03-467MW	B03-464MW	B03-468MW	B03-465MW		
Chloriated pesticides (ng/L)	α-HCH	-	43.5	1.0	22.4	34.4	8.5	0.6	ND	3.2	0.5 ng/L	-
	β-HCH	-	0.5	18.5	244.8	749.8	64.7	2.7	1.8	27.4	0.5 ng/L	-
	γ-HCH(Lindane)	2000 ng/L	46.3	6.9	120.0	279.1	1.7	6.5	2.8	10.3	0.5 ng/L	WHO Guidelines for drinking water quality
	δ-HCH	-	4.1	0.9	48.5	211.7	341.4	2.3	1.1	7.4	0.5 ng/L	-
	HCB	-	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	Heptachlor	-	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	Heptachlor Epoxide	-	ND	9.0	8.4	10.0	6.4	ND	0.6	2.6	0.5 ng/L	-
	Aldrin	30 ng/L (Aldrin+ Dieldrin)	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	WHO Guidelines for drinking water quality
	Dieldrin		24.1	30.5	57.7	79.8	0.7	ND	ND	7.6	0.5 ng/L	
	Endrin	600 ng/L	ND	ND	ND	0.5	ND	ND	ND	ND	0.5 ng/L	
	Oxychlordane	-	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	trans-Chlordane	200 ng/L (*trans*+*cis*)	ND	3.2	ND	ND	ND	ND	ND	ND	0.5 ng/L	WHO Guidelines for drinking water quality
	cis-Chlordane		ND	4.1	1.7	1.0	ND	ND	ND	0.6	0.5 ng/L	
	trans-Nonachlor	-	ND	0.8	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	cis-Nonachlor	-	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	2,4-DDE	1000 ng/L	ND	0.8	ND	ND	ND	ND	ND	ND	0.5 ng/L	WHO Guidelines for drinking water quality
	4,4-DDE		ND	8.9	0.7	ND	ND	0.6	ND	ND	0.5 ng/L	
	2,4-DDD		ND	21.0	ND	9.7	ND	ND	ND	ND	0.5 ng/L	
	4,4-DDD		ND	49.9	ND	ND	ND	ND	ND	0.7	0.5 ng/L	
	2,4-DDT		ND	4.4	ND	ND	ND	ND	ND	ND	0.5 ng/L	
	4,4-DDT		ND	19.7	1.0	ND	ND	1.4	2.3	ND	0.5 ng/L	
	Mirex	-	ND	ND	ND	ND	ND	ND	ND	ND	0.5 ng/L	-
	Pentachlorobenzene		ND	ND	1.9	1.7	ND	ND	ND	ND	0.5 ng/L	

	Analytes	Standard (drinking water)	Monitoring Well								LOQ	Note
			B07-217MW	B07-218MW	B09-193MW	B03-466MW	B03-467MW	B03-464MW	B03-468MW	B03-465MW		
	α-Endosulfan	600 ng/L	ND	8.2	3.3	ND	2.2	0.6	ND	ND	0.5 ng/L	
	β-Endosulfan		ND	ND	0.7	ND	1.3	1.0	0.6	ND	0.5 ng/L	
VOCs (mg/L)	1,1-Dichloroethene	0.03 mg/L	ND	ND	ND	ND	ND	ND	ND	0.007	0.001 mg/L	Korean drinking water standard
	Methylene chloride	0.02 mg/L	ND	ND	ND	ND	ND	ND	ND	0.001	0.002 mg/L	
	Chloroform	0.08 mg/L	0.005	ND	0.002	0.002	ND	ND	ND	ND	0.001 mg/L	
	1,1,1-Trichloroethane	0.1 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Carbon tetrachloride	0.002 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Benzene	0.01 mg/L	ND	ND	ND	ND	0.008	ND	ND	0.005	0.001 mg/L	
	Trichloroethene	0.03 mg/L	0.743	0.004	0.427	0.021	ND	0.016	ND	0.132	0.001 mg/L	
	Bromodichloromethane	0.03 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Toluene	0.7 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Dibromochloromethane	0.1 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Tetrachloroethene	0.01 mg/L	0.497	0.033	0.063	0.227	ND	0.031	0.034	0.025	0.001 mg/L	
	Ethylbenzene	0.3 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	o-Xylene	0.5 mg/L (o+m+p)	ND	ND	ND	ND	0.002	ND	ND	ND	0.001 mg/L	
	m-Xylene		ND	ND	ND	ND	0.001	ND	ND	0.001	0.001 mg/L	
	p-Xylene		ND	ND	ND	ND	0.002	ND	ND	0.001	0.001 mg/L	
	trans-1,2-Dichloroethene	0.1 mg/L	0.005	ND	0.001	ND	ND	ND	ND	0.042	0.0005 mg/L	EPA National

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	Analytes	Standard (drinking water)	Monitoring Well								LOQ	Note
			B07-217MW	B07-218MW	B09-193MW	B03-466MW	B03-467MW	B03-464MW	B03-468MW	B03-465MW		
	cis-1,2-Dichloroethene	0.07 mg/L	0.280	0.031	0.099	0.041	ND	ND	ND	1.346	0.0005 mg/L	primary drinking water regulations
	Bromoform	0.08 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
PAHs (ng/L)	Acenaphthylene	-	ND	-	-	-	ND	ND	ND	ND	0.017 ng/L	-
	Acenaphthene	-	ND	-	-	-	ND	ND	ND	ND	0.035 ng/L	
	Fluorene	-	ND	-	-	-	ND	ND	ND	ND	0.027 ng/L	
	Phenanthrene	-	ND	-	-	-	ND	ND	ND	ND	0.049 ng/L	
	Anthracene	-	ND	-	-	-	ND	ND	ND	ND	0.015 ng/L	
	Fluoranthene	-	ND	-	-	-	ND	ND	ND	ND	0.022 ng/L	
	Pyrene	-	ND	-	-	-	ND	ND	ND	ND	0.032 ng/L	
	Benzo(a)anthracene	-	ND	-	-	-	ND	ND	ND	ND	0.031 ng/L	
	Chrysene	-	ND	-	-	-	ND	ND	ND	ND	0.014 ng/L	
	Benzo(b)fluoranthene	-	ND	-	-	-	ND	ND	ND	ND	0.019 ng/L	
	Benzo(k)fluoranthene	-	ND	-	-	-	ND	ND	ND	ND	0.029 ng/L	
	Benzo(a)pyrene	200 ng/L	ND	-	-	-	ND	ND	ND	ND	0.023 ng/L	EPA National primary drinking water regulations
		700 ng/L										WHO Guidelines for drinking water quality
	Indeno(1,2,3)Pyrene	-	ND	-	-	-	ND	ND	ND	ND	0.022 ng/L	-
	Dibenz(a,h)anthracene	-	ND	-	-	-	ND	ND	ND	ND	0.019 ng/L	
	Benzo(g,h,i)perylene	-	ND	-	-	-	ND	ND	ND	ND	0.027 ng/L	
	Total-PAHs	-	ND			-	ND	ND	ND	ND	-	

	Analytes	Standard (drinking water)	Monitoring Well								LOQ	Note
			B07-217MW	B07-218MW	B09-193MW	B03-466MW	B03-467MW	B03-464MW	B03-468MW	B03-465MW		
TPHs (mg/L)	TPHs	1.5mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.2 mg/L	Groundwater remediation goal
Metals (mg/L)	Al	0.2 mg/L	ND	0.99	0.06	ND	ND	0.24	0.52	0.03	0.02 mg/L	Korean drinking water standard
	Fe	0.3 mg/L	0.06	0.07	0.08	ND	ND	0.11	ND	ND	0.05 mg/L	
	Mn	0.05 mg/L	0.015	0.113	0.101	0.601	6.457	0.008	0.007	0.299	0.005 mg/L	
	Zn	3 mg/L	0.007	0.009	0.011	0.004	0.003	0.014	ND	0.005	0.002 mg/L	
	Cr	0.05 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.02 mg/L	
	Cd	0.005 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.002 mg/L	
	Cu	1 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.008 mg/L	
	Pb	0.01 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.005 mg/L	
	As	0.01 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.005 mg/L	
	Se	0.01 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.005 mg/L	
	B	1 mg/L	ND	ND	ND	0.03	0.10	0.01	0.01	0.01	0.01 mg/L	
	Hg	0.001 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.001 mg/L	
	Ba	2 mg/L	0.06	0.08	0.06	0.07	0.08	0.12	0.01	0.19	0.002 mg/L	EPA drinking water MCL

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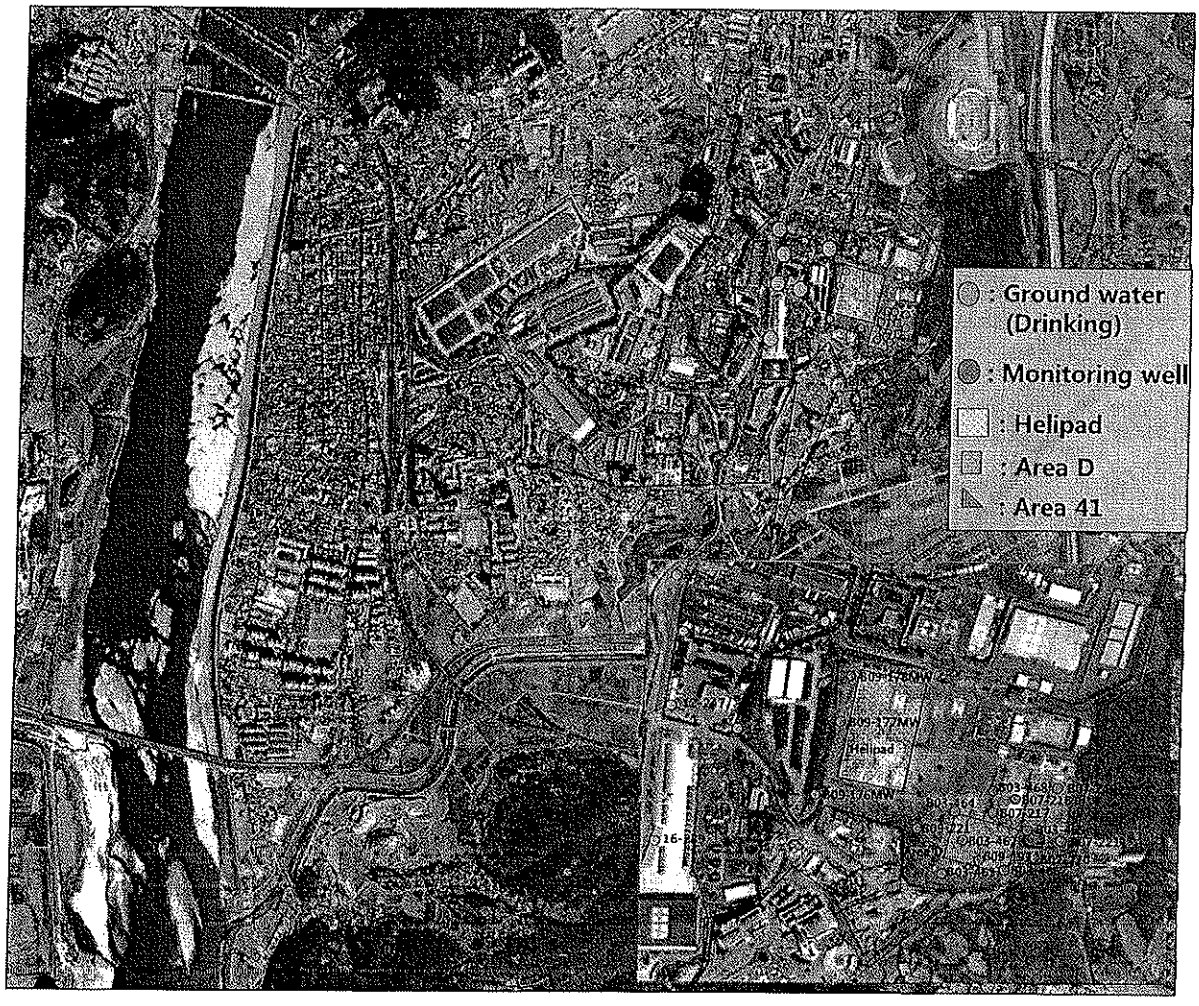
Appendix 1 | Sampling points



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Appendix 2 | Analytical Methods and Conditions

❑ Herbicides (2,4-D, 2,4,5-T)

○ Analytical method (Korean Official Testing Method for Drinking Water)

Funnel

- sample 200mL
- H_2SO_4 5mL
- Na_2SO_4 60g
- shaking
- Ether 25mL
- shaking
- transfer

Organic(Ether)

- dryness
- Trifluoroacetic anhydride 100㎕
- Trifluoroethanol 50㎕
- 80℃, 1hr
- cooling
- dryness
- adding ethyl acetate 100㎕

(containing phenanthrene-d10 10ppm ; ISTD)

GC/MSD

○ GC/MS condition

GC	Instrument	Agilent 7890A
	Injection mode	Splitless, 2㎕, 280℃ (purge time 0.75min)
	Separation column	DB5-MS (30m×0.25mm×250㎛ film thickness)
	Oven temperature	100℃ → 10℃/min → 300℃ (min), (21min)
	Carrier gas flow	Helium (99.9999%), 0.7㎖/min
MS	Instrument	Agilent 5975C
	Ion mode	SIM mode
	Resolution	above 1,000
	Ionization mode	Electron Ionization
	Ionization energy	70 eV
	Ion source temp.	200℃

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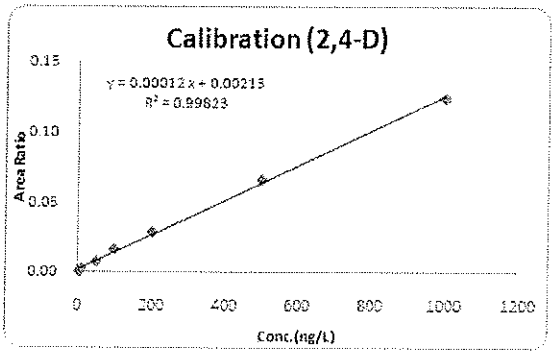
❍ **Calibrations** : 5, 10, 50, 100, 200, 500, 1000 ng/L

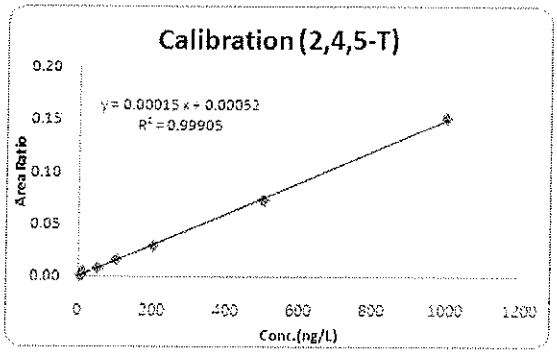
Compound	Calibration Curve	R^2	Recovery (%)
2,4-D	y=0.00012x + 0.00213	0.99823	89.8
2,4,5-T	y=0.00015x + 0.00052	0.99905	97.2

❍ Calibration curves

- 2,4-D



- 2,4,5-T



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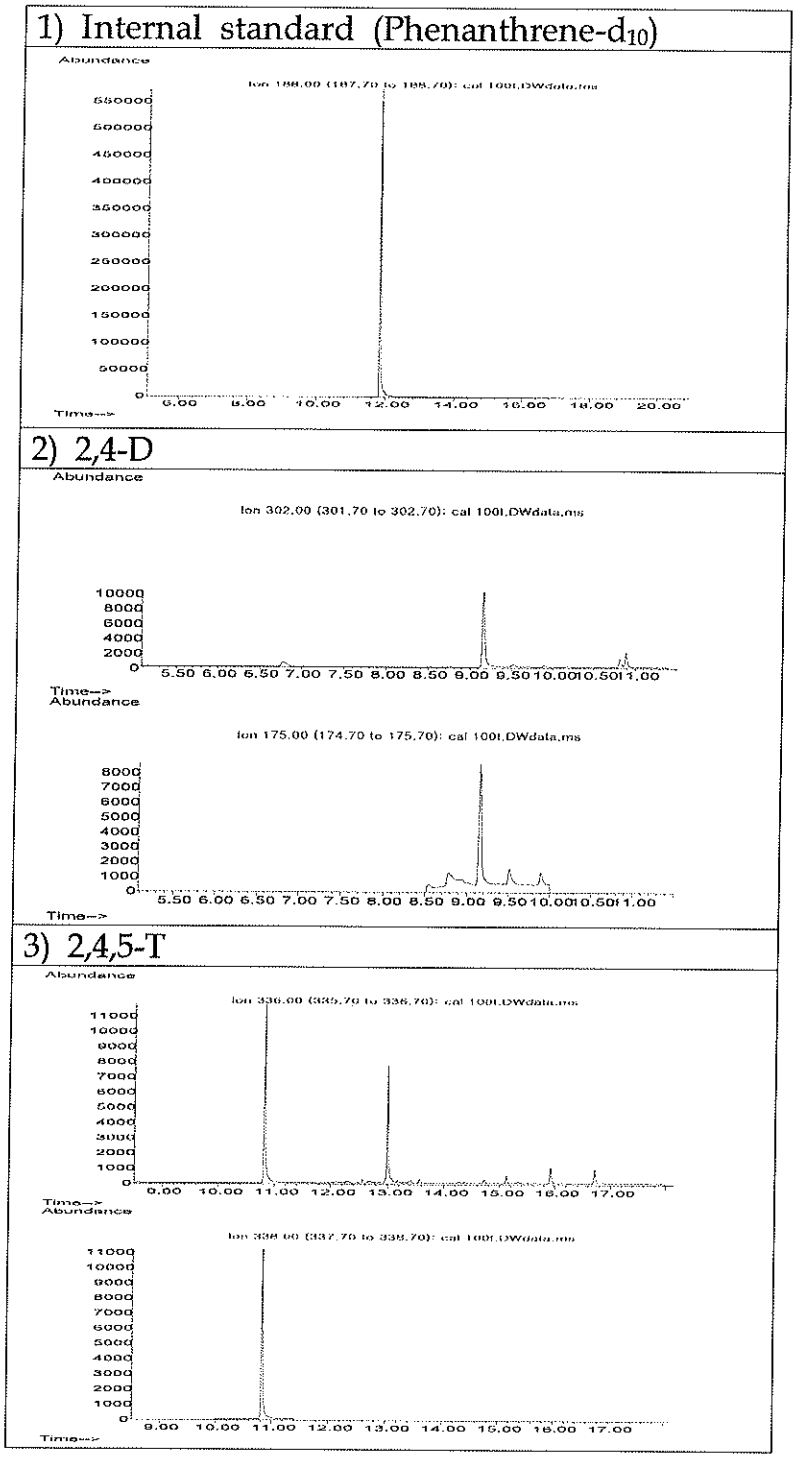
○ **Chromatogram** (100 ng/L)

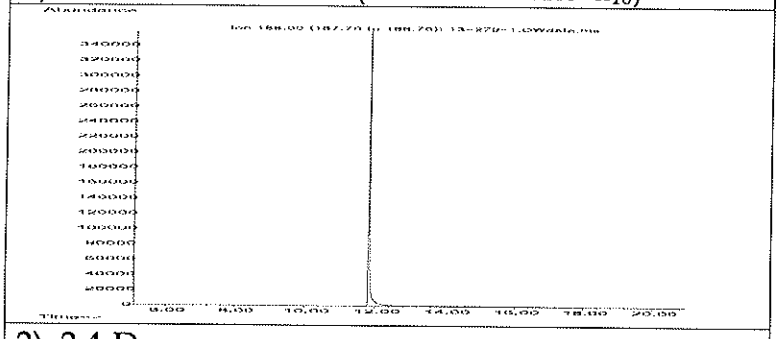
- Standards



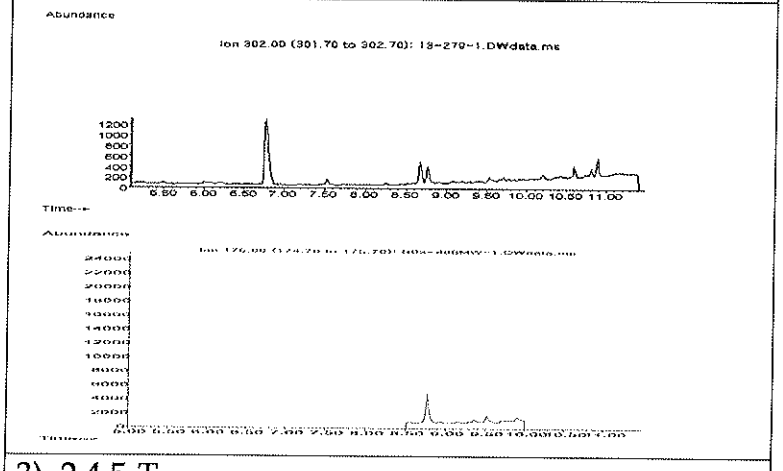
4498

- Samples : 13-279 (Drinking water well)

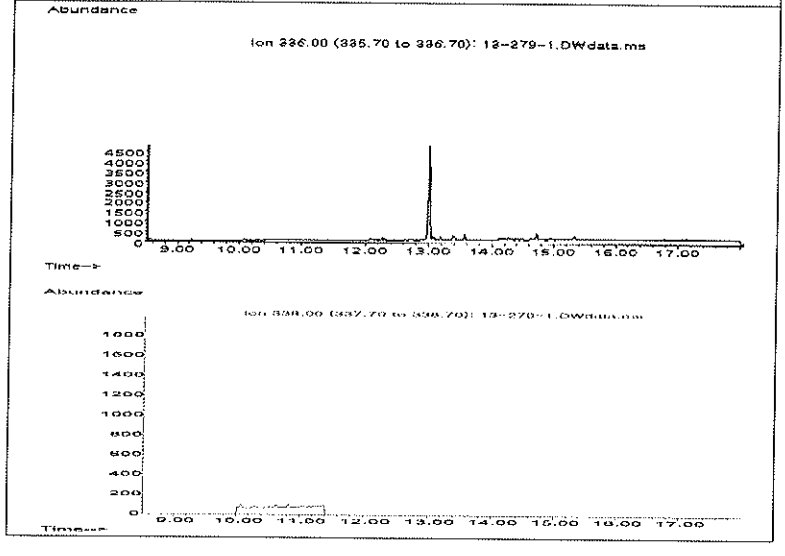
1) Internal standard (Phenanthrene-d_{10})



2) 2,4-D



3) 2,4,5-T



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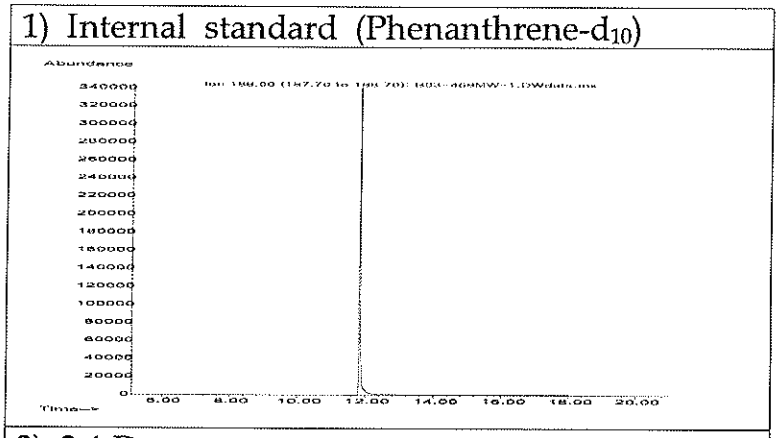
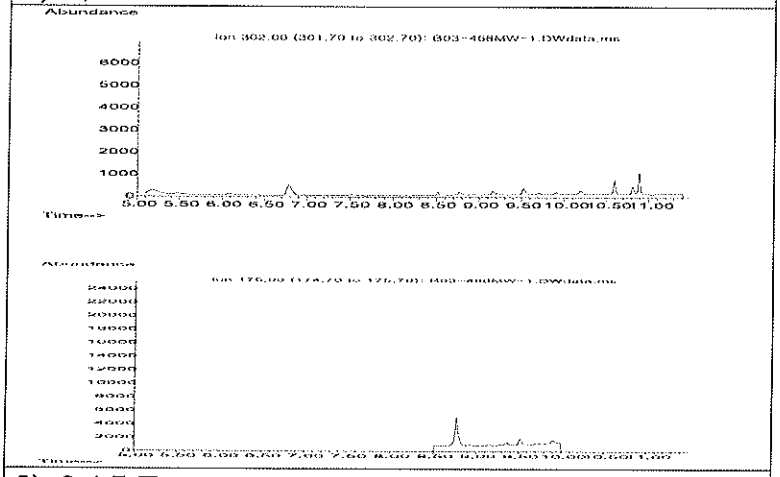
- Samples : B03-468MW (Monitoring well)

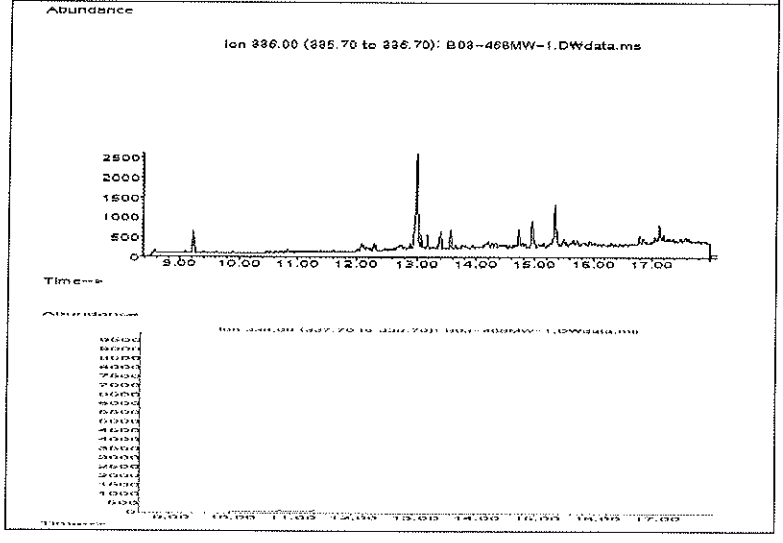
1) Internal standard (Phenanthrene-d_{10})



2) 2,4-D



3) 2,4,5-T



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