시 험 성 적 서
Test Report

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시험성적서 번호
Report No. KOMERI-0906-13T972-3

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■ 접수일자 : 2013. 05. 16
Date of Receipt

■ 접수번호 : 13T972
Receipt No.

■ 신 청 자 : SUNBO INDUSTRIES CO., Ltd
Applicant

■ 주 소 : 1517-2, DADAE-DONG, SAHA-GU, BUSAN, KOREA
Address

■ 시 료 명 : BlueZone™ BWMS
Name of Product

■ 모 델 명 : DNS 250
Model

■ 제품번호 : -
Serial No.

■ 시험규격 : PR. No. 2013-56, Annex 4 and 6 by the Ministry of Oceans and Fisheries and IMO G8 (Res. MEPC. 174(58))
Test Standard

■ 성적서 용도 : Type Approval by the Ministry of Oceans and Fisheries
Use of Report

■ 시험기간 : 2013. 06. 12 ~ 2013. 10. 28
Test Period

■ 시험환경 : 온도 (24.3 ± 4.9) ℃, 습도 (55 ± 12) % R.H.
Environment Temperature Humidity

■ 시험결과 : Conformity
Test Result

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This document is substitute for certificate No. KOMERI-0906-13T972 and KOMERI-0906-13T972-1.

발급일 : 2015. 11. 10
Date of issue

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(재)한국조선해양기자재연구원장 김 영 철
The President of Korea Marine Equipment Research Institute

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

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GENERAL

■ MANUFACTURER ☑ Same as the Applicant

Company Name : SUNBO INDUSTRIES CO., Ltd

Address : 1517-2, DADAE-DONG, SAHA-GU, BUSAN, KOREA

■ ADDITIONAL TEST INFORMATION

Treatment Rated Capacity : (244 ± 9) m^3/h

■ TEST SUMMARY

Test Item	Test Standard	Result
Land-based test	PR. No. 2013-56, Annex 4 and 6 by the Ministry of Oceans and Fisheries and IMO G8 (Res. MEPC. 174(58))	Conformity

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1. LAND-BASED TEST

1.1 TEST ENVIRONMENT

·Ambient temperature (24.3 ± 4.9) ℃

·Relative Humidity (55 ± 12) % R.H.

1.2 TEST STANDARD

· 'The Provisional Regulation of Type Approval of Ballast Water Management System' by the Ministry of Oceans and Fisheries (PR. No. 2013-56, Annex 4 and Annex 6) and IMO G8 (Res. MEPC. 174(58), Annex, PART 2, 2.3, 2.4 & PART 4).

	Test Item	Test Method
◆	Water temperature	APHA Standard Method 2550:2012
◆	pH	APHA Standard Method 4500 H^+ B:2012
◆	ORP	APHA Standard Method 2580:2012
◆	Salinity	APHA Standard Method 2520 B:2012
◆	DO	ASTM Standard Method D888-09 C:2010
◆	Turbidity	APHA Standard Method 2130 B:2012
◆	TSS	APHA Standard Method 2540 D:2005
◆	DOC/POC[1]	ISO 8245:1999
◆	≥ 50 μm organisms	Fleming & Coughlan, 1978[2], US EPA 600/R-10/146:2010[3], APHA Standard Method 10200 C:2012[4]
◆	≥ 10 μm and < 50 μm organisms	Anja et al., 2005[5], APHA Standard Method 10200 C:2012
◆	Heterotrophic bacteria	APHA Standard Method 9125:2012
◆	Coliform	APHA Standard Method 9222 B:2012
◆	*Escherichia coli*	US EPA 1603:2009
◆	Intestinal Enterococci	US EPA 1600:2009
◆	Toxicogenic *Vibrio cholerae* (O1, O139)	APHA Standard Method 9260 H:2012 and/or API 20E kit (BioMerieux, Inc.)

[1] The test is conducted by Korea Testing & Research Institute (KTR).

[2] Staining with Neutral Red.

[3] Touch with the point of a fine dissecting needle.

[4] Concentration techniques.

[5] Fluorescence staining with 5-CFDA-AM.

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1.3 TEST EQUIPMENT

Description	Manufacturer	Model Number	Serial Number	Calibration Due
◆ Auto pipette	Labnet Int'l, inc.	BP-10000	944090050	~ 2013. 12. 01
◆ Auto pipette	Labnet Int'l, inc.	BP-1000	744061707	~ 2013. 12. 01
◆ Auto pipette	BioScience inc.	BP-200	943850205	~ 2013. 12. 01
◆ Autoclave	DH Sci.	WAC-60	DHWAC01060	~ 2013. 12. 06
◆ Bogorov counting chamber	DH Sci.	-	-	-
◆ Clean bench	SY Sci.	SH-150S	-	-
◆ Colony counter	SUNTEX	570	071203875	-
◆ Digital imaging	Olympus	JUJAK 5.5	-	-
◆ Drying and heating oven	DH Sci.	WON-105	5A17185	-
◆ Electronic balance	OHAUS	Pioneer™ Balances	4007270901018	~ 2013. 12. 06
◆ Filtration system	Nalgene	350 mL	8330420867	~ 2013. 12. 06
◆ Fluorescent microscope	Olympus	CFX41-33FL	-	-
◆ Humidity Recorder	CENTER	313	1C39498	-
◆ Incubators	DH Sci.	WIG-155	-	~ 2013. 11. 18
◆ Mass cylinder	Witeg	250 mL	WIG1550905:4006	~ 2013. 12. 06
◆ Micro (Pasteur) pipette	Hilgenberg	31 501 02	-	~ 2015. 06. 04
◆ Multiprobe (Hydrolab)	Hach company	Hydrolab MS5	-	-
◆ Plankton net	SA Sci.	conical 30 μm	041000049050	-
◆ Plankton net	SA Sci.	conical 7 ~ 8 μm	-	-
◆ Sedgewick-Rafter chamber	Pyser-SGI	-	-	-
◆ Standard sieve	Sefar	30 μm	-	-
◆ Standard sieve	Sefar	7 ~ 8 μm	-	~ 2013. 11. 29
◆ Stereo-microscope	Olympus	SZ40	-	-
◆ Turbidity meter	Hach company	2100 P	8L02417	-
◆ Vacuum pump	THOMAS	1617-353 series	10010C0391:4	~2013. 11. 18

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1.4 TEST SET-UP

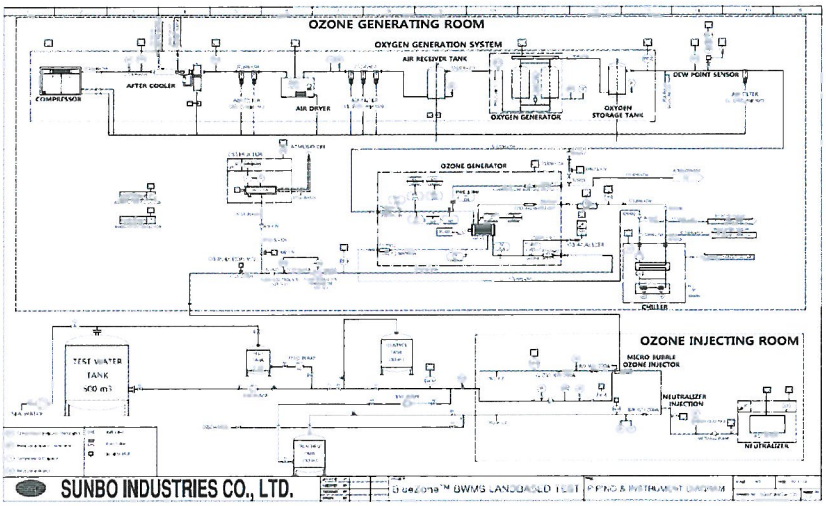

Figure 1-1 Test diagram of BlueZone™ (refer to ATTACHMENT I)

1.5 TEST PROCEDURE

· See ATTACHMENT II. PROCEDURES FOR LAND-BASED TEST.

1.6 TEST SCHEDULE

Period	Cycle	Test mode and date		Location
		Ballasting	de-Ballasting	
1 (20 ~ 21 PSU)	1	2013. 06. 12.	2013. 06. 17	KIOST, South Sea Research Institute (34° 59' 31.00" N, 128° 40' 23.39" E)
	3	2013. 06. 26	2013. 07. 01	
	4	2013. 07. 03	2013. 07. 08	
	5	2013. 07. 10	2013. 07. 15	
	13	2013. 09. 25	2013. 09. 30	
	14	2013. 10. 02.	2013. 10. 07	
	15	2013. 10. 11	2013. 10. 16	
	16	2013. 10. 17	2013. 10. 22.	
	17	2013. 10. 23	2013. 10. 28	
2 (32 ~ 34 PSU)	2	2013. 06. 19	2013. 06. 24	
	6	2013. 07. 17	2013. 07. 22.	
	7	2013. 07. 24	2013. 07. 29	
	8	2013. 08. 07	2013. 08. 12.	
	9	2013. 08. 21	2013. 08. 26	
	10	2013. 08. 28	2013. 09. 02.	
	11	2013. 09. 04	2013. 09. 09	
	12	2013. 09. 11	2013. 09. 16	

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1.7 TEST RESULT

1.7.1 Assessment of valid test

(1) Basic water parameter in the test (challenge) water

Period	Cycle	Salinity (PSU)	TSS (mg/L)	DOC (mg/L)	POC (mg/L)	Remark
1 (20 ~ 21 PSU)	1	20.54 ± 0.05	63.6 ± 4.13	7.65 ± 0.02	8.97 ± 0.97	Valid
	3	21.41 ± 0.03	55.1 ± 5.81	7.34 ± 0.04	6.79 ± 0.52	Valid
	4	21.22 ± 0.05	58.8 ± 4.52	7.07 ± 0.24	8.23 ± 0.16	Valid
	5	20.72 ± 0.05	52.5 ± 4.49	6.01 ± 0.06	5.22 ± 0.72	Valid
	13	21.13 ± 0.04	56.4 ± 7.35	8.10 ± 0.06	7.45 ± 0.21	Valid
	14	21.15 ± 0.03	68.2 ± 10.8	8.61 ± 0.37	9.32 ± 0.32	Valid
	15	21.61 ± 0.04	58.2 ± 5.07	7.88 ± 0.55	6.96 ± 0.35	Valid
	16	21.53 ± 0.05	58.4 ± 3.85	8.47 ± 0.40	7.18 ± 0.93	Valid
	17	21.25 ± 0.06	114.6 ± 14.37	7.57 ± 0.04	6.31 ± 0.59	Valid
Valid requirement		3 ~ 32	> 50	> 5	> 5	-
2 (32 ~ 34 PSU)	2	33.01 ± 0.18	27.1 ± 1.23	4.14 ± 0.15	1.94 ± 0.30	Valid
	6	33.64 ± 0.16	24.5 ± 3.75	3.00 ± 0.04	1.80 ± 0.26	Valid
	7	33.56 ± 0.18	25.0 ± 1.61	3.03 ± 0.12	1.35 ± 0.39	Valid
	8	34.08 ± 0.08	25.6 ± 6.44	3.06 ± 0.02	1.69 ± 0.34	Valid
	9	33.99 ± 0.13	16.9 ± 2.91	2.98 ± 0.07	1.98 ± 0.41	Valid
	10	33.71 ± 0.06	19.6 ± 1.33	3.25 ± 0.03	1.44 ± 0.35	Valid
	11	32.85 ± 0.20	23.6 ± 2.17	3.39 ± 0.12	1.87 ± 0.07	Valid
	12	33.49 ± 0.13	30.7 ± 5.89	2.98 ± 0.04	1.94 ± 0.39	Valid
Valid requirement		> 32	> 1	> 1	> 1	-

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

(2) Viable organisms in the test (challenge) water

Period	Cycle	≥ 50 μm organisms (inds./m^3)	≥ 10 μm and < 50 μm organisms (inds./mL)	Heterotrophic bacteria (CFU/mL)	Remark
1 (20 ~ 21 PSU)	1	196 334 ± 43 824	2 101 ± 370	30 700 ± 3 225	Valid
	3	156 334 ± 12 595	1 859 ± 135	16 023 ± 3 648	Valid
	4	222 778 ± 32 042	1 026 ± 83	25 567 ± 14 199	Valid
	5	148 556 ± 10 827	1 028 ± 40	47 623 ± 3 970	Valid
	13	295 223 ± 25 758	1 655 ± 254	11 545 ± 1 124	Valid
	14	237 889 ± 10 314	1 508 ± 290	21 523 ± 1 192	Valid
	15	262 000 ± 24 719	1 172 ± 99	16 212 ± 1 727	Valid
	16	209 000 ± 30 668	1 295 ± 184	17 067 ± 1 682	Valid
	17	250 445 ± 13 474	1 370 ± 172	24 212 ± 1 617	Valid
2 (32 ~ 34 PSU)	2	179 667 ± 16 210	1 425 ± 228	5 756 ± 5 661	Invalid
	6	150 500 ± 16 884	1 916 ± 182	13 323 ± 1 263	Valid
	7	138 556 ± 15 485	1 934 ± 414	TNTC*	Valid
	8	207 945 ± 12 985	1 520 ± 259	14 645 ±1 968	Valid
	9	249 334 ± 29 598	1 204 ± 137	3 712 ± 988	Invalid
	10	176 778 ± 18 295	1 255 ± 172	11 900 ± 1 527	Valid
	11	219 334 ± 18 895	1 766 ± 245	11 167 ± 913	Valid
	12	216 112 ± 11 275	1 203 ± 123	13 567 ± 1 564	Valid
Valid requirement		≥ 100 000	≥ 1 000	≥ 10 000	-

* Too Numerous To Count

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

(3) Organisms diversity in the test (challenge) water

Period	Cycle	≥ 50 μm organisms	≥ 10 μm and < 50 μm organisms	Remark
1 (20 ~ 21 PSU)	1	4 Phyla/Division 10 Species	3 Phyla/Division 12 Species	Valid
	3	5 Phyla/Division 10 Species	3 Phyla/Division 9 Species	Valid
	4	4 Phyla/Division 10 Species	4 Phyla/Division 12 Species	Valid
	5	3 Phyla/Division 11 Species	3 Phyla/Division 12 Species	Valid
	13	3 Phyla/Division 11 Species	3 Phyla/Division 12 Species	Valid
	14	4 Phyla/Division 13 Species	3 Phyla/Division 13 Species	Valid
	15	4 Phyla/Division 11 Species	4 Phyla/Division 9 Species	Valid
	16	4 Phyla/Division 12 Species	4 Phyla/Division 12 Species	Valid
	17	5 Phyla/Division 12 Species	3 Phyla/Division 7 Species	Valid
2 (32 ~ 34 PSU)	2	3 Phyla/Division 9 Species	3 Phyla/Division 7 Species	Valid
	6	3 Phyla/Division 16 Species	4 Phyla/Division 14 Species	Valid
	7	4 Phyla/Division 17 Species	3 Phyla/Division 10 Species	Valid
	8	3 Phyla/Division 12 Species	4 Phyla/Division 7 Species	Valid
	9	3 Phyla/Division 15 Species	4 Phyla/Division 10 Species	Valid
	10	4 Phyla/Division 15 Species	4 Phyla/Division 12 Species	Valid
	11	5 Phyla/Division 13 Species	4 Phyla/Division 11 Species	Valid
	12	4 Phyla/Division 13 Species	4 Phyla/Division 11 Species	Valid
Valid requirement		≥ 3 Phyla/Division 5 Species	≥ 3 Phyla/Division 5 Species	-

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(4) Viable organisms in the discharge control water

Period	Cycle	≥ 50 μm organisms (inds./m^3)	≥ 10 μm and < 50 μm organisms (inds./mL)	Remark
1 (20 ~ 21 PSU)	1	13 889 ± 17 373	402 ± 114	Valid
	3	28 000 ± 3 658	474 ± 50	Valid
	4	9 278 ± 1 987	188 ± 47	Valid
	5	612 ± 221	322 ± 54	Valid
	13	278 ± 441	113 ± 16	Valid
	14	1 056 ± 882	123 ± 22	Valid
	15	1 056 ± 683	126 ± 21	Valid
	16	344 112 ± 78 635	1 818 ± 140	Valid
	17	17 223 ± 3 701	1 418 ± 75	Valid
2 (32 ~ 34 PSU)	2	3 056 ± 1 158	95 ± 19	Invalid
	6	567 ± 450	163 ± 48	Valid
	7	556 ± 167	175 ± 57	Valid
	8	2 389 ± 858	152 ± 28	Valid
	9	945 ± 391	62 ± 30	Invalid
	10	778 ± 364	113 ± 21	Valid
	11	1 112 ± 782	98 ± 22	Valid*
	12	1 223 ± 755	200 ± 42	Valid
Valid requirement		> 100	> 100	-

* The test result is average except the largest variation in beginning, middle, and end sample. The average of these results are satisfied within 10 % valid criteria, the test are accepted as satisfying the valid requirement (refer to ATTACHMENT V).

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1.7.2 Assessment of discharge treated water

Period	Cycle	≥ 50 μm organisms (inds./m³)	≥ 10 μm and < 50 μm organisms (inds./mL)	Bacteria (CFU/100 mL)			Remark
				Escherichia coli	Intestinal Enterococci	Toxicogenic *Vibrio cholerae* (O1, O139)	
1 (20 ~ 21 PSU)	1	1 ± 0.6	8.5 ± 1.1	1 ± 0.4	4 ± 3.8	0 ± 0.0	Conformity
	3	1 ± 1.2	0.8 ± 0.6	1 ± 0.4	85 ± 28.7	0 ± 0.0	Conformity
	4	1 ± 1.2	0.2 ± 0.2	1 ± 0.7	171 ± 34.9	0 ± 0.0	Non Conformity
	5	1 ± 0.6	3.8 ± 3.1	8 ± 2.4	228 ± 44.6	0 ± 0.0	Non Conformity
	13	0 ± 0.0	2.2 ± 0.8	2 ± 1.0	82 ± 53.6	0 ± 0.0	Conformity
	14	0 ± 0.0	1.9 ± 1.0	1 ± 0.8	205 ± 86.3	0 ± 0.0	Non Conformity
	15	0 ± 0.0	2.3 ± 1.2	0 ± 0.0	57 ± 37.9	0 ± 0.0	Conformity
	16	4 ± 2.6	3.5 ± 1.3	0 ± 0.0	106 ± 23.4	0 ± 0.0	Non Conformity
	17	7 ± 5.6	2.5 ± 0.9	0 ± 0.0	7 ± 2.8	0 ± 0.0	Conformity
2 (32 ~ 34 PSU)	2	62 ± 10.6	0.0 ± 0.0	0 ± 0.0	7 ± 9.5	0 ± 0.0	Non Conformity
	6	0 ± 0.0	0.1 ± 0.1	0 ± 0.0	70 ± 13.3	0 ± 0.0	Conformity
	7	0 ± 0.0	0.0 ± 0.0	0 ± 0.0	76 ± 28.7	0 ± 0.0	Conformity
	8	0 ± 0.0	0.2 ± 0.1	0 ± 0.0	TNTC*	0 ± 0.0	Non Conformity
	9	0 ± 0.0	0.5 ± 0.3	0 ± 0.0	1 ± 0.8	0 ± 0.0	Invalid
	10	1 ± 1.2	0.2 ± 0.2	0 ± 0.0	3 ± 2.3	0 ± 0.0	Conformity
	11	0 ± 0.0	0.2 ± 0.1	5 ± 3.4	2 ± 1	0 ± 0.0	Conformity
	12	0 ± 0.0	0.1 ± 0.1	1 ± 0.5	10 ± 4.7	0 ± 0.0	Conformity
Discharge standard		< 10	< 10	< 250	< 100	< 1	-

* Too Numerous To Count

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1.7.3 Recording data of operation parameters

Period	Cycle	Ballasting		de-Ballasting	
		TRC (m^3/h)	TRO (mg/L as Cl_2)	TRC (m^3/h)	TRO (mg/L as Cl_2)
1 (20 ~ 21 PSU)	1	244 ± 4	2.07 ± 0.13	245 ± 3	0.00 ± 0.00
	3	237 ± 10	2.01 ± 0.07	240 ± 6	0.00 ± 0.00
	4	243 ± 4	1.96 ± 0.21	243 ± 5	0.00 ± 0.00
	5	244 ± 4	2.01 ± 0.23	224 ± 6	0.00 ± 0.00
	13	246 ± 4	2.32 ± 0.12	250 ± 5	0.00 ± 0.00
	14	246 ± 5	1.84 ± 0.83	248 ± 3	0.00 ± 0.00
	15	247 ± 3	2.32 ± 0.12	239 ± 6	0.00 ± 0.00
	16	248 ± 4	2.35 ± 0.16	247 ± 6	0.00 ± 0.00
	17	248 ± 3	2.33 ± 0.14	243 ± 4	0.00 ± 0.00
2 (32 ~ 34 PSU)	2	245 ± 3	2.02 ± 0.48	245 ± 7	0.00 ± 0.00
	6	245 ± 2	2.29 ± 0.06*	212 ± 4	0.00 ± 0.00
	7	233 ± 12	2.23 ± 0.49*	242 ± 6	0.00 ± 0.00
	8	240 ± 4	1.58 ± 1.10	245 ± 6	0.00 ± 0.00
	9	250 ± 3	2.20 ± 0.44	251 ± 7	0.00 ± 0.00
	10	248 ± 3	2.34 ± 0.20	255 ± 5	0.00 ± 0.00
	11	246 ± 3	2.37 ± 0.10	250 ± 8	0.00 ± 0.00
	12	247 ± 3	2.29 ± 0.11	248 ± 3	0.00 ± 0.00

* The value of TRO sensor #1 is used instead of TRO sensor #2. Because the value of TRO sensor #2 occurred error.

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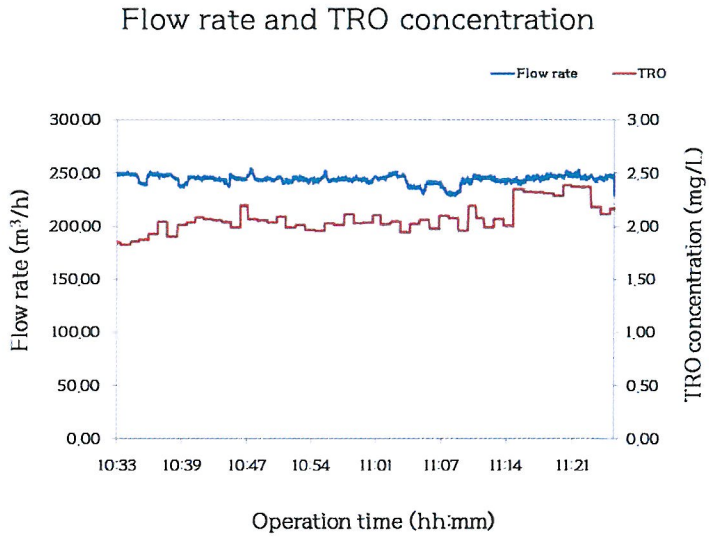
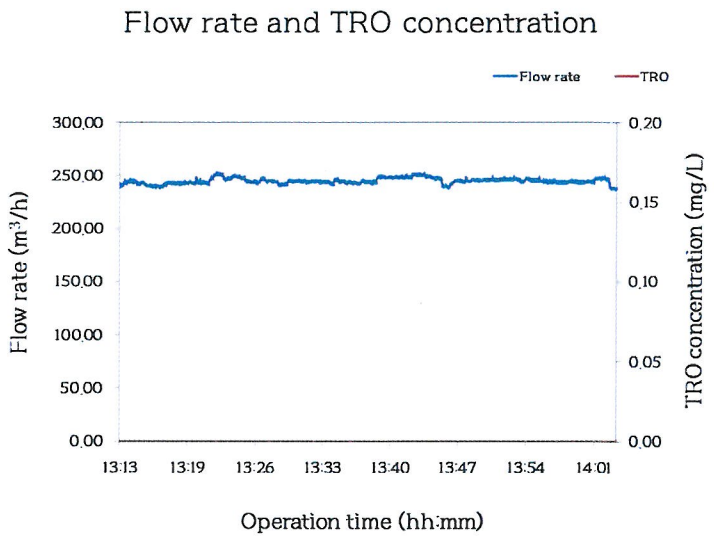
(1) 1st test cycle, Ballasting (20 ~ 21 PSU, 2013. 06. 12)



(2) 1st test cycle, de-Ballasting (20 ~ 21 PSU, 2013. 06. 17)



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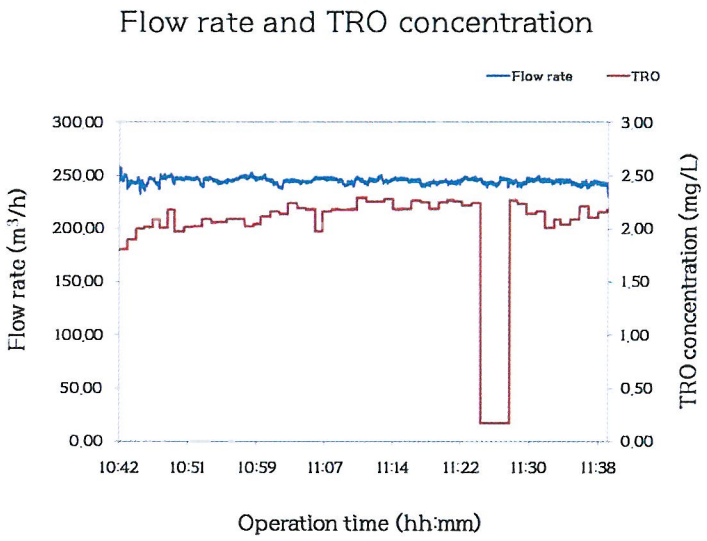
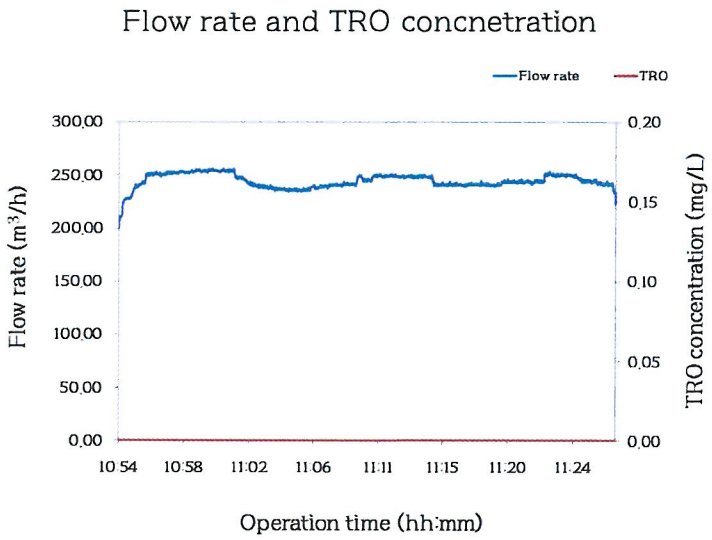
(3) 2nd. test cycle, Ballasting (32 ~ 34 PSU, 2013. 06. 19)

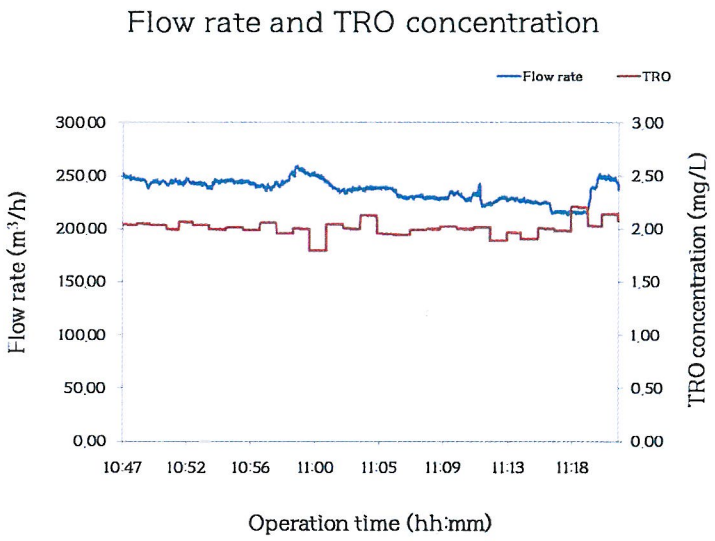


(4) 2nd. test cycle, de-Ballasting (32 ~ 34 PSU, 2013. 06. 24)

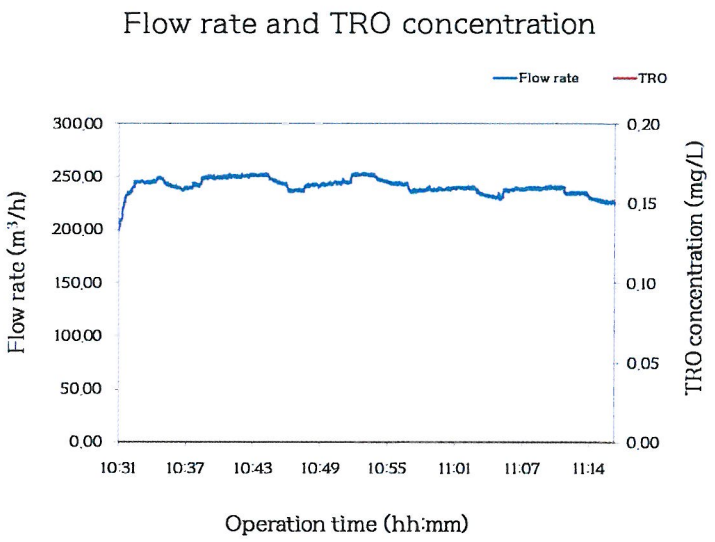


G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

(5) 3rd. test cycle, Ballasting (20 ~ 21 PSU, 2013. 06. 26)

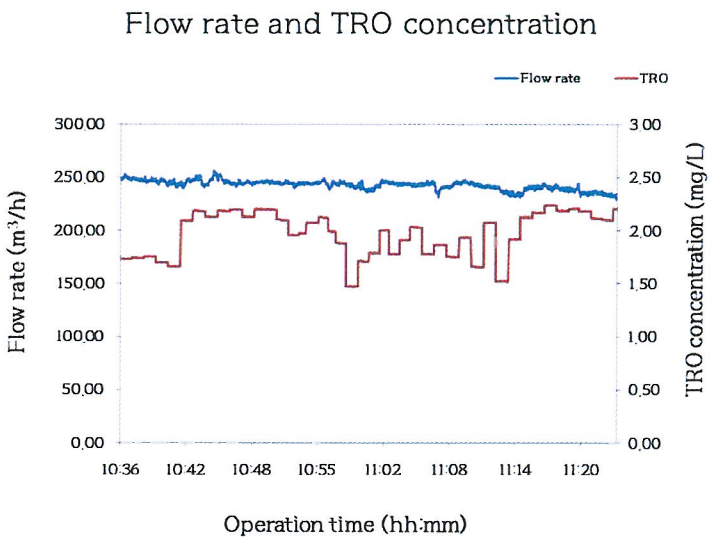


(6) 3rd. test cycle, de-Ballasting (20 ~ 21 PSU, 2013. 07. 01)

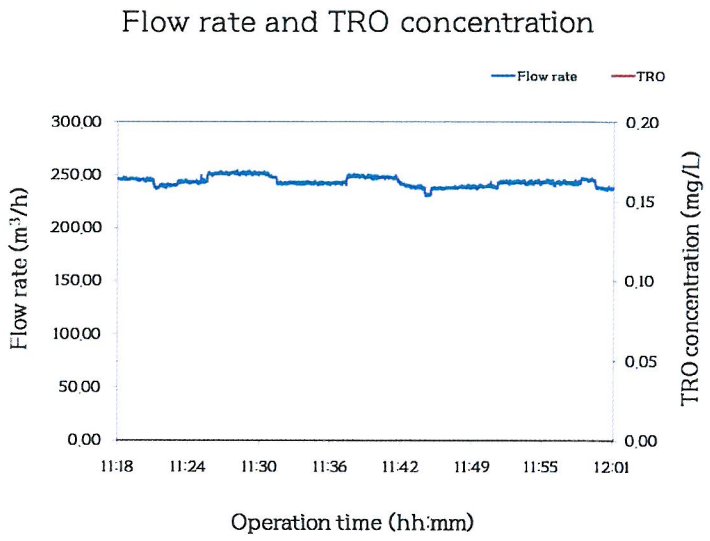


G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

(7) 4th. test cycle. Ballasting (20 ~ 21 PSU. 2013. 07. 03)

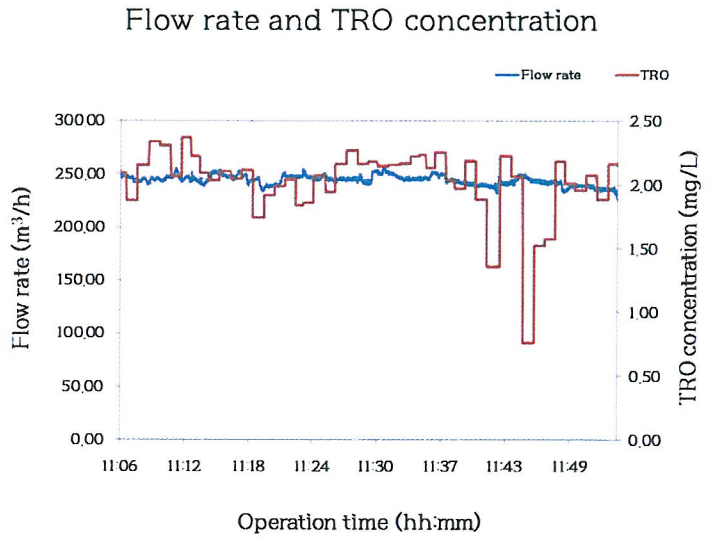


(8) 4th. test cycle. de-Ballasting (20 ~ 21 PSU. 2013. 07. 08)

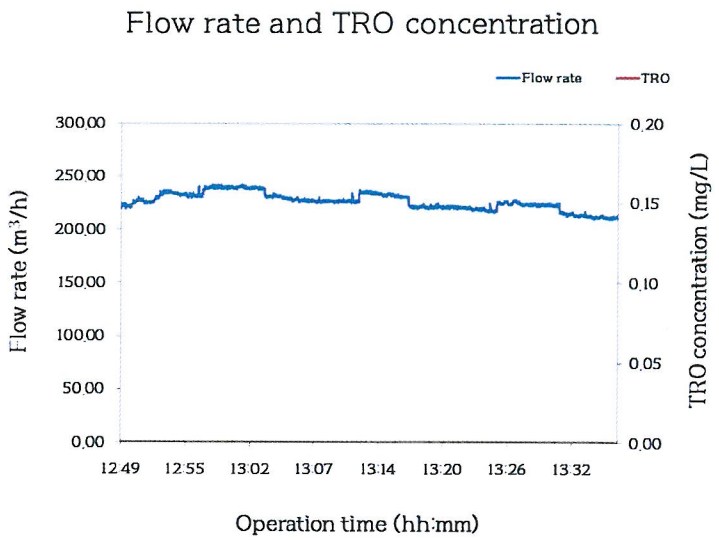


G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

(9) 5th. test cycle, Ballasting (20 ~ 21 PSU, 2013. 07. 10)

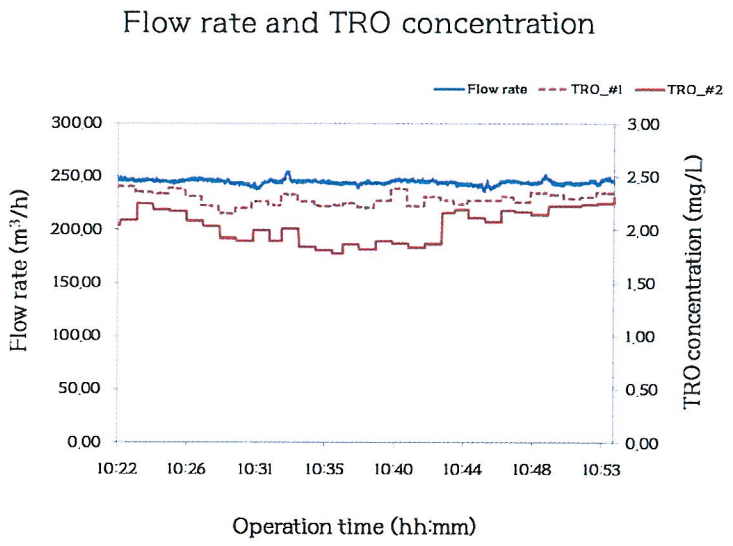


(10) 5th. test cycle, de-Ballasting (20 ~ 21 PSU, 2013. 07. 15)

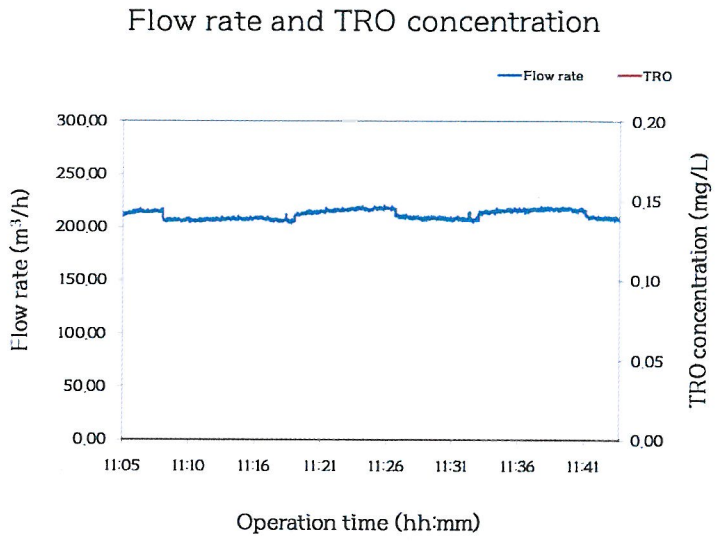


G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

(11) 6th. test cycle, Ballasting (32 ~ 34 PSU, 2013. 07. 17)

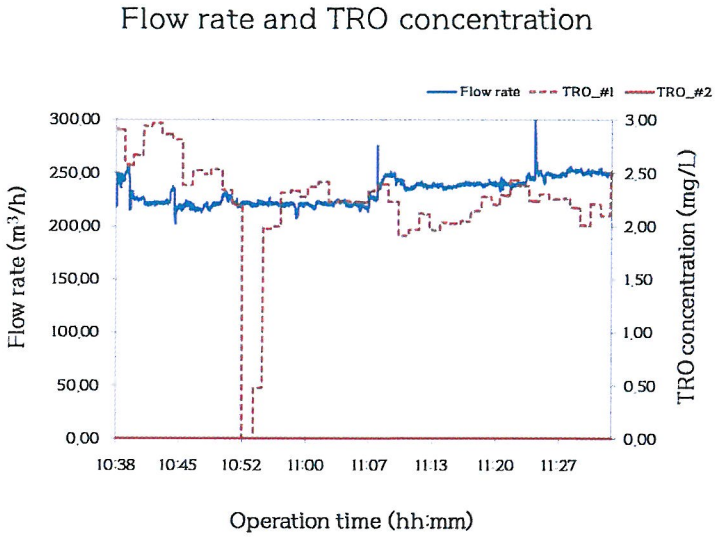


(12) 6th. test cycle, de-Ballasting (32 ~ 34 PSU, 2013. 07. 22)

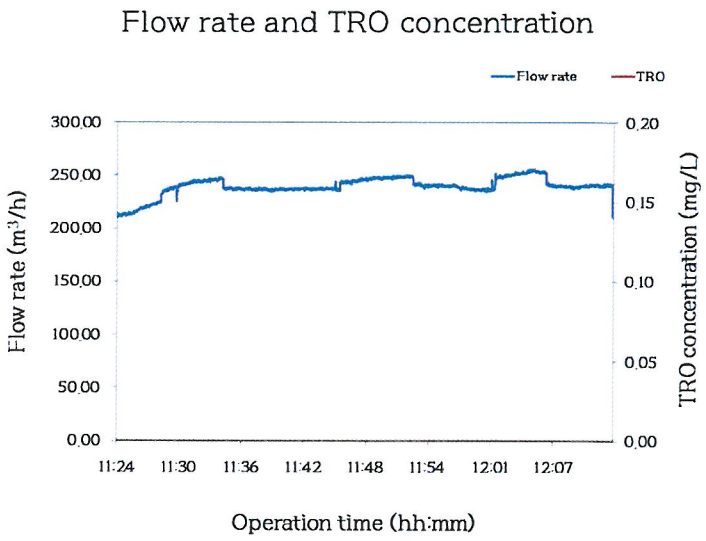


G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

(13) 7th. test cycle, Ballasting (32 ~ 34 PSU, 2013. 07. 24)

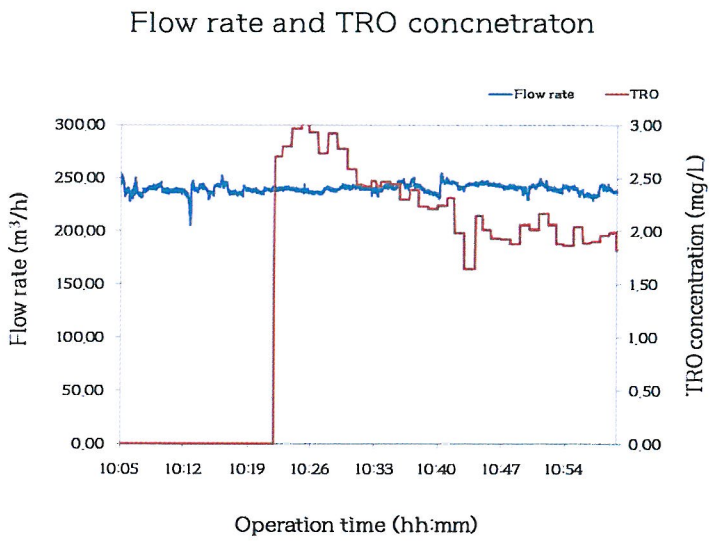


(14) 7th. test cycle, de-Ballasting (32 ~ 34 PSU, 2013. 07. 29)

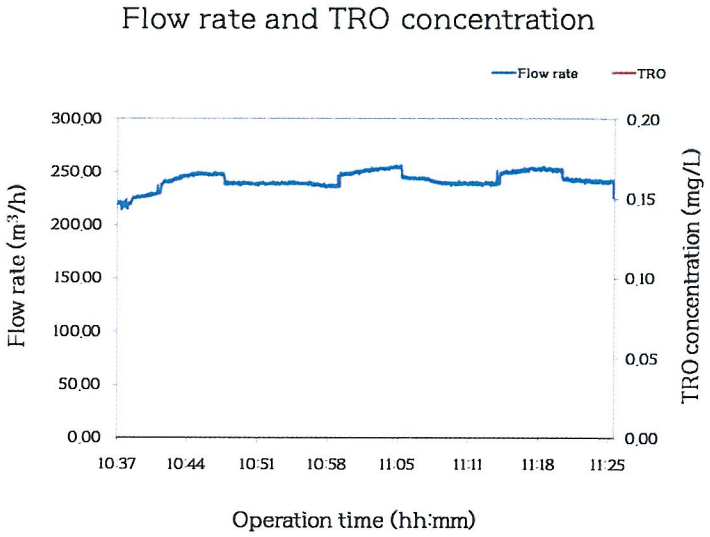


G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

(15) 8th. test cycle, Ballasting (32 ~ 34 PSU, 2013. 08. 07)

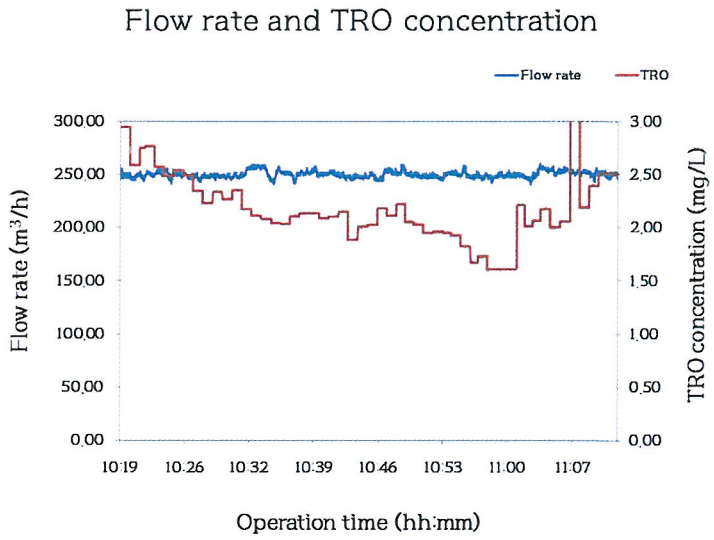


(16) 8th. test cycle, de-Ballasting (32 ~ 34 PSU, 2013. 08. 12)

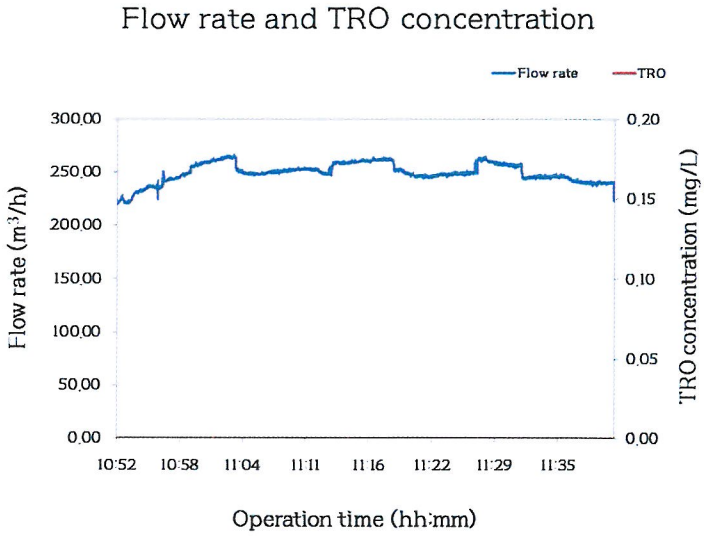


G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

(17) 9th. test cycle. Ballasting (32 ~ 34 PSU. 2013. 08. 21)

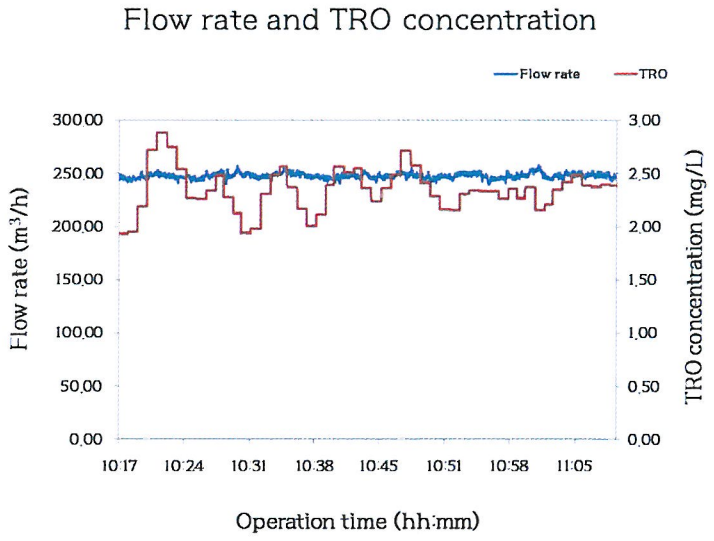


(18) 9th. test cycle. de-Ballasting (32 ~ 34 PSU. 2013. 08. 26)

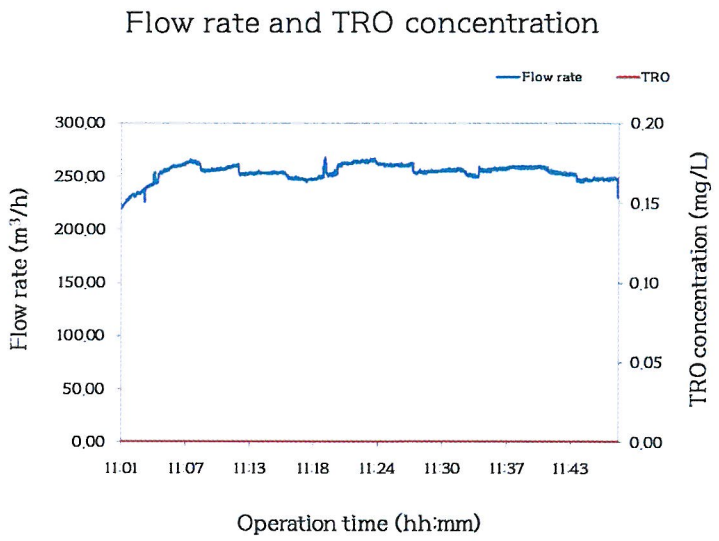


G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

(19) 10th. test cycle, Ballasting (32 ~ 34 PSU, 2013. 08. 28)

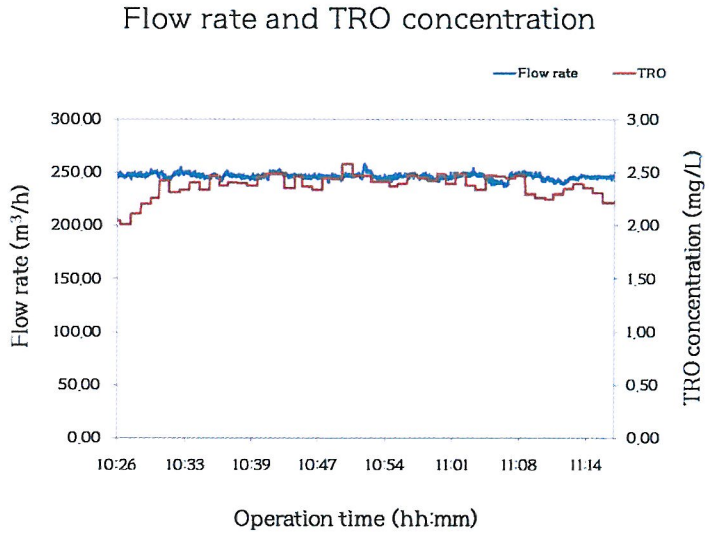


(20) 10th. test cycle, de-Ballasting (32 ~ 34 PSU, 2013. 09. 02)

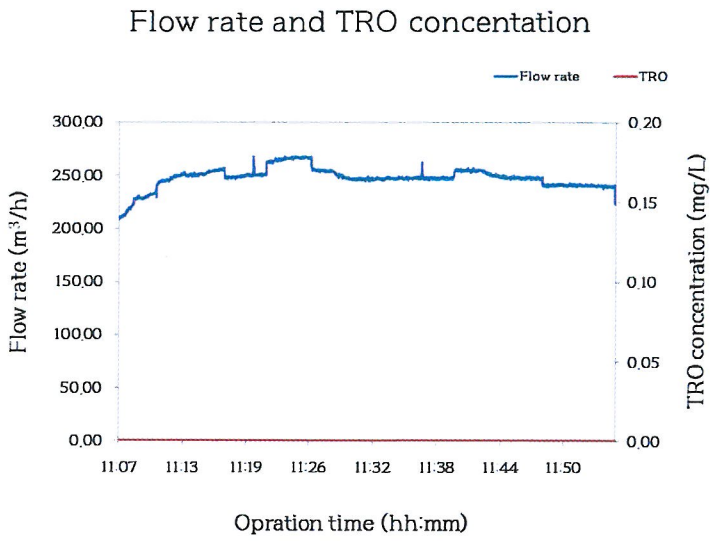


G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

(21) 11th. test cycle, Ballasting (32 ~ 34 PSU, 2013. 09. 04)

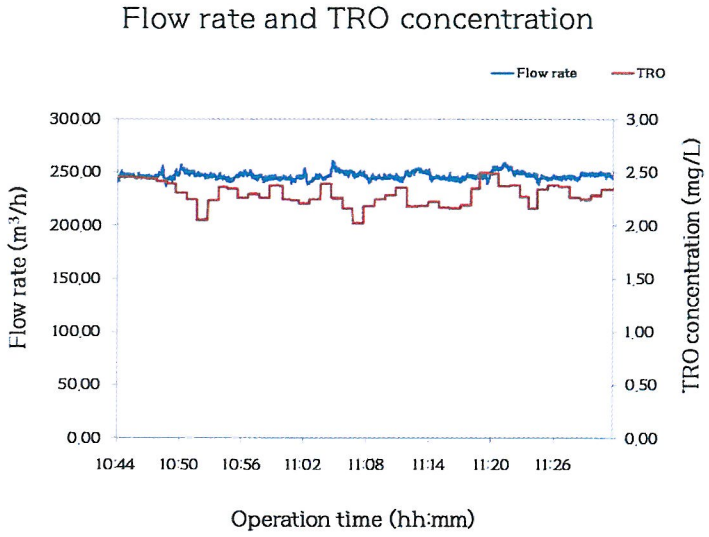


(22) 11th. test cycle, de-Ballasting (32 ~ 34 PSU, 2013. 09. 09)

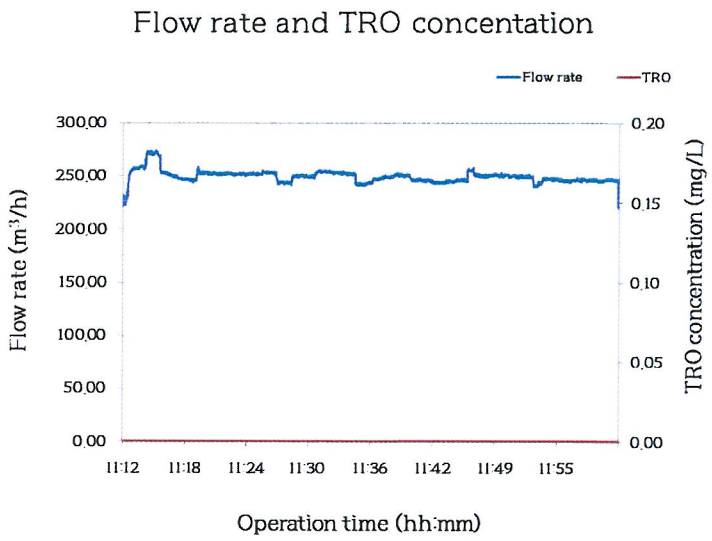


G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

(23) 12th. test cycle. Ballasting (32 ~ 34 PSU. 2013. 09. 11)

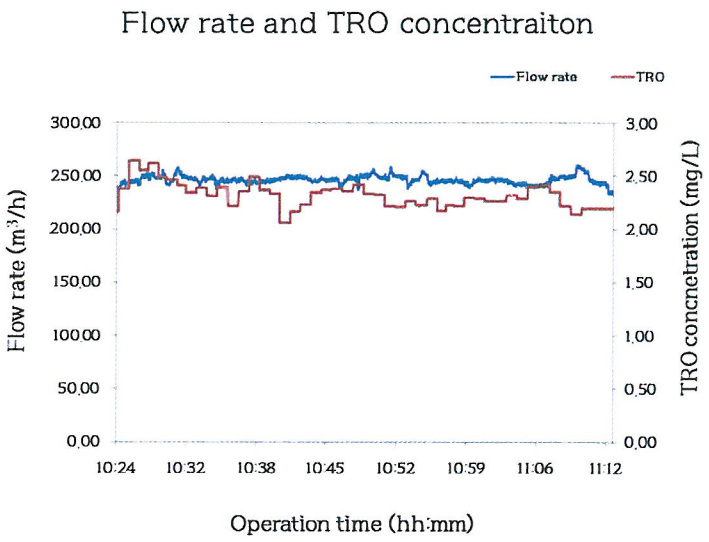


(24) 12th. test cycle. de-Ballasting (32 ~ 34 PSU. 2013. 09. 16)

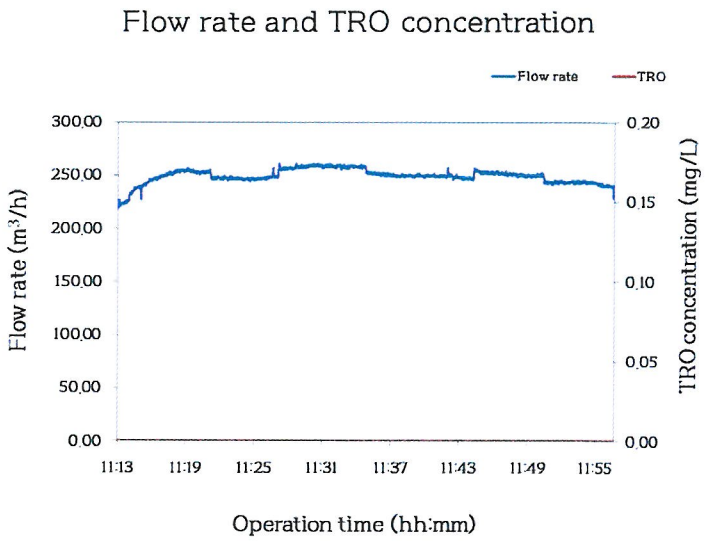


G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

(25) 13th. test cycle, Ballasting (20 ~ 21 PSU, 2013. 09. 25)

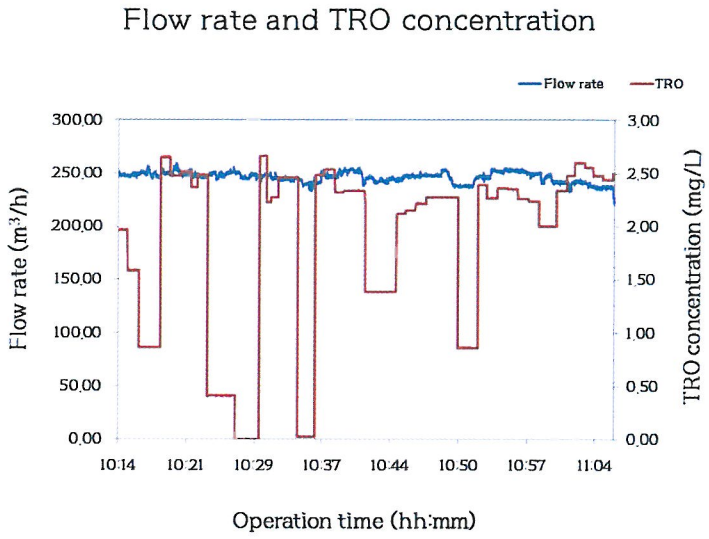


(26) 13th. test cycle, de-Ballasting (20 ~ 21 PSU, 2013. 09. 30)

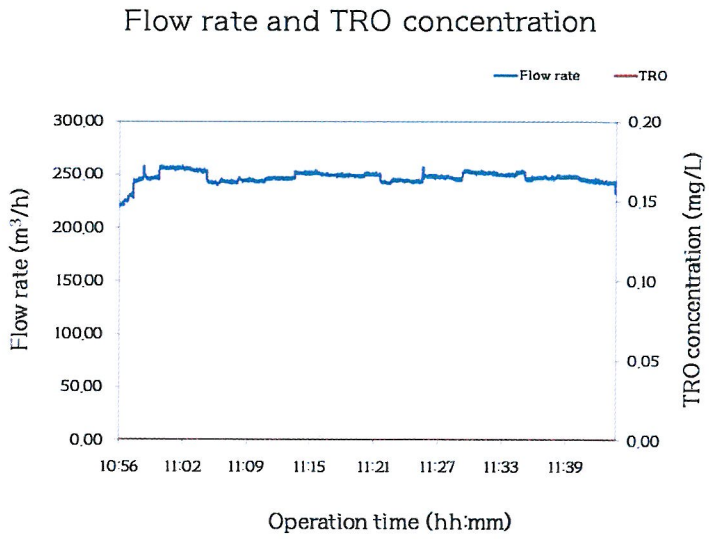


G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

(27) 14th. test cycle, Ballasting (20 ~ 21 PSU, 2013. 10. 02)

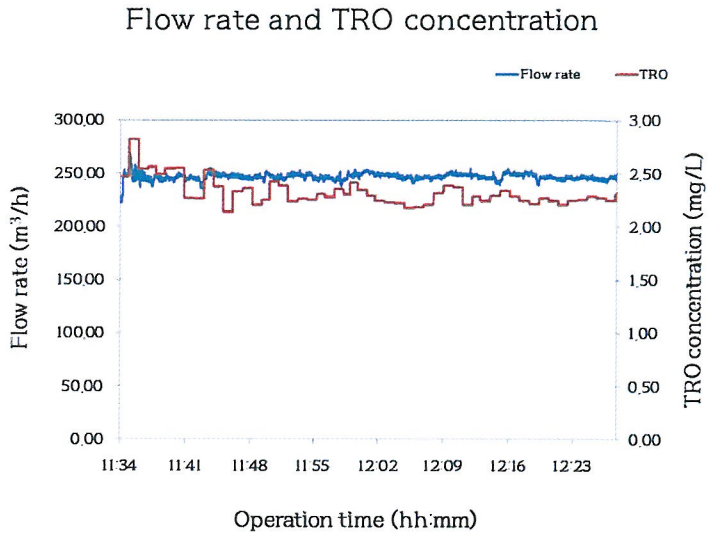


(28) 14th. test cycle, de-Ballasting (20 ~ 21 PSU, 2013. 10. 07)

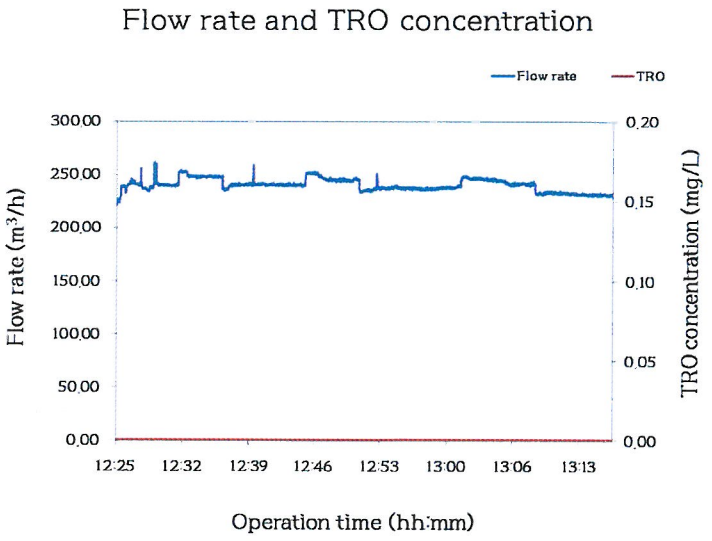


G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

(29) 15th. test cycle. Ballasting (20 ~ 21 PSU. 2013. 10. 11)

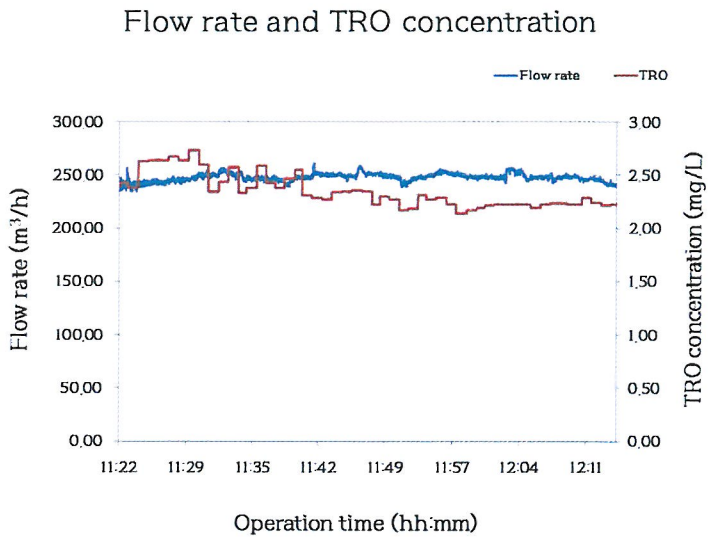


(30) 15th. test cycle. de-Ballasting (20 ~ 21 PSU. 2013. 10. 16)

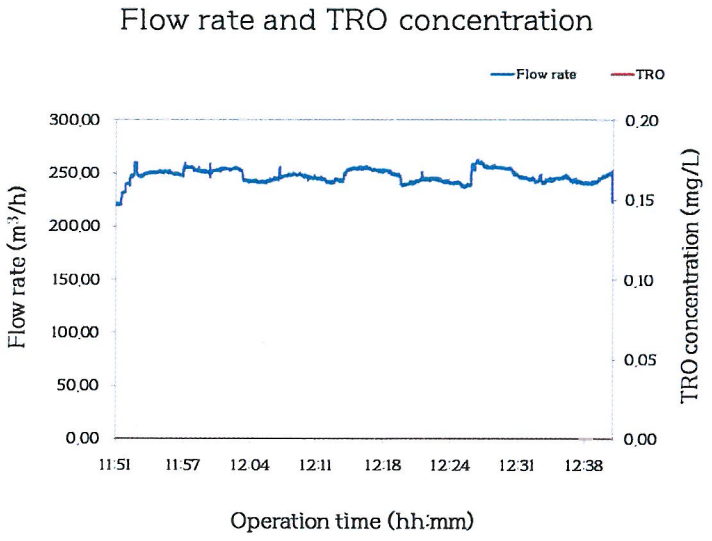


G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

(31) 16th. test cycle. Ballasting (20 ~ 21 PSU. 2013. 10. 17)

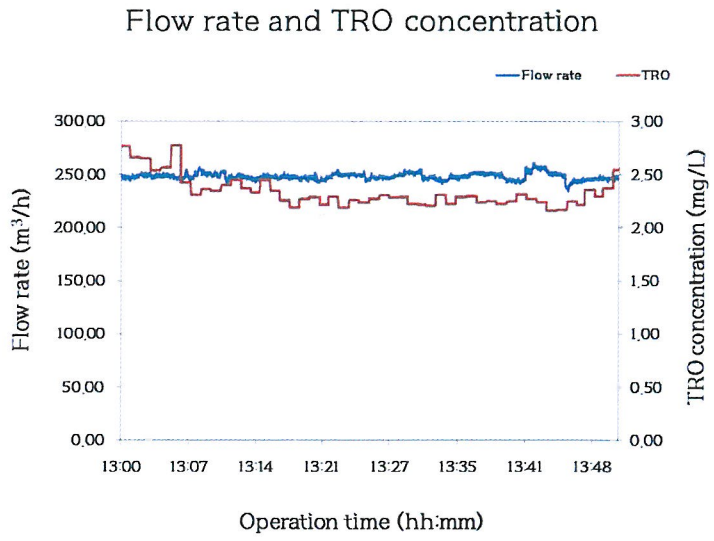


(32) 16th. test cycle. de-Ballasting (20 ~ 21 PSU. 2013. 10. 22)

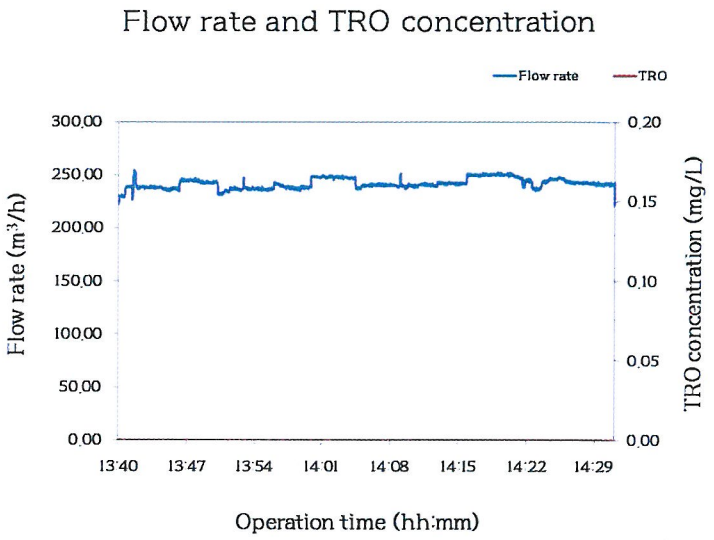


G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

(33) 17th. test cycle, Ballasting (20 ~ 21 PSU, 2013. 10. 23)



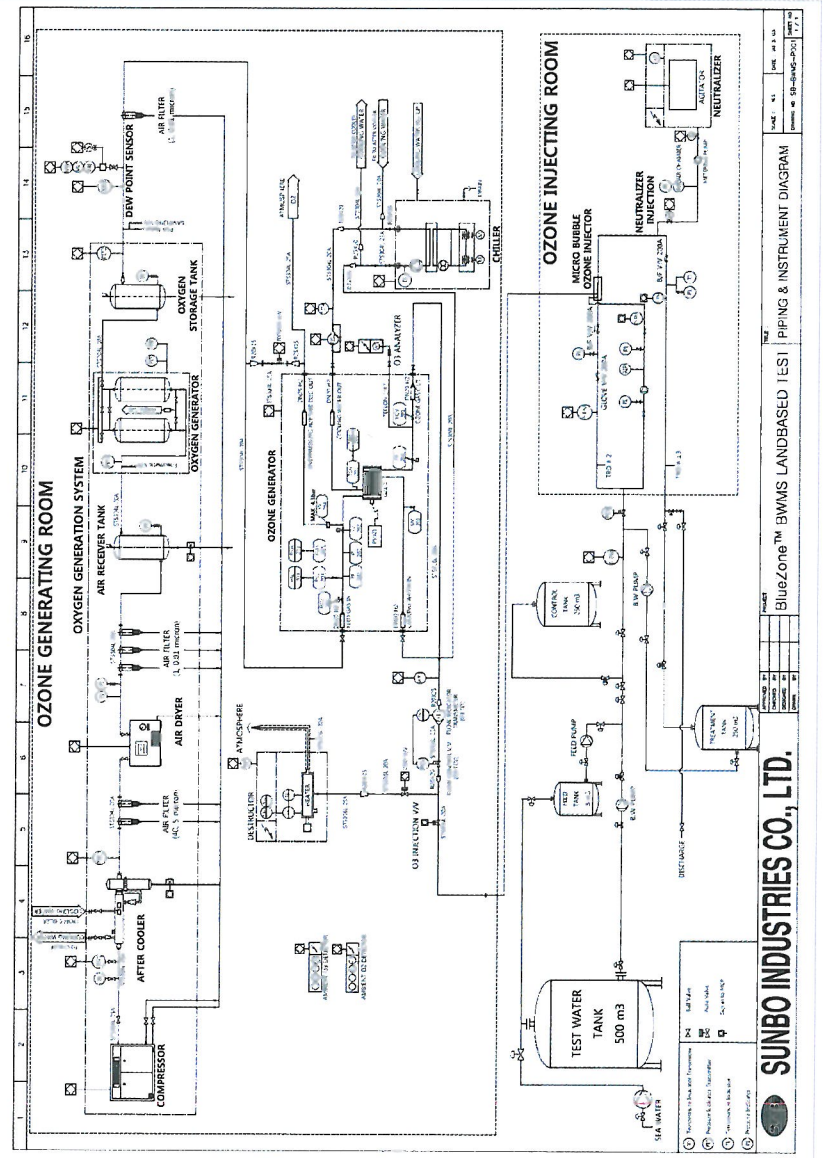
(34) 17th. test cycle, de-Ballasting (20 ~ 21 PSU, 2013. 10. 28)



G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

ATTACHMENT

I. DRAWING

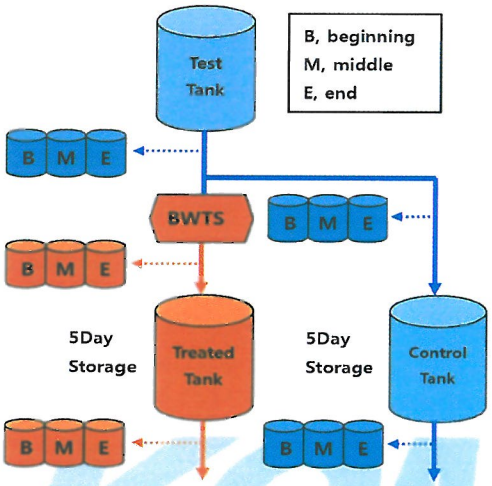


G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

II. PROCEDURE FOR LAND-BASED TEST

KOMERI SOP BWMS 01
Rev. 5.0 February 2015

BWMS Test Procedure for Land-Based Test



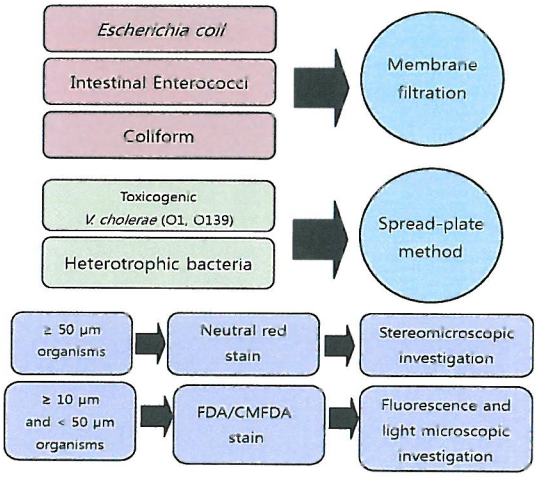
Sample volume			
Uptake	Test water	≥ 50 µm organisms	20 L
		≥ 10 µm and < 50 µm organisms	1 L
		Bacteria	1 L
	Control water	≥ 50 µm organisms	20 L
		≥ 10 µm and < 50 µm organisms	1 L
		Bacteria	1 L
	Treated water	≥ 50 µm organisms	1 m^3
		≥ 10 µm and < 50 µm organisms	10 L
		Bacteria	2 L
Discharge	Control water	≥ 50 µm organisms	20 L
		≥ 10 µm and < 50 µm organisms	1 L
		Bacteria	1 L
	Treated water	≥ 50 µm organisms	1 m^3
		≥ 10 µm and < 50 µm organisms	10 L
		Bacteria	2 L

<Standard for valid test>

Salinity in the test water			
	> 32 PSU	3-32 PSU	< 3 PSU
DOC	> 1 mg/L	> 5 mg/L	> 5 mg/L
POC	> 1 mg/L	> 5 mg/L	> 5 mg/L
TSS	> 1 mg/L	> 50 mg/L	> 50 mg/L

Density of test organisms in the test water	
≥ 50 µm test organisms	≥ 3 Phyla/Division 5 species ≥ 100,000 inds./m^3
≥ 10 µm and < 50 µm test organisms	≥ 3 Phyla/Division 5 species ≥ 1,000 inds./mL
Heterotrophic bacteria	≥ 10,000 CFU/mL

Density of organisms in the treated water		
≥ 50 µm organisms		< 10 inds./m^3
≥ 10 µm and < 50 µm organisms		< 10 inds./mL
Bacteria	Toxicogenic *Vibrio cholerae* (O1, O139)	< 1 CFU/100 mL
	Escherichia coil	< 250 CFU/100 mL
	Intestinal Enterococci	< 100 CFU/100 mL



G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

III. ORGANISMS DIVERSITY IN THE TEST WATER

- Ballasting (1st. test cycle: 2013. 06. 12)

≥ 50 μm test organisms

Phyla/Divisions	Class	Order	Genus/Species
Protozoa	Spirotrichea	Tintinnida	*Tintinnopsis* sp.
Arthropoda	Branchiopoda	Anostraca	*Artemia salina*
		Cladocera	*Podon* sp.
	Maxillopoda	Cyclopoida	*Oithona* sp.
			Copepodite
		Calanoida	Copepodite
		Sessilia	Balanus larva
		-	Copepod nauplius
Annelida	Polychaeta	-	Polychaeta larva
Mollusca	Bivalvia	-	Bivalve larva

≥ 10 μm and < 50 μm test organisms

Phylum	Oder	Genus/Species
Bacillariophyta	Thalassiosirales	*Thalassiosira* sp.
	Dictyochales	*Dictyocha* sp.
	Hemiaulales	*Eucampia* sp.
	Chaetocerotales	*Chaetoceros* sp.
Dinophyta	Prorocentrales	*Prorocentrum* sp.
	Gymnodiniales	*Gyrodinium* sp.
		Akashiwo sanguinea
	Peridiniales	*Ceratium fusus*
		Gonyaulax sp.
Chlorophyta	Chlorodentrales	*Tetraselmis suecica*
	Chlamydomonadales	*Brachiomonas* sp.
	Sphaeropleales	*Scenedesmus* sp.

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

III. To be continued

- Ballasting (2nd. test cycle: 2013. 06. 19)

≥ 50 μm test organisms

Phyla/Divisions	Class	Order	Genus/Species
Arthropoda	Branchiopoda	Anostraca	*Artemia salina*
	Maxillopoda	Cyclopoida	*Oithona* sp.
			Copepodite
		Calanoida	Copepodite
		Harpacticoida	Unidentified harpacticoid
		Sessilia	Balanus larva
		-	Copepod nauplius
Annelida	Polychaeta	-	Polychaeta larva
Mollusca	Bivalvia	-	Bivalve larva

≥ 10 μm and < 50 μm test organisms

Phylum	Oder	Genus/Species
Bacillariophyta	Thalassiosirales	*Thalassiosira* sp
	Chaetocerotales	*Chaetoceros* sp.
	Naviculales	*Navicula* sp.
Dinophyta	Gymnodiniales	*Gyrodinium* sp.
	Peridiniales	*Ceratium fusus*
		Ceratium furca
Chlorophyta	Chlorodentrales	*Tetraselmis suecica*

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

III. To be continued

· Ballasting (3rd. test cycle: 2013. 06. 26)

≥ 50 μm test organisms

Phyla/Divisions	Class	Order	Genus/Species
Rotifera	Monogononta	Ploimida	*Brachionus plicatilis*
Protozoa	Spirotrichea	Tintinnida	*Tintinnopsis* sp.
Arthropoda	Branchiopoda	Anostraca	*Artemia salina*
	Maxillopoda	Cyclopoida	*Oithona* sp.
			Copepodite
		Calanoida	Copepodite
		-	Copepod nauplius
		Sessilia	Balanus larva
Annelida	Polychaeta	-	Polychaeta larva
Mollusca	Bivalvia	-	Bivalve larva

≥ 10 μm and < 50 μm test organisms

Phylum	Oder	Genus/Species
Bacillariophyta	Thalassiosirales	*Thalassiosira* sp.
	Dictyochales	*Dictyocha* sp.
	Rhizosoleniales	*Rhizosolenia* sp.
		Guinardia sp.
	Hemiaulales	*Eucampia* sp.
	Chaetocerotales	*Chaetoceros* sp.
Dinophyta	Peridiniales	*Ceratium furca*
Chlorophyta	Chlorodentrales	*Tetraselmis suecica*
	Sphaeropleales	*Scenedesmus* sp.

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

III. To be continued

- Ballasting (4th. test cycle: 2013. 07. 03)

≥ 50 μm test organisms

Phyla/Divisions	Class	Order	Genus/Species
Rotifera	Monogononta	Ploimida	*Brachionus plicatilis*
Arthropoda	Branchiopoda	Anostraca	*Artemia salina*
	Maxillopoda	Cyclopoida	*Oithona* sp.
			Copepodite
		Calanoida	Copepodite
		-	Copepod nauplius
		Harpacticoida	Unidentified harpacticoid
		Sessilia	Balanus larva
Annelida	Polychaeta	-	Polychaeta larva
Mollusca	Bivalvia	-	Bivalve larva

≥ 10 μm and < 50 μm test organisms

Phylum	Oder	Genus/Species
Bacillariophyta	Thalassiosirales	*Thalassiosira* sp.
	Rhizosoleniales	*Rhizosolenia* sp.
	Hemiaulales	*Hemiaulus* sp.
	Chaetocerotales	*Chaetoceros* sp.
	-	Unidentified species
Dinophyta	Prorocentrales	*Prorocentrum* sp.
	Gymnodiniales	*Gyrodinium* sp.
	Peridiniales	*Ceratium fusus*
		Ceratium furca
	-	Unidentified species
Chlorophyta	Chlorodentrales	*Tetraselmis suecica*
Protozoa	-	Unidentified species

G4B(www.g4b.go.kr)진위확인코드 : bVbrORVTulE=

III. To be continued

- Ballasting (5th. test cycle: 2013. 07. 10)

≥ 50 μm test organisms

Phyla/Divisions	Class	Order	Genus/Species
Arthropoda	Branchiopoda	Anostraca	*Artemia salina*
	Maxillopoda	Calanoida	*Acartia omorii*
			Copepodite
		Cyclopoida	*Oithona* sp.
			Copepodite
		-	Copepod nauplius
		Harpacticoida	Unidentified harpacticoid
		Sessilia	Balanus larva
Annelida	Polychaeta	-	Polychaeta larva
Mollusca	Bivalvia	-	Bivalve larva
	Gastropoda	-	Gastropod larva

≥ 10 μm and < 50 μm test organisms

Phylum	Oder	Genus/Species
Bacillariophyta	Thalassiosirales	*Thalassiosira* sp.
		Skeletonema sp.
	Dictyochales	*Dictyocha* sp.
	Rhizosoleniales	*Guinardia* sp.
	Chaetocerotales	*Chaetoceros* sp.
	Lithodesmidales	*Ditylum brightwellii*
Dinophyta	Oxyrrhinales	*Oxyrrhis* sp.
	Gymnodiniales	*Gyrodinium* sp.
	Peridiniales	*Ceratium fusus*
		Scrippsiella sp.
Chlorophyta	Chlorodentrales	*Tetraselmis suecica*
	Sphaeropleales	*Scenedesmus* sp.

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

III. To be continued

- Ballasting (6th. test cycle: 2013. 07. 17)

≥ 50 μm test organisms

Phyla/Divisions	Class	Order	Genus/Species
Arthropoda	Branchiopoda	Anostraca	*Artemia salina*
		Cladocera	*Podon* sp.
			Evadne sp.
	Maxillopoda	Calanoida	*Acartia omorii*
			Clausocalanus furcatus
			Paracalanus sp.
			Copepodite
		Cyclopoida	*Oithona* sp.
			Copepodite
		Poecilostomatoida	*Corycaeus affinis*
		Harpacticoida	Unidentified harpacticoid
		Sessilia	Balanus larva
		-	Copepod nauplius
Annelida	Polychaeta	-	Polychaeta larva
Mollusca	Bivalvia	-	Bivalve larva
	Gastropoda	-	Gastropod larva

≥ 10 μm and < 50 μm test organisms

Phylum	Oder	Genus/Species
Bacillariophyta	Thalassiosirales	*Thalassiosira* sp.
	Dictyochales	*Dictyocha* sp.
	Rhizosoleniales	*Guinardia* sp.
	Hemiaulales	*Eucampia* sp.
	Chaetocerotales	*Chaetoceros* sp.
	Lithodesmidales	*Ditylum brightwellii*
Dinophyta	Prorocentrales	*Prorocentrum* sp.
	Oxyrrhinales	*Oxyrrhis* sp.
	Gymnodiniales	*Gyrodinium* sp.
	Peridiniales	*Ceratium fusus*
		Ceratium furca
		Protoperidinium sp.
Chlorophyta	Chlorodentrales	*Tetraselmis suecica*
Protozoa	-	Unidentified species

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

III. To be continued

- Ballasting (7th. test cycle: 2013. 07. 24)

≥ 50 μm test organisms

Phyla/Divisions	Class	Order	Genus/Species
Arthropoda	Branchiopoda	Anostraca	*Artemia salina*
		Cladocera	*Podon* sp.
	Maxillopoda	Calanoida	*Acartia omorii*
			Clausocalanus furcatus
			Paracalanus sp.
			Copepodite
		Cyclopoida	*Oithona* sp.
			Copepodite
		-	Copepod nauplius
		Poecilostomatoida	*Corycaeus affinis*
		Harpacticoida	Unidentified harpacticoid
		Sessilia	Balanus larva
			Cyprid larva
Annelida	Polychaeta	-	Polychaeta larva
Mollusca	Bivalvia	-	Bivalve larva
	Gastropoda	-	Gastropod larva
Platyhelminthes	Turbellaria	Polycladida	Müller's larva

≥ 10 μm and < 50 μm test organisms

Phylum	Oder	Genus/Species
Bacillariophyta	Thalassiosirales	*Thalassiosira* sp.
		Detonula sp.
	Dictyochales	*Dictyocha* sp
	Rhizosoleniales	*Guinardia* sp.
	Chaetocerotales	*Chaetoceros* sp.
	Lithodesmidales	*Ditylum* sp.
	Naviculales	*Navicula* sp.
Dinophyta	Oxyrrhinales	*Oxyrrhis* sp.
	Peridiniales	*Protoperidinium* sp.
Chlorophyta	Chlorodentrales	*Tetraselmis suecica*

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

III. To be continued

- Ballasting (8th. test cycle: 2013. 08. 07)

≥ 50 μm test organisms

Phyla/Divisions	Class	Order	Genus/Species
Arthropoda	Branchiopoda	Anostraca	*Artemia salina*
	Maxillopoda	Calanoida	*Acartia omorii*
			Paracalanus sp.
			Copepodite
		Cyclopoida	*Oithona* sp.
			Copepodite
		-	Copepod nauplius
		Sessilia	Balanus larva
			Cyprid larva
Annelida	Polychaeta	-	Polychaeta larva
Mollusca	Bivalvia	-	Bivalve larva
	Gastropoda	-	Gastropod larva

≥ 10 μm and < 50 μm test organisms

Phylum	Oder	Genus/Species
Bacillariophyta	Thalassiosirales	*Thalassiosira* sp.
	Rhizosoleniales	*Guinardia* sp.
	Chaetocerotales	*Chaetoceros* sp.
	Naviculales	*Pleurosigma* sp.
Dinophyta	Peridiniales	*Ceratium furca*
Chlorophyta	Chlorodentrales	*Tetraselmis suecica*
Protozoa	-	Unidentified species

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

III. To be continued

- Ballasting (9th. test cycle: 2013. 08. 21)

≥ 50 μm test organisms

Phyla/Divisions	Class	Order	Genus/Species
Arthropoda	Branchiopoda	Anostraca	*Artemia salina*
		Cladocera	*Podon* sp.
	Maxillopoda	Calanoida	*Acartia omorii*
			Paracalanus sp.
			Pseudodiaptomus marinus
			Copepodite
		Cyclopoida	*Oithona* sp.
			Copepodite
		-	Copepod nauplius
		Poecilostomatoida	*Corycaeus affinis*
		Harpacticoida	Unidentified harpacticoid
		Sessilia	Balanus larva
Annelida	Polychaeta	-	Polychaeta larva
Mollusca	Bivalvia	-	Bivalve larva
	Gastropoda	-	Gastropod larva

≥ 10 μm and < 50 μm test organisms

Phylum	Oder	Genus/Species
Bacillariophyta	Thalassiosirales	*Thalassiosira* sp.
	Chaetocerotales	*Chaetoceros* sp.
	Lithodesmidales	*Ditylum brightwellii*
Dinophyta	Gymnodiniales	*Gyrodinium* sp.
		Katodinium sp.
	Peridiniales	*Ceratium furca*
		Ceratium fusus
		Protoperidinium sp.
Chlorophyta	Chlorodentrales	*Tetraselmis suecica*
Protozoa	-	Unidentified species

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

III. To be continued

- Ballasting (10th. test cycle: 2013. 08. 28)

≥ 50 μm test organisms

Phyla/Divisions	Class	Order	Genus/Species
Arthropoda	Branchiopoda	Anostraca	*Artemia salina*
	Maxillopoda	Calanoida	*Acartia omorii*
			Paracalanus sp.
			Copepodite
		Cyclopoida	*Oithona* sp.
			Copepodite
		-	Copepod nauplius
		Poecilostomatoida	*Corycaeus affinis*
		Harpacticoida	Unidentified harpacticoid
		Sessilia	Balanus larva
			Cyprid larva
Annelida	Polychaeta	-	Polychaeta larva
Mollusca	Bivalvia	-	Bivalve larva
	Gastropoda	-	Gastropod larva
Echinodermata	Ophiuroidea	-	Ophiopluteus larva

≥ 10 μm and < 50 μm test organisms

Phylum	Oder	Genus/Species
Bacillariophyta	Thalassiosirales	*Thalassiosira* sp.
	Chaetocerotales	*Chaetoceros* sp.
	Lithodesmidales	*Ditylum brightwellii*
	Naviculales	*Pleurosigma* sp.
Dinophyta	Gymnodiniales	*Gyrodinium* sp.
		Katodinium sp.
	Peridiniales	*Ceratium furca*
		Ceratium fusus
		Scrippsiella sp.
		Protoperidinium sp.
Chlorophyta	Chlorodentrales	*Tetraselmis suecica*
Protozoa	-	Unidentified species

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

III. To be continued

- Ballasting (11th. test cycle: 2013. 09. 04)

≥ 50 μm test organisms

Phyla/Divisions	Class	Order	Genus/Species
Protozoa	Spirotrichea	Tintinnida	*Tintinnopsis* sp.
Arthropoda	Branchiopoda	Anostraca	*Artemia salina*
	Maxillopoda	Calanoida	Copepodite
		Cyclopoida	*Oithona* sp.
			Copepodite
		-	Copepod nauplius
		Poecilostomatoida	*Corycaeus affinis*
		Harpacticoida	Unidentified harpacticoid
		Sessilia	Balanus larva
Annelida	Polychaeta	-	Polychaeta larva
Mollusca	Bivalvia	-	Bivalve larva
	Gastropoda	-	Gastropod larva
Platyhelminthes	Turbellaria	Polycladida	Müller's larva

≥ 10 μm and < 50 μm test organisms

Phylum	Oder	Genus/Species
Bacillariophyta	Thalassiosirales	*Thalassiosira* sp.
	Chaetocerotales	*Chaetoceros* sp.
	Naviculales	*Navicula* sp.
Dinophyta	Dinophysiales	*Dinophysis* sp.
	Gymnodiniales	*Cochlodinium* sp.
		Gyrodinium sp.
	Peridiniales	*Ceratium furca*
		Ceratium fusus
		Protoperidinium sp.
Chlorophyta	Chlorodentrales	*Tetraselmis suecica*
Protozoa	-	Unidentified species

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

III. To be continued

- Ballasting (12th. test cycle: 2013. 09. 11)

≥ 50 μm test organisms

Phyla/Divisions	Class	Order	Genus/Species
Arthropoda	Branchiopoda	Anostraca	*Artemia salina*
	Maxillopoda	Calanoida	*Acartia omorii*
			Copepodite
		Cyclopoida	*Oithona* sp.
			Copepodite
		-	Copepod nauplius
		Harpacticoida	Unidentified harpacticoid
		Sessilia	Balanus larva
			Cyprid larva
Annelida	Polychaeta	-	Polychaeta larva
Mollusca	Bivalvia	-	Bivalve larva
	Gastropoda	-	Gastropod larva
Platyhelminthes	Turbellaria	Polycladida	Müller's larva

≥ 10 μm and < 50 μm test organisms

Phylum	Oder	Genus/Species
Bacillariophyta	Thalassiosirales	*Thalassiosira* sp.
	Melosirales	*Stephanopyxis* sp.
	Rhizosoleniales	*Guinardia* sp.
	Chaetocerotales	*Chaetoceros* sp.
	Lithodesmidales	*Ditylum brightwellii*
Diniphyta	Oxyrrhinales	*Oxyrrhis* sp.
	Gymnodiniales	*Gyrodinium* sp.
	Peridiniales	*Ceratium fusus*
Chlorophyta	Chlorodentrales	*Tetraselmis suecica*
Protozoa	-	*Tintinnopsis* sp.
	-	Unidentified species

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

III. To be continued

- Ballasting (13th. test cycle: 2013. 09. 25)

≥ 50 μm test organisms

Phyla/Divisions	Class	Order	Genus/Species
Arthropoda	Branchiopoda	Anostraca	*Artemia salina*
		Cladocera	*Bosmina* sp.
	Maxillopoda	Calanoida	*Acartia* sp.
			Copepodite
		Cyclopoida	*Oithona* sp.
			Copepodite
		-	Copepod nauplius
		Harpacticoida	Unidentified harpacticoid
		Sessilia	Balanus larva
Annelida	Polychaeta	-	Polychaeta larva
Mollusca	Gastropoda	-	Gastropod larva

≥ 10 μm and < 50 μm test organisms

Phylum	Oder	Genus/Species
Bacillariophyta	Thalassiosirales	*Thalassiosira* sp.
	Melosirales	*Melosira* sp.
		Stephanopyxis sp.
	Hemiaulales	*Eucampia* sp.
	Chaetocerotales	*Chaetoceros* sp.
	Lithodesmidales	*Ditylum brightwellii*
	Naviculales	*Navicula* sp.
Dinophyta	Oxyrrhinales	*Oxyrrhis* sp.
	Gymnodiniales	*Gyrodinium* sp.
	Peridiniales	*Ceratium furca*
		Gonyaulax sp.
Chlorophyta	Chlorodentrales	*Tetraselmis suecica*

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

III. To be continued

- Ballasting (14th. test cycle: 2013. 10. 02)

≥ 50 μm test organisms

Phyla/Divisions	Class	Order	Genus/Species
Rotifera	Monogononta	Ploimida	*Brachionus plicatilis*
Arthropoda	Branchiopoda	Anostraca	*Artemia salina*
	Maxillopoda	Calanoida	*Paracalanus* sp.
			Copepodite
		Cyclopoida	*Oithona* sp.
			Copepodite
		-	Copepod nauplius
		Poecilostomatoida	*Corycaeus affinis*
		Harpacticoida	Unidentified harpacticoid
		Sessilia	Balanus larva
Annelida	Polychaeta	-	Polychaeta larva
Mollusca	Bivalvia	-	Bivalve larva
	Gastropoda	-	Gastropod larva

≥ 10 μm and < 50 μm test organisms

Phylum	Oder	Genus/Species
Bacillariophyta	Thalassiosirales	*Thalassiosira* sp.
		Detonula sp.
	Melosirales	*Melosira* sp.
		Stephanopyxis sp.
	Hemiaulales	*Eucampia* sp.
	Chaetocerotales	*Chaetoceros* sp.
	Lithodesmidales	*Ditylum brightwellii*
	-	Unidentified species
Dinophyta	Oxyrrhinales	*Oxyrrhis* sp.
	Gymnodiniales	*Gymnodinium* sp.
		Gyrodinium sp.
	Peridiniales	*Gonyaulax* sp.
Chlorophyta	Chlorodentrales	*Tetraselmis suecica*

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

III. To be continued

- Ballasting (15th. test cycle: 2013. 10. 11)

≥ 50 μm test organisms

Phyla/Divisions	Class	Order	Genus/Species
Rotifera	Monogononta	Ploimida	*Brachionus plicatilis*
Arthropoda	Branchiopoda	Anostraca	*Artemia salina*
	Maxillopoda	Calanoida	Copepodite
		Cyclopoida	*Oithona* sp.
			Copepodite
		-	Copepod nauplius
		Sessilia	Balanus larva
			Cyprid larva
Annelida	Polychaeta	-	Polychaeta larva
Mollusca	Bivalvia	-	Bivalve larva
	Gastropoda	-	Gastropod larva

≥ 10 μm and < 50 μm test organisms

Phylum	Oder	Genus/Species
Bacillariophyta	Thalassiosirales	*Thalassiosira* sp.
	Melosirales	*Stephanopyxis* sp.
	Hemiaulales	*Eucampia* sp.
	Chaetocerotales	*Chaetoceros* sp.
	Lithodesmidales	*Ditylum brightwellii*
Dinophyta	Gymnodiniales	*Gyrodinium* sp.
		Katodinium sp.
Chlorophyta	Chlorodentrales	*Tetraselmis suecica*
Protozoa	-	Unidentified species

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

III. To be continued

- Ballasting (16th. test cycle: 2013. 10. 17)

≥ 50 μm test organisms

Phyla/Divisions	Class	Order	Genus/Species
Rotifera	Monogononta	Ploimida	*Brachionus plicatilis*
Arthropoda	Branchiopoda	Anostraca	*Artemia salina*
	Maxillopoda	Calanoida	*Paracalanus* sp.
			Copepodite
		Cyclopoida	*Oithona* sp.
			Copepodite
		-	Copepod nauplius
		Harpacticoida	Unidentified harpacticoid
		Sessilia	Balanus larva
			Cyprid larva
Annelida	Polychaeta	-	Polychaeta larva
Mollusca	Bivalvia	-	Bivalve larva

≥ 10 μm and < 50 μm test organisms

Phylum	Oder	Genus/Species
Bacillariophyta	Thalassiosirales	*Thalassiosira* sp.
	Melosirales	*Stephanopyxis* sp.
	Hemiaulales	*Eucampia* sp.
	Chaetocerotales	*Chaetoceros* sp.
	Dictyochales	*Dictyocha* sp.
	Rhizosoleniales	*Rhizosolenia* sp.
	Naviculales	*Pleurosigma* sp.
	Lithodesmidales	*Ditylum brightwellii*
Dinophyta	Oxyrrhinales	*Oxyrrhis* sp.
	Gymnodiniales	*Gyrodinium* sp.
Chlorophyta	Chlorodentrales	*Tetraselmis suecica*
Protozoa	-	Unidentified species

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

III. To be continued

- Ballasting (17th. test cycle: 2013. 10. 23)

≥ 50 μm test organisms

Phyla/Divisions	Class	Order	Genus/Species
Protozoa	Spirotrichea	Tintinnida	*Tintinnopsis* sp.
Rotifera	Monogononta	Ploimida	*Brachionus plicatilis*
Arthropoda	Branchiopoda	Anostraca	*Artemia salina*
		Cladocera	*Podon* sp.
	Maxillopoda	Calanoida	Copepodite
		Cyclopoida	*Oithona* sp.
			Copepodite
		-	Copepod nauplius
		Harpacticoida	Unidentified harpacticoid
		Sessilia	Balanus larva
Annelida	Polychaeta	-	Polychaeta larva
Mollusca	Bivalvia	-	Bivalve larva

≥ 10 μm and < 50 μm test organisms

Phylum	Oder	Genus/Species
Bacillariophyta	Thalassiosirales	*Thalassiosira* sp.
	Chaetocerotales	*Chaetoceros* sp.
	Naviculales	*Pleurosigma* sp.
	Lithodesmidales	*Ditylum brightwellii*
Dinophyta	Oxyrrhinales	*Oxyrrhis* sp.
	Gymnodiniales	*Gyrodinium* sp.
Chlorophyta	Chlorodentrales	*Tetraselmis suecica*

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. TEST RESULT DETAILS

- Ballasting (1st. test cycle : 2013. 06. 12) - Basic water parameters

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Water temperature (℃)	20.71	20.35	20.51	20.39	20.35	20.41	20.47	20.53	20.49
	20.54	20.35	20.40	20.42	20.36	20.45	20.47	20.48	20.47
	20.54	20.36	20.41	20.46	20.36	20.43	20.54	20.48	20.53
Average	20.60	20.35	20.44	20.42	20.36	20.43	20.49	20.50	20.50
Standard deviation	0.10	0.01	0.06	0.04	0.01	0.02	0.04	0.03	0.03
pH	7.94	7.95	7.93	7.99	7.97	7.96	7.97	7.96	7.97
	7.96	7.96	7.94	7.99	7.97	7.97	7.96	7.97	7.96
	7.98	7.96	7.96	7.99	7.97	7.98	7.95	7.95	7.95
Average	7.96	7.96	7.94	7.99	7.97	7.97	7.96	7.96	7.96
Standard deviation	0.02	0.01	0.02	0.00	0.00	0.01	0.01	0.01	0.01
ORP (mV)	259	428	452	236	417	422	478	603	619
	248	426	455	232	399	420	527	609	633
	243	424	447	216	397	414	546	597	635
Average	250	426	451	228	404	419	517	603	629
Standard deviation	8	2	4	11	11	4	35	6	9
Salinity (PSU)	20.49	20.58	20.44	20.70	20.68	20.71	20.59	20.56	20.57
	20.57	20.59	20.52	20.71	20.69	20.73	20.60	20.57	20.58
	20.57	20.59	20.55	20.70	20.69	20.73	20.61	20.58	20.58
Average	20.54	20.59	20.50	20.70	20.69	20.72	20.60	20.57	20.58
Standard deviation	0.05	0.01	0.06	0.01	0.01	0.01	0.01	0.01	0.01
DO (mg/L)	7.90	8.01	7.92	7.96	7.97	7.93	9.49	9.38	9.16
	7.95	7.97	7.95	7.94	7.97	7.95	9.43	9.35	9.26
	7.95	7.96	7.94	7.93	7.96	7.93	9.42	9.38	9.34
Average	7.93	7.98	7.94	7.94	7.97	7.94	9.45	9.37	9.25
Standard deviation	0.03	0.03	0.02	0.02	0.01	0.01	0.04	0.02	0.09
Turbidity (NTU)	19.6	20.7	20.1	19.9	20.3	19.3	17.2	16.2	18.8
	19.7	20.4	19.9	19.9	20.7	19.0	16.2	16.0	18.7
	19.1	21.2	20.5	19.8	19.8	19.5	18.6	17.5	18.5
Average	19.5	20.8	20.2	19.9	20.3	19.3	17.3	16.6	18.7
Standard deviation	0.32	0.40	0.31	0.06	0.45	0.25	1.21	0.81	0.15
TSS (mg/L)	69.2	64.8	69.6	72.8	64.4	56.8	59.2	54.0	63.6
	64.0	58.4	62.0	63.6	60.8	70.4	56.8	55.6	59.6
	64.0	62.4	57.6	62.8	60.0	56.4	54.8	56.4	61.2
Average	65.7	61.9	63.1	66.4	61.7	61.2	56.9	55.3	61.5
Standard deviation	3.00	3.23	6.07	5.56	2.34	7.97	2.20	1.22	2.01
DOC (mg/L)	7.66	7.66	7.63	7.87	7.64	7.55	7.53	7.43	7.80
POC (mg/L)	9.38	9.67	7.87	8.72	8.44	8.52	9.55	8.51	7.09

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IV. To be continued

- Ballasting (1st. test cycle : 2013. 06. 12) - Viable organisms (Plankton)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
≥ 50 μm (inds/m³)	128 000	253 000	175 000	150 000	155 000	201 000	11 750	23 300	17 400
	171 000	237 000	196 000	136 000	155 000	186 000	13 850	26 800	18 300
	147 000	226 000	234 000	141 000	151 000	179 000	14 650	25 900	17 400
Average	148 667	238 667	201 667	142 334	153 667	188 667	13 417	25 334	17 700
Standard deviation	21 548.4	13 576.9	29 905.4	7 094.6	2 309.4	11 239.8	1 497.8	1 817.5	519.6
≥ 10 μm and < 50 μm (inds/mL)	1 843	2 623	2 256	1 542	2 371	1 590	2.9	1.2	2.1
	1 993	2 554	1 957	1 566	2 785	1 530	2.5	0.9	1.8
	1 675	2 380	1 620	1 243	2 887	1 384	1.4	0.6	1.1
Average	1 837	2 519	1 945	1 451	2 681	1 502	2.3	0.9	1.7
Standard deviation	159.1	125.2	318.2	180.0	273.3	105.9	0.8	0.3	0.5

- Ballasting (1st. test cycle : 2013. 06. 12) - Viable organisms (Bacteria)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	33 000	31 600	35 000	22 100	24 700	20 500	0	20	0
	29 600	33 500	28 900	23 600	25 200	29 100	20	0	10
	24 100	29 200	31 400	22 000	25 400	26 800	60	0	0
Average	28 900	31 434	31 767	22 567	25 100	25 467	27	7	4
Standard deviation	4 491.1	2 154.8	3 066.5	896.3	360.6	4 452.3	30.6	11.5	5.8
Coliform (CFU/100 mL)	38	52	42	56	42	42	0	0	0
	34	42	36	32	38	38	0	0	0
	34	38	34	56	24	36	0	0	0
Average	36	44	38	48	35	39	0	0	0
Standard deviation	2.3	7.2	4.2	13.9	9.5	3.1	0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	18	14	14	16	16	20	0	0	0
	14	6	18	18	18	16	0	0	0
	4	10	18	16	18	8	0	0	0
Average	12	10	17	17	18	15	0	0	0
Standard deviation	7.2	4.0	2.3	1.2	1.2	6.1	0.0	0.0	0.0
Enterococci (CFU/100 mL)	10	20	24	14	12	8	0	0	0
	24	18	14	12	14	2	0	0	0
	10	34	14	8	10	14	0	0	0
Average	15	24	18	12	12	8	0	0	0
Standard deviation	8.1	8.7	5.8	3.1	2.0	6.0	0.0	0.0	0.0
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

CFU. Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (1st. test cycle : 2013. 06. 17) - Basic water parameters

Test item	Control water			Treated water		
	B	M	E	B	M	E
Water temperature (℃)	23.10	23.31	22.37	22.64	22.40	22.57
	22.93	23.00	22.34	22.61	22.67	22.57
	23.12	23.12	22.30	22.57	22.41	22.52
Average	23.05	23.14	22.34	22.61	22.49	22.55
Standard deviation	0.10	0.16	0.04	0.04	0.15	0.03
pH	7.15	7.14	7.13	6.88	6.99	7.08
	7.15	7.15	7.13	6.98	7.00	7.08
	7.11	7.15	7.12	6.99	7.01	7.09
Average	7.14	7.15	7.13	6.95	7.00	7.08
Standard deviation	0.02	0.01	0.01	0.06	0.01	0.01
ORP (mV)	313	309	307	340	317	315
	309	307	305	333	318	315
	307	306	304	330	318	314
Average	310	307	305	334	318	315
Standard deviation	3	2	2	5	1	1
Salinity (PSU)	21.68	21.64	21.66	21.11	21.09	21.04
	21.68	21.75	21.66	21.14	21.10	21.07
	21.69	21.73	21.66	21.17	21.11	21.07
Average	21.68	21.71	21.66	21.14	21.10	21.06
Standard deviation	0.01	0.06	0.00	0.03	0.01	0.02
DO (mg/L)	6.43	6.50	6.85	7.13	7.05	7.14
	6.51	6.53	6.88	7.07	7.05	7.17
	6.57	6.52	6.78	7.12	7.08	7.20
Average	6.50	6.52	6.84	7.11	7.06	7.17
Standard deviation	0.07	0.02	0.05	0.03	0.02	0.03
Turbidity (NTU)	18.2	16.7	18.5	18.1	19.1	18.5
	18.0	16.7	17.4	17.8	18.3	17.0
	18.2	17.9	17.1	17.7	18.9	18.3
Average	18.1	17.1	17.7	17.9	18.8	17.9
Standard deviation	0.12	0.69	0.74	0.21	0.42	0.81
TSS (mg/L)	46.4	59.0	61.0	62.0	63.0	64.0
	64.0	64.0	67.0	68.0	73.0	68.0
	63.0	63.0	66.0	67.0	77.0	65.0
Average	57.8	62.0	64.7	65.7	71.0	65.7
Standard deviation	9.89	2.65	3.21	3.21	7.21	2.08
DOC (mg/L)	4.53	4.64	4.42	3.57	3.51	3.58
POC (mg/L)	5.16	5.29	5.49	8.39	7.59	9.82

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (1st. test cycle : 2013. 06. 17) - Viable organisms (Plankton)

Test item	Control water			Treated water		
	B	M	E	B	M	E
≥ 50 μm (inds/m³)	40 000	4 000	0	1*	0*	0*
	41 000	4 500	500			
	28 000	7 000	0			
Average	36 334	5 167	167			
Standard deviation	7 234.2	1 607.3	288.7			
≥ 10 μm and < 50 μm (inds/mL)	552	325	320	10.3	8.5	8.6
	531	347	318	7.3	8.7	7.7
	572	312	337	8.6	9.6	7.2
Average	552	328	325	8.8	9.0	7.9
Standard deviation	20.5	17.7	10.4	1.5	0.6	0.7

* Analysed entire sample volume.

- de-Ballasting (1st. test cycle : 2013. 06. 17) - Viable organisms (Bacteria)

Test item	Control water			Treated water		
	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	34 000	36 400	45 800	8 000	7 440	6 560
	38 000	36 000	30 800	7 520	6 000	6 360
	28 000	34 000	37 600	8 200	5 000	6 360
Average	33 334	35 467	33 067	7 907	6 147	6 427
Standard deviation	5 033.2	1 285.8	7 510.9	349.5	1 226.6	115.5
Coliform (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	0	10	10	0	1	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	4	4	0	1	0
Standard deviation	0.0	5.8	5.8	0.0	0.6	0.0
Enterococci (CFU/100 mL)	80	20	20	7	3	4
	0	20	60	6	2	0
	0	0	20	0	11	0
Average	27	14	34	5	6	2
Standard deviation	46.2	11.5	23.1	3.8	4.9	2.3
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0

CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (2nd. test cycle : 2013. 06. 19) - Basic water parameters

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Water temperature (℃)	23.55	23.65	23.59	23.53	23.57	23.54	23.39	23.82	23.76
	23.58	23.55	23.57	23.58	23.49	23.45	23.44	23.84	23.71
	23.55	23.53	23.58	23.61	23.41	23.42	23.45	23.80	23.71
Average	23.56	23.58	23.58	23.59	23.49	23.47	23.43	23.82	23.73
Standard deviation	0.02	0.06	0.01	0.02	0.08	0.06	0.03	0.02	0.03
pH	7.89	7.97	8.20	7.96	8.12	8.24	7.92	7.91	7.91
	7.91	7.99	8.22	7.96	8.14	8.25	7.93	7.92	7.91
	7.92	8.02	8.22	7.95	8.18	8.25	7.93	7.91	7.91
Average	7.91	7.99	8.21	7.96	8.15	8.25	7.93	7.91	7.91
Standard deviation	0.02	0.03	0.01	0.01	0.03	0.01	0.01	0.01	0.00
ORP (mV)	283	207	165	273	176	157	667	720	751
	278	196	163	271	174	156	670	726	750
	277	190	161	269	171	155	674	725	753
Average	279	198	163	271	174	156	670	724	751
Standard deviation	3	9	2	2	3	1	4	3	2
Salinity (PSU)	33.22	32.81	32.80	32.75	32.73	32.78	33.18	33.52	33.16
	33.25	32.93	32.96	32.41	32.61	32.61	33.20	33.53	33.20
	33.22	32.94	32.96	33.03	32.48	32.71	33.24	33.54	33.30
Average	33.23	32.89	32.91	32.73	32.61	32.70	33.21	33.53	33.22
Standard deviation	0.02	0.07	0.09	0.31	0.13	0.09	0.03	0.01	0.07
DO (mg/L)	6.78	7.19	7.20	6.79	7.22	7.20	7.76	8.33	8.50
	6.79	7.23	7.21	6.81	7.23	7.23	7.90	8.19	8.39
	6.80	7.22	7.21	6.76	7.25	7.22	7.96	8.03	8.34
Average	6.79	7.21	7.21	6.79	7.23	7.22	7.87	8.18	8.41
Standard deviation	0.01	0.02	0.01	0.03	0.02	0.02	0.10	0.15	0.08
Turbidity (NTU)	4.60	4.31	4.98	5.60	5.01	4.56	4.32	3.78	4.78
	4.75	4.21	5.28	5.50	4.41	5.21	3.81	4.31	4.06
	5.06	4.67	4.46	4.84	5.22	4.58	4.21	3.72	3.88
Average	4.80	4.40	4.91	5.31	4.88	4.78	4.11	3.94	4.24
Standard deviation	0.23	0.24	0.41	0.41	0.42	0.37	0.27	0.32	0.48
TSS (mg/L)	26.4	27.2	25.2	30.8	27.2	31.6	23.6	29.6	20.4
	26.4	26.0	27.2	30.0	32.8	28.0	25.6	27.6	26.0
	29.2	27.6	28.4	28.4	30.0	31.2	25.2	23.2	25.2
Average	27.3	26.9	26.9	29.7	30.0	30.3	24.8	26.8	23.9
Standard deviation	1.62	0.83	1.62	1.22	2.80	1.97	1.06	3.27	3.03
DOC (mg/L)	4.12	4.30	4.00	3.90	3.95	4.20	3.99	4.13	3.99
POC (mg/L)	1.85	1.69	2.27	2.33	2.30	2.31	2.67	2.17	2.88

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

IV. To be continued

- Ballasting (2nd. test cycle : 2013. 06. 19) - Viable organisms (Plankton)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
≥ 50 μm (inds/m³)	155 000	189 000	193 000	154 000	141 000	195 000	20 700	39 750	29 250
	158 000	189 000	191 000	159 000	161 000	171 000	21 150	43 200	27 600
	162 000	187 000	193 000	173 000	159 000	162 000	19 050	40 200	30 000
Average	158 334	188 334	192 334	162 000	153 667	176 000	20 300	41 050	28 950
Standard deviation	3 511.9	1 154.7	1 154.7	9 848.9	11 015.1	17 058.7	1 105.7	1 875.5	1 227.8
≥ 10 μm and < 50 μm (inds/mL)	1 290	1 642	1 464	1 323	1 500	1 249	0.7	0.1	0.7
	1 228	1 840	1 156	1 239	1 713	1 166	0.3	0.4	0.4
	1 243	1 587	1 373	1 255	1 792	1 106	0.4	0.6	0.4
Average	1 254	1 690	1 331	1 273	1 669	1 174	0.5	0.4	0.5
Standard deviation	32.3	133.1	158.2	44.6	151.0	71.8	0.2	0.3	0.2

- Ballasting (2nd. test cycle : 2013. 06. 19) - Viable organisms (Bacteria)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	9 600	4 200	1 800	5 900	2 300	17 900	0	0	0
	11 500	400	3 100	10 400	3 900	4 200	0	0	0
	17 000	1 200	3 000	3 900	3 200	5 200	0	0	0
Average	12 700	1 934	2 634	6 734	3 134	9 100	0	0	0
Standard deviation	3 843.2	2 003.3	723.4	3 329.2	802.1	7 637.4	0.0	0.0	0.0
Coliform (CFU/100 mL)	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Enterococci (CFU/100 mL)	10	2	2	12	2	4	0	0	0
	0	0	0	6	2	6	0	0	0
	6	0	0	0	0	0	0	0	0
Average	6	1	1	6	2	4	0	0	0
Standard deviation	5.0	1.2	1.2	6.0	1.2	3.1	0.0	0.0	0.0
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (2nd. test cycle : 2013. 06. 24) - Basic water parameters

Test item	Control water			Treated water		
	B	M	E	B	M	E
Water temperature (℃)	23.79	23.73	23.89	23.80	23.61	23.67
	23.72	23.65	23.83	23.70	23.65	23.61
	23.69	23.65	23.87	23.71	23.61	23.75
Average	23.73	23.68	23.86	23.74	23.62	23.68
Standard deviation	0.05	0.05	0.03	0.06	0.02	0.07
pH	7.27	7.39	7.45	7.54	7.55	7.56
	7.34	7.38	7.48	7.57	7.58	7.61
	7.54	7.46	7.45	7.60	7.58	7.59
Average	7.38	7.41	7.46	7.57	7.57	7.59
Standard deviation	0.14	0.04	0.02	0.03	0.02	0.03
ORP (mV)	342	335	328	371	349	330
	328	325	318	358	337	331
	322	321	315	352	333	325
Average	331	327	320	360	340	329
Standard deviation	10	7	7	10	8	3
Salinity (PSU)	33.39	33.42	33.26	33.26	33.47	33.31
	33.46	33.50	33.36	33.33	33.49	33.40
	33.45	33.51	33.33	33.37	33.51	33.43
Average	33.43	33.48	33.32	33.32	33.49	33.38
Standard deviation	0.04	0.05	0.05	0.06	0.02	0.06
DO (mg/L)	6.18	6.41	6.42	6.90	6.91	6.87
	6.12	6.37	6.44	6.91	6.91	6.87
	6.12	6.33	6.41	6.91	6.89	6.87
Average	6.14	6.37	6.42	6.91	6.90	6.87
Standard deviation	0.03	0.04	0.02	0.01	0.01	0.00
Turbidity (NTU)	3.14	2.81	3.34	2.90	2.93	2.95
	3.04	3.26	3.25	2.87	2.84	3.03
	2.70	3.02	3.11	2.72	2.83	3.23
Average	2.96	3.03	3.23	2.83	2.87	3.07
Standard deviation	0.23	0.23	0.12	0.10	0.06	0.14
TSS (mg/L)	10.0	17.6	11.6	23.6	20.4	24.4
	17.2	18.8	20.4	23.6	20.0	20.0
	20.4	21.2	20.8	25.6	21.6	25.2
Average	15.9	19.2	17.6	24.3	20.7	23.2
Standard deviation	5.33	1.83	5.20	1.15	0.83	2.80
DOC (mg/L)	2.53	2.56	2.86	2.34	2.21	2.35
POC (mg/L)	0.23	0.30	0.22	1.38	1.57	1.14

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (2nd. test cycle : 2013. 06. 24) - Viable organisms (Plankton)

Test item	Control water			Treated water		
	B	M	E	B	M	E
≥ 50 μm (inds/m^3)	5 000	1 000	2 500	66*	50*	70*
	3 500	4 000	2 000			
	3 500	3 000	3 000			
Average	4 000	2 667	2 500			
Standard deviation	866.0	1 527.5	500.0			
≥ 10 μm and < 50 μm (inds/mL)	121	70	80	0.0	0.0	0.0
	120	76	86	0.0	0.0	0.0
	94	107	94	0.0	0.0	0.0
Average	112	85	87	0.0	0.0	0.0
Standard deviation	15.3	19.9	7.0	0.0	0.0	0.0

* Analysed entire sample volume

- de-Ballasting (2nd. test cycle : 2013. 06. 24) - Viable organisms (Bacteria)

Test item	Control water			Treated water		
	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	11 100	5 500	10 300	TNTC*	TNTC*	TNTC*
	10 300	6 800	13 900	TNTC*	TNTC*	TNTC*
	11 700	6 500	13 300	TNTC*	TNTC*	TNTC*
Average	11 034	6 267	12 500			
Standard deviation	702.4	680.7	1 928.7			
Coliform (CFU/100 mL)	2	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	1	0	0	0	0	0
Standard deviation	1.2	0.0	0.0	0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0
Enterococci (CFU/100 mL)	2	4	0	0	0	18
	0	2	0	0	0	14
	0	0	0	0	0	23
Average	1	2	0	0	0	19
Standard deviation	1.2	2.0	0.0	0.0	0.0	4.5
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count
CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (3rd. test cycle : 2013. 06. 26) - Basic water parameters

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Water temperature (℃)	22.41	22.33	22.43	22.32	22.36	22.51	22.32	22.32	22.39
	22.38	22.32	22.42	22.30	22.36	22.48	22.31	22.28	22.41
	22.38	22.35	22.44	22.32	22.37	22.52	22.33	22.31	22.46
Average	22.39	22.33	22.43	22.31	22.36	22.50	22.32	22.30	22.42
Standard deviation	0.02	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.04
pH	7.95	7.98	7.99	7.99	8.00	7.98	7.99	7.98	7.99
	7.97	7.99	7.99	7.99	8.01	8.00	7.99	7.97	7.97
	7.97	7.98	8.00	8.01	8.00	8.00	7.98	7.95	7.96
Average	7.96	7.98	7.99	8.00	8.00	7.99	7.99	7.97	7.97
Standard deviation	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
ORP (mV)	268	266	267	262	282	305	662	545	667
	264	269	270	262	281	296	530	659	685
	263	274	273	262	281	302	625	696	643
Average	265	270	270	262	281	301	606	633	665
Standard deviation	3	4	3	0	1	5	68	79	21
Salinity (PSU)	21.34	21.41	21.40	21.54	21.52	21.50	21.37	21.47	21.44
	21.39	21.44	21.43	21.52	21.53	21.51	21.37	21.47	21.46
	21.39	21.43	21.42	21.52	21.53	21.54	21.38	21.47	21.43
Average	21.37	21.43	21.42	21.53	21.53	21.52	21.37	21.47	21.44
Standard deviation	0.03	0.02	0.02	0.01	0.01	0.02	0.01	0.00	0.02
DO (mg/L)	7.40	7.42	7.42	7.42	7.43	7.46	8.90	8.55	8.49
	7.43	7.44	7.44	7.44	7.44	7.37	8.72	8.58	8.69
	7.44	7.43	7.43	7.42	7.43	7.44	8.82	8.54	8.95
Average	7.42	7.43	7.43	7.43	7.43	7.42	8.81	8.56	8.71
Standard deviation	0.02	0.01	0.01	0.01	0.01	0.05	0.09	0.02	0.23
Turbidity (NTU)	18.0	18.2	19.7	19.9	19.3	18.5	18.3	15.8	15.9
	18.1	18.7	19.8	18.1	19.3	19.0	17.0	16.5	17.3
	17.8	19.5	18.8	19.8	19.3	20.2	17.8	16.2	17.3
Average	18.0	18.8	19.4	19.3	19.3	19.2	17.7	16.2	16.8
Standard deviation	0.15	0.66	0.55	1.01	0.00	0.87	0.66	0.35	0.81
TSS (mg/L)	52.8	52.8	67.6	60.4	61.6	58.0	60.4	60.8	58.8
	49.6	49.6	50.4	57.2	56.8	62.8	53.6	56.0	53.6
	57.6	57.6	58.0	50.4	55.2	54.8	54.0	53.6	50.8
Average	53.3	53.3	58.7	56.0	57.9	58.5	56.0	56.8	54.4
Standard deviation	4.03	4.03	8.62	5.11	3.33	4.03	3.82	3.67	4.06
DOC (mg/L)	7.36	7.30	7.36	7.17	7.22	7.18	7.47	7.20	7.29
POC (mg/L)	6.43	6.57	7.39	6.67	7.01	6.56	7.31	7.06	7.55

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

IV. To be continued

- Ballasting (3rd. test cycle : 2013. 06. 26) - Viable organisms (Plankton)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
≥ 50 μm (inds/m³)	152 000	152 500	176 500	136 500	155 500	123 500	30 400	45 600	36 600
	140 500	159 000	166 000	139 000	149 000	130 000	30 000	37 800	37 800
	140 500	150 000	170 000	123 000	144 000	130 000	29 200	42 000	36 800
Average	144 334	153 834	170 834	132 834	149 500	127 834	29 867	41 800	37 067
Standard deviation	6 639.5	4 645.8	5 299.4	8 607.2	5 766.3	3 752.8	611.0	3 903.8	642.9
≥ 10 μm and < 50 μm (inds/mL)	1 952	1 850	1 725	1 354	1 024	1 052	0.6	0.0	0.0
	1 964	1 665	1 941	1 332	1 068	1 079	0.3	0.0	0.0
	2 079	1 755	1 795	1 421	1 078	997	0.0	0.0	0.0
Average	1 999	1 757	1 821	1 369	1 057	1 043	0.3	0.0	0.0
Standard deviation	70.1	92.5	110.2	46.4	28.7	41.8	0.3	0.0	0.0

- Ballasting (3rd. test cycle : 2013. 06. 26) - Viable organisms (Bacteria)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	23 200	14 500	18 800	15 300	5 600	9 100	10	0	0
	14 200	13 900	14 000	18 900	11 900	10 900	0	0	30
	18 800	15 800	11 000	12 900	15 600	16 100	0	0	40
Average	18 734	14 734	14 600	15 700	11 034	12 034	4	0	24
Standard deviation	4 500.4	971.3	3 934.5	3 019.9	5 056.0	3 635.0	5.8	0.0	20.8
Coliform (CFU/100 mL)	45	5	35	0	5	0	0	0	0
	5	5	45	0	0	0	0	0	0
	0	0	10	0	0	0	0	0	0
Average	17	4	30	0	2	0	0	0	0
Standard deviation	24.7	2.9	18.0	0.0	2.9	0.0	0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	15	10	15	5	20	10	0	0	0
	5	10	10	5	20	5	0	0	0
	0	10	5	0	5	5	0	0	0
Average	7	10	10	4	15	7	0	0	0
Standard deviation	7.6	0.0	5.0	2.9	8.7	2.9	0.0	0.0	0.0
Enterococci (CFU/100 mL)	5	10	5	0	5	5	0	0	2
	0	0	0	0	0	0	0	0	5
	0	0	0	0	0	0	0	0	3
Average	2	4	2	0	2	2	0	0	4
Standard deviation	2.9	5.8	2.9	0.0	2.9	2.9	0.0	0.0	1.5
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (3rd. test cycle : 2013. 07. 01) - Basic water parameters

Test item	Control water			Treated water		
	B	M	E	B	M	E
Water temperature (℃)	23.92	23.85	23.99	23.49	23.46	23.73
	23.69	23.72	24.00	23.56	23.49	23.58
	23.77	23.76	24.04	23.57	23.49	23.65
Average	23.79	23.78	24.01	23.54	23.48	23.65
Standard deviation	0.12	0.07	0.03	0.04	0.02	0.08
pH	7.12	7.08	7.10	6.86	6.82	6.80
	7.15	7.15	7.17	6.90	6.85	6.93
	7.15	7.16	7.18	6.91	6.85	6.94
Average	7.14	7.13	7.15	6.89	6.84	6.89
Standard deviation	0.02	0.04	0.04	0.03	0.02	0.08
ORP (mV)	362	363	358	413	395	386
	354	354	348	398	388	369
	345	342	344	392	384	363
Average	354	353	350	401	389	373
Standard deviation	9	11	7	11	6	12
Salinity (PSU)	21.54	21.53	21.74	21.47	21.46	21.30
	21.61	21.65	21.71	21.45	21.49	21.41
	21.62	21.63	21.83	21.49	21.48	21.39
Average	21.59	21.60	21.76	21.47	21.48	21.37
Standard deviation	0.04	0.06	0.06	0.02	0.02	0.06
DO (mg/L)	6.50	6.73	6.46	6.68	6.12	6.77
	6.57	6.73	6.50	6.69	6.17	6.72
	6.56	6.61	6.50	6.73	6.17	6.74
Average	6.54	6.69	6.49	6.70	6.15	6.74
Standard deviation	0.04	0.07	0.02	0.03	0.03	0.03
Turbidity (NTU)	17.6	17.4	18.4	17.8	17.6	18.2
	17.9	17.0	17.5	17.4	18.3	17.9
	16.2	16.7	18.0	16.8	17.7	17.4
Average	17.2	17.0	18.0	17.3	17.9	17.8
Standard deviation	0.91	0.35	0.45	0.50	0.38	0.40
TSS (mg/L)	61.6	61.2	61.6	66.0	77.0	75.0
	48.0	50.4	53.6	54.0	66.0	67.0
	47.6	53.2	53.2	60.0	60.0	63.0
Average	52.4	54.9	56.1	60.0	67.7	68.3
Standard deviation	7.97	5.60	4.74	6.00	8.62	6.11
DOC (mg/L)	5.17	5.28	5.16	2.26	2.29	2.33
POC (mg/L)	6.68	6.31	6.77	5.74	7.25	7.35

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (3rd. test cycle : 2013. 07. 01) - Viable organisms (Plankton)

Test item	Control water			Treated water		
	B	M	E	B	M	E
≥ 50 μm (inds/m^3)	31 500	24 000	30 000	0*	0*	2*
	32 500	28 500	28 000			
	31 000	23 500	23 000			
Average	31 667	25 334	27 000			
Standard deviation	763.8	2 753.8	3 605.6			
≥ 10 μm and < 50 μm (inds/mL)	501	512	500	0.6	0.6	2.1
	484	468	401	0.6	0.2	0.2
	405	548	447	1.1	0.5	0.9
Average	464	510	450	0.8	0.5	1.1
Standard deviation	51.2	40.1	49.5	0.3	0.2	1.0

* Analysed entire sample volume.

- de-Ballasting (3rd. test cycle : 2013. 07. 01) - Viable organisms (Bacteria)

Test item	Control water			Treated water		
	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	44 800	55 700	60 000	TNTC*	TNTC*	TNTC*
	41 000	45 900	52 100	TNTC*	TNTC*	TNTC*
	45 600	62 900	45 600	TNTC*	TNTC*	TNTC*
Average	43 800	54 834	52 567			
Standard deviation	2 457.6	8 533.1	7 211.3			
Coliform (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	0	0	0	1	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	1	0	0
Standard deviation	0.0	0.0	0.0	0.6	0.0	0.0
Enterococci (CFU/100 mL)	306	378	298	61	42	65
	496	512	380	71	85	133
	346	382	416	96	118	91
Average	383	424	365	76	82	97
Standard deviation	100.2	76.2	60.5	18.0	38.1	34.3
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count

CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (4th. test cycle : 2013. 07. 03) - Basic water parameters

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Water temperature (℃)	23.23	23.35	23.30	23.18	23.26	23.26	23.29	23.25	23.32
	23.20	23.24	23.29	23.18	23.28	23.28	23.26	23.27	23.33
	23.21	23.22	23.31	23.18	23.27	23.29	23.25	23.29	23.33
Average	23.21	23.27	23.30	23.18	23.27	23.28	23.27	23.27	23.33
Standard deviation	0.02	0.07	0.01	0.00	0.01	0.02	0.02	0.02	0.01
pH	7.92	7.90	7.93	7.95	7.94	7.95	7.98	8.02	8.04
	7.94	7.90	7.94	7.94	7.94	7.95	7.99	8.02	8.04
	7.94	7.93	7.94	7.94	7.94	7.95	8.00	8.01	8.03
Average	7.93	7.91	7.94	7.94	7.94	7.95	7.99	8.02	8.04
Standard deviation	0.01	0.02	0.01	0.01	0.00	0.00	0.01	0.01	0.01
ORP (mV)	313	308	290	301	292	286	715	759	767
	307	303	289	298	289	284	737	762	769
	305	297	289	296	288	283	742	758	769
Average	308	303	289	298	290	284	731	760	768
Standard deviation	4	6	1	3	2	2	14	2	1
Salinity (PSU)	21.22	21.13	21.15	21.15	21.18	21.23	21.17	21.22	21.18
	21.28	21.21	21.26	21.16	21.20	21.22	21.24	21.16	21.14
	21.28	21.23	21.26	21.15	21.16	21.24	21.23	21.22	21.20
Average	21.26	21.19	21.22	21.15	21.18	21.23	21.21	21.20	21.17
Standard deviation	0.03	0.05	0.06	0.01	0.02	0.01	0.04	0.03	0.03
DO (mg/L)	7.31	7.31	7.32	7.32	7.32	7.31	8.74	8.60	8.79
	7.31	7.31	7.32	7.32	7.31	7.31	8.76	8.53	8.89
	7.32	7.32	7.31	7.32	7.32	7.30	8.64	8.57	8.60
Average	7.31	7.31	7.32	7.32	7.32	7.31	8.71	8.57	8.76
Standard deviation	0.01	0.01	0.01	0.00	0.01	0.01	0.06	0.04	0.15
Turbidity (NTU)	20.5	15.6	18.2	17.9	15.0	14.9	17.6	15.4	15.2
	20.8	15.1	19.1	18.1	16.4	15.6	17.1	15.3	16.2
	20.2	13.9	21.3	17.9	15.4	15.9	17.0	14.0	15.5
Average	20.5	14.9	19.5	18.0	15.6	15.5	17.2	14.9	15.6
Standard deviation	0.30	0.87	1.59	0.12	0.72	0.51	0.32	0.78	0.51
TSS (mg/L)	67.6	64.0	60.8	58.0	54.0	63.2	56.8	66.4	55.6
	57.2	53.6	57.6	55.2	54.0	54.4	50.4	45.6	55.6
	56.8	54.8	56.8	51.6	51.2	55.2	53.6	50.0	60.0
Average	60.5	57.5	58.4	54.9	53.1	57.6	53.6	54.0	57.1
Standard deviation	6.12	5.69	2.12	3.21	1.62	4.87	3.20	11.0	2.54
DOC (mg/L)	6.94	6.92	7.35	6.90	6.88	6.69	6.39	7.04	6.45
POC (mg/L)	8.42	8.15	8.13	5.78	8.12	5.60	5.05	7.50	8.18

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (4th. test cycle : 2013. 07. 03) - Viable organisms (Plankton)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
≥ 50 μm (inds./m³)	176 500	249 000	263 000	194 500	216 000	210 500	17 600	28 800	27 800
	184 500	227 000	245 000	197 500	198 000	216 000	13 600	25 000	28 400
	186 000	233 000	241 000	193 500	206 500	208 000	18 200	29 000	31 000
Average	182 334	236 334	249 667	195 167	206 834	211 500	16 467	27 600	29 067
Standard deviation	5 107.2	11 372.5	11 718.9	2 081.7	9 004.6	4 092.7	2 500.7	2 253.9	1 701.0
≥ 10 μm and < 50 μm (inds./mL)	1 177	1 121	1 003	645	645	855	0.0	0.0	0.0
	988	1 024	947	667	682	745	0.0	0.1	0.0
	921	1 065	982	687	817	716	0.1	0.0	0.0
Average	1 029	1 070	978	667	715	772	0.1	0.1	0.0
Standard deviation	132.8	48.7	28.3	21.0	90.5	73.3	0.1	0.1	0.0

- Ballasting (4th. test cycle : 2013. 07. 03) - Viable organisms (Bacteria)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	44 400	18 300	13 500	14 400	11 100	11 200	0	0	0
	46 200	16 600	16 600	13 400	20 800	9 700	0	0	0
	42 500	14 700	17 300	16 000	11 300	11 000	0	0	0
Average	44 367	16 534	15 800	14 600	14 400	10 634	0	0	0
Standard deviation	1 850.2	1 800.9	2 022.4	1 311.5	5 543.5	814.5	0.0	0.0	0.0
Coliform (CFU/100 mL)	10	42	38	74	84	38	0	0	0
	20	44	30	58	64	34	1	0	0
	16	52	42	44	40	42	1	0	0
Average	16	46	37	59	63	38	1	0	0
Standard deviation	5.0	5.3	6.1	15.0	22.0	4.0	0.6	0.0	0.0
Escherichia coli (CFU/100 mL)	4	6	8	6	6	6	0	0	0
	0	8	8	4	0	8	0	0	0
	0	10	8	2	2	2	0	0	0
Average	2	8	8	4	3	6	0	0	0
Standard deviation	2.3	2.0	0.0	2.0	3.1	3.1	0.0	0.0	0.0
Enterococci (CFU/100 mL)	8	10	6	10	14	12	0	0	0
	4	4	12	4	4	0	0	0	0
	12	12	16	0	14	14	0	0	0
Average	8	9	12	5	11	9	0	0	0
Standard deviation	4.0	4.2	5.0	5.0	5.8	7.6	0.0	0.0	0.0
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (4th. test cycle : 2013. 07. 08) - Basic water parameters

Test item	Control water			Treated water		
	B	M	E	B	M	E
Water temperature (℃)	24.72	25.15	25.36	24.68	24.74	24.66
	24.77	24.95	24.98	24.47	24.53	24.60
	24.79	24.90	24.88	24.58	24.59	24.60
Average	24.76	25.00	25.07	24.58	24.62	24.62
Standard deviation	0.04	0.13	0.25	0.11	0.11	0.03
pH	6.99	7.00	7.02	6.82	6.78	6.97
	7.04	7.05	7.07	6.84	6.86	7.00
	7.05	7.07	7.06	6.85	6.88	7.02
Average	7.03	7.04	7.05	6.84	6.84	7.00
Standard deviation	0.03	0.04	0.03	0.02	0.05	0.03
ORP (mV)	319	315	314	331	338	322
	295	304	299	324	324	314
	289	295	293	319	319	308
Average	301	305	302	325	327	315
Standard deviation	16	10	11	6	10	7
Salinity (PSU)	20.76	21.30	21.14	21.24	21.17	21.27
	21.18	20.87	21.14	21.29	21.25	21.28
	21.28	21.26	21.17	21.26	21.27	21.31
Average	21.07	21.14	21.15	21.26	21.23	21.29
Standard deviation	0.28	0.24	0.02	0.03	0.05	0.02
DO (mg/L)	6.76	6.61	6.49	6.34	6.50	6.60
	6.47	6.45	6.49	6.34	6.13	6.67
	6.48	6.45	6.49	6.30	6.17	6.70
Average	6.57	6.50	6.49	6.33	6.27	6.66
Standard deviation	0.16	0.09	0.00	0.02	0.20	0.05
Turbidity (NTU)	17.8	18.0	17.1	17.5	17.9	16.4
	17.7	17.5	16.7	17.4	17.6	16.7
	17.3	18.6	16.8	17.3	17.8	16.5
Average	17.6	18.0	16.9	17.4	17.8	16.5
Standard deviation	0.26	0.55	0.21	0.10	0.15	0.15
TSS (mg/L)	81.0	87.0	76.0	65.2	63.2	60.4
	73.0	74.0	71.0	43.6	47.6	50.4
	67.0	59.0	63.0	49.6	48.8	45.6
Average	73.7	73.3	70.0	52.8	53.2	52.1
Standard deviation	7.02	14.0	6.56	11.1	8.68	7.55
DOC (mg/L)	1.75	1.88	1.83	1.38	1.36	1.94
POC (mg/L)	6.27	6.13	6.42	6.62	6.75	6.65

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

IV. To be continued

- de-Ballasting (4th. test cycle : 2013. 07. 08) - Viable organisms (Plankton)

Test item	Control water			Treated water		
	B	M	E	B	M	E
≥ 50 μm (inds/m³)	10 500	12 500	8 000	2*	0*	0*
	8 000	7 000	12 000			
	9 500	7 500	8 500			
Average	9 334	9 000	9 500			
Standard deviation	1 258.3	3 041.4	2 179.4			
≥ 10 μm and < 50 μm (inds/mL)	222	124	208	0.1	0.1	0.1
	208	135	185	0.5	0.2	0.3
	274	162	171	0.1	0.1	0.1
Average	235	141	188	0.3	0.2	0.2
Standard deviation	34.8	19.6	18.7	0.2	0.1	0.1

* Analysed entire sample volume

- de-Ballasting (4th. test cycle : 2013. 07. 08) - Viable organisms (Bacteria)

Test item	Control water			Treated water		
	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*
Average						
Standard deviation						
Coliform (CFU/100 mL)	8	0	0	1	0	0
	8	0	0	1	0	0
	0	0	0	0	0	0
Average	6	0	0	1	0	0
Standard deviation	4.6	0.0	0.0	0.6	0.0	0.0
Escherichia coli (CFU/100 mL)	TNTC*	TNTC*	TNTC*	1	1	2
	TNTC*	TNTC*	TNTC*	0	1	1
	TNTC*	TNTC*	TNTC*	0	0	1
Average				1	1	2
Standard deviation				0.6	0.6	0.6
Enterococci (CFU/100 mL)	60	102	78	194	187	150
	86	94	86	193	162	123
	58	82	102	214	198	116
Average	68	93	89	201	183	130
Standard deviation	15.6	10.1	12.2	11.8	18.4	18.0
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count

CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (5th. test cycle : 2013. 07. 10) - Basic water parameters

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Water temperature (℃)	24.89	24.47	24.88	24.70	24.66	24.86	24.82	24.79	24.78
	24.68	24.48	25.00	24.72	24.77	24.93	24.87	24.69	24.99
	24.66	24.64	24.84	24.76	24.81	24.99	24.85	24.62	24.98
Average	24.74	24.53	24.91	24.73	24.75	24.93	24.85	24.70	24.92
Standard deviation	0.13	0.10	0.08	0.03	0.08	0.07	0.03	0.09	0.12
pH	8.05	8.08	8.10	8.07	8.10	8.11	7.84	7.84	7.85
	8.06	8.09	8.10	8.07	8.09	8.11	7.82	7.83	7.83
	8.06	8.10	8.10	8.08	8.10	8.11	7.82	7.80	7.82
Average	8.06	8.09	8.10	8.07	8.10	8.11	7.83	7.82	7.83
Standard deviation	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.02	0.02
ORP (mV)	242	233	233	242	235	232	717	755	763
	241	233	234	242	235	231	718	756	762
	243	235	234	242	236	231	718	756	760
Average	242	234	234	242	235	231	718	756	762
Standard deviation	1	1	1	0	1	1	1	1	2
Salinity (PSU)	20.74	20.76	20.70	20.51	20.69	20.72	20.58	20.70	20.71
	20.71	20.78	20.70	20.71	20.74	20.74	20.71	20.71	20.70
	20.62	20.78	20.70	20.69	20.75	20.76	20.76	20.74	20.73
Average	20.69	20.77	20.70	20.64	20.73	20.74	20.68	20.72	20.71
Standard deviation	0.06	0.01	0.00	0.11	0.03	0.02	0.09	0.02	0.02
DO (mg/L)	7.22	7.25	7.22	7.26	7.28	7.26	8.55	8.42	8.67
	7.21	7.25	7.24	7.27	7.27	7.25	8.56	8.55	8.60
	7.26	7.25	7.26	7.25	7.27	7.28	8.51	8.71	8.51
Average	7.23	7.25	7.24	7.26	7.27	7.26	8.54	8.56	8.59
Standard deviation	0.03	0.00	0.02	0.01	0.01	0.02	0.03	0.15	0.08
Turbidity (NTU)	19.8	17.9	20.7	16.8	16.6	18.1	16.3	15.5	20.2
	19.4	18.0	19.2	15.7	15.7	18.0	14.1	14.7	19.8
	17.8	16.5	20.7	17.0	16.9	19.8	13.8	15.8	19.1
Average	19.0	17.5	20.2	16.5	16.4	18.6	14.7	15.3	19.7
Standard deviation	1.06	0.84	0.87	0.70	0.62	1.01	1.37	0.57	0.56
TSS (mg/L)	47.6	61.6	56.4	56.8	61.6	64.0	51.2	59.6	68.8
	47.2	50.4	54.4	52.0	51.6	56.4	51.6	50.8	61.2
	50.8	52.4	52.0	55.2	52.0	54.0	54.4	51.6	60.0
Average	48.5	54.8	54.3	54.7	55.1	58.1	52.4	54.0	63.3
Standard deviation	1.97	5.97	2.20	2.44	5.66	5.22	1.74	4.87	4.77
DOC (mg/L)	6.05	5.94	6.03	5.99	5.83	6.02	6.18	5.77	6.02
POC (mg/L)	4.44	5.87	5.34	5.85	5.95	5.45	6.17	6.42	8.72

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

IV. To be continued

- Ballasting (5th. test cycle : 2013. 07. 10) - Viable organisms (Plankton)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
≥ 50 μm (inds/m³)	151 500	139 500	136 500	117 000	115 500	112 000	22 600	16 400	13 000
	174 000	144 500	150 500	105 500	113 500	109 000	23 800	21 000	24 400
	147 500	150 000	143 000	123 500	119 000	118 500	27 600	20 000	27 000
Average	157 667	144 667	143 334	115 334	116 000	113 167	24 667	19 134	21 467
Standard deviation	14 285.8	5 252.0	7 005.9	9 115.0	2 783.9	4 856.3	2 610.2	2 419.4	7 446.7
≥ 10 μm and < 50 μm (inds/mL)	1 001	1 096	988	1 090	1 024	1 079	0.0	0.0	0.0
	1 032	1 043	987	1 121	1 097	1 043	0.0	0.0	0.0
	1 021	1 081	998	1 036	1 068	1 011	0.0	0.0	0.0
Average	1 018	1 074	991	1 083	1 063	1 045	0.0	0.0	0.0
Standard deviation	15.7	27.3	6.1	43.0	36.8	34.0	0.0	0.0	0.0

- Ballasting (5th. test cycle : 2013. 07. 10) - Viable organisms (Bacteria)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	44 900	45 700	44 400	57 600	44 400	52 000	0	0	0
	53 400	52 000	50 600	59 200	58 800	45 200	0	0	0
	44 300	51 100	42 800	50 800	50 800	34 300	0	0	0
Average	47 534	49 600	45 934	55 867	51 334	43 834	0	0	0
Standard deviation	5 089.5	3 407.3	4 119.9	4 460.2	7 214.8	8 928.8	0.0	0.0	0.0
Coliform (CFU/100 mL)	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	1	1	0
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	0	0
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	0	0
Average							1	1	0
Standard deviation							0.6	0.6	0.0
Escherichia coli (CFU/100 mL)	26	46	32	38	40	64	0	0	1
	30	40	18	32	54	48	0	0	0
	42	26	24	20	28	64	0	0	0
Average	33	38	25	30	41	59	0	0	1
Standard deviation	8.3	10.3	7.0	9.2	13.0	9.2	0.0	0.0	0.6
Enterococci (CFU/100 mL)	50	72	78	38	56	84	2	3	3
	54	76	70	40	30	34	0	2	4
	94	76	104	28	96	78	0	0	3
Average	66	75	84	36	61	66	1	2	4
Standard deviation	24.3	2.3	17.8	6.4	33.2	27.3	1.2	1.5	0.6
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count
CFU. Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (5th. test cycle : 2013. 07. 15) - Basic water parameters

Test item	Control water			Treated water		
	B	M	E	B	M	E
Water temperature (℃)	26.67	26.66	26.52	26.80	26.69	26.78
	26.51	26.48	26.52	26.62	26.56	26.59
	26.47	26.44	26.53	26.58	26.51	26.55
Average	26.55	26.53	26.52	26.67	26.59	26.64
Standard deviation	0.11	0.12	0.01	0.12	0.09	0.12
pH	7.01	7.08	7.10	7.01	7.09	7.13
	7.06	7.11	7.11	7.05	7.10	7.12
	7.07	7.10	7.14	7.02	7.10	7.13
Average	7.05	7.10	7.12	7.03	7.10	7.13
Standard deviation	0.03	0.02	0.02	0.02	0.01	0.01
ORP (mV)	322	302	308	341	325	320
	304	294	298	335	319	315
	285	287	291	331	315	312
Average	304	294	299	336	320	316
Standard deviation	19	8	9	5	5	4
Salinity (PSU)	20.65	20.67	20.69	20.72	20.81	20.75
	20.62	20.79	20.76	20.81	20.81	20.58
	20.75	20.78	20.74	20.83	20.84	20.79
Average	20.67	20.75	20.73	20.79	20.82	20.71
Standard deviation	0.07	0.07	0.04	0.06	0.02	0.11
DO (mg/L)	6.43	6.52	6.49	6.63	6.65	6.67
	6.36	6.55	6.49	6.61	6.62	6.68
	6.33	6.54	6.49	6.53	6.66	6.68
Average	6.37	6.54	6.49	6.59	6.64	6.68
Standard deviation	0.05	0.02	0.00	0.05	0.02	0.01
Turbidity (NTU)	17.4	16.7	17.2	15.8	16.3	16.3
	17.0	17.0	16.2	15.5	15.1	17.2
	17.8	16.5	16.6	15.7	16.6	15.4
Average	17.4	16.7	16.7	15.7	16.0	16.3
Standard deviation	0.40	0.25	0.50	0.15	0.79	0.90
TSS (mg/L)	55.6	66.0	63.0	58.4	60.0	57.6
	42.5	57.0	65.0	54.8	68.0	60.0
	66.0	56.0	57.0	67.6	64.0	65.2
Average	54.7	59.7	61.7	60.3	64.0	60.9
Standard deviation	11.8	5.51	4.16	6.60	4.00	3.89
DOC (mg/L)	2.71	2.58	2.68	1.82	1.89	1.95
POC (mg/L)	5.06	5.13	5.37	5.90	5.82	6.71

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (5th. test cycle : 2013. 07. 15) - Viable organisms (Plankton)

Test item	Control water			Treated water		
	B	M	E	B	M	E
≥ 50 μm (inds/m³)	500	500	500	1*	0*	1*
	500	1 000	500			
	1 000	500	500			
Average	667	667	500			
Standard deviation	288.7	288.7	0.0			
≥ 10 μm and < 50 μm (inds/mL)	375	308	312	0.5	2.0	8.8
	259	361	361	1.5	3.1	5.6
	215	357	342	1.4	2.6	8.1
Average	283	342	339	1.2	2.6	7.5
Standard deviation	82.7	29.5	24.7	0.6	0.6	1.7

* Analysed entire sample volume.

- de-Ballasting (5th. test cycle : 2013. 07. 15) - Viable organisms (Bacteria)

Test item	Control water			Treated water		
	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	71 600	91 600	77 200	TNTC*	TNTC*	TNTC*
	78 400	83 200	75 200	TNTC*	TNTC*	TNTC*
	85 600	78 400	79 600	TNTC*	TNTC*	TNTC*
Average	78 534	84 400	77 334			
Standard deviation	7 001.0	6 681.3	2 203.0			
Coliform (CFU/100 mL)	TNTC*	TNTC*	TNTC*	0	0	0
	TNTC*	TNTC*	TNTC*	0	0	0
	TNTC*	TNTC*	TNTC*	0	0	0
Average				0	0	0
Standard deviation				0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	TNTC*	TNTC*	TNTC*	9	4	4
	TNTC*	TNTC*	TNTC*	6	8	6
	TNTC*	TNTC*	TNTC*	8	10	10
Average				8	8	7
Standard deviation				1.5	3.1	3.1
Enterococci (CFU/100 mL)	120	216	424	294	295	308
	52	314	424	309	228	259
	46	362	440	312	219	360
Average	73	298	430	305	248	309
Standard deviation	41.1	74.4	9.2	9.6	41.5	50.5
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count
CFU, Colony Forming Unit.

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (6th. test cycle : 2013. 07. 17) - Basic water parameters

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Water temperature (℃)	25.37	25.33	25.35	25.37	25.09	25.33	25.55	25.46	25.47
	25.25	25.12	25.49	25.30	25.08	25.22	25.22	25.23	25.45
	25.23	25.18	25.37	25.37	25.10	25.23	25.18	25.36	25.53
Average	25.28	25.21	25.40	25.35	25.09	25.26	25.32	25.35	25.48
Standard deviation	0.08	0.11	0.08	0.04	0.01	0.06	0.20	0.12	0.04
pH	7.96	7.94	7.96	8.01	7.95	7.96	7.87	8.05	8.07
	7.99	7.94	7.96	8.02	7.95	7.97	7.87	8.06	8.07
	8.00	7.95	7.97	8.02	7.95	7.96	7.86	8.07	8.07
Average	7.98	7.94	7.96	8.02	7.95	7.96	7.87	8.06	8.07
Standard deviation	0.02	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.00
ORP (mV)	347	265	261	316	270	267	705	637	673
	332	267	261	305	271	269	658	685	713
	326	269	263	297	272	270	694	728	734
Average	335	267	262	306	271	269	686	683	707
Standard deviation	11	2	1	10	1	2	25	46	31
Salinity (PSU)	33.89	33.55	33.61	33.63	33.57	33.46	33.38	33.52	33.55
	33.80	33.63	33.41	33.70	33.52	33.48	33.54	33.65	33.57
	33.80	33.59	33.51	33.68	33.55	33.47	33.57	33.58	33.53
Average	33.83	33.59	33.51	33.67	33.55	33.47	33.50	33.58	33.55
Standard deviation	0.05	0.04	0.10	0.04	0.03	0.01	0.10	0.07	0.02
DO (mg/L)	6.76	6.70	6.67	6.72	6.72	6.70	7.65	8.22	8.77
	6.77	6.79	6.71	6.73	6.74	6.73	7.75	8.13	8.84
	6.75	6.77	6.71	6.72	6.74	6.74	7.86	8.12	8.85
Average	6.76	6.75	6.70	6.72	6.73	6.72	7.75	8.16	8.82
Standard deviation	0.01	0.05	0.02	0.01	0.01	0.02	0.11	0.06	0.04
Turbidity (NTU)	3.96	4.78	4.15	4.42	4.98	4.75	3.53	4.74	3.82
	4.08	4.41	4.21	4.76	4.48	4.82	3.78	4.10	4.46
	4.13	4.13	3.78	4.94	4.64	4.43	3.13	4.29	3.76
Average	4.06	4.44	4.05	4.71	4.70	4.67	3.48	4.38	4.01
Standard deviation	0.09	0.33	0.23	0.26	0.26	0.21	0.33	0.33	0.39
TSS (mg/L)	24.4	20.4	24.4	26.0	25.2	27.6	19.6	24.0	23.2
	25.6	26.4	27.6	24.0	26.0	22.8	22.8	23.2	19.6
	16.8	28.8	26.4	23.6	25.6	25.6	22.0	20.8	24.8
Average	22.3	25.2	26.1	24.5	25.6	25.3	21.5	22.7	22.5
Standard deviation	4.77	4.33	1.62	1.29	0.40	2.41	1.67	1.67	2.66
DOC (mg/L)	2.97	3.04	2.99	3.07	2.97	2.94	2.94	2.94	3.01
POC (mg/L)	2.08	1.75	1.57	2.31	2.31	1.81	1.71	1.89	2.35

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (6th. test cycle : 2013. 07. 17) - Viable organisms (Plankton)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
≥ 50 μm (inds./m³)	163 000	154 500	130 500	119 000	159 000	152 500	690	1 110	840
	164 500	142 500	128 500	127 500	157 000	144 500	390	750	840
	179 500	139 500	152 000	123 500	161 000	131 500	300	870	930
Average	169 000	145 500	137 000	123 334	159 000	142 834	460	910	870
Standard deviation	9 124.1	7 937.3	13 028.8	4 252.5	2 000.0	10 598.7	204.2	183.3	52.0
≥ 10 μm and < 50 μm (inds./mL)	2 092	1 952	1 855	1 753	1 673	2 003	0.0	0.0	0.0
	2 210	1 907	1 878	1 892	1 529	1 919	0.1	0.1	0.2
	2 009	1 779	1 825	1 978	1 614	1 936	0.0	0.0	0.1
Average	2 104	1 880	1 853	1 875	1 606	1 953	0.1	0.1	0.1
Standard deviation	101.0	89.8	26.6	113.5	72.4	44.4	0.1	0.1	0.1

- Ballasting (6th. test cycle : 2013. 07. 17) - Viable organisms (Bacteria)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	14 300	11 800	12 900	14 500	14 400	14 300	0	0	0
	15 500	11 600	13 700	14 200	14 000	15 600	0	0	0
	14 200	12 500	13 400	14 600	14 000	15 000	0	0	0
Average	14 667	11 967	13 334	14 434	14 134	14 967	0	0	0
Standard deviation	723.4	472.6	404.1	208.2	230.9	650.6	0.0	0.0	0.0
Coliform (CFU/100 mL)	0	2	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	1	0	0	0	0	0	0	0
Standard deviation	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	0	64	2	2	0	8	0	0	0
	0	46	0	0	0	4	0	0	0
	0	64	0	0	0	6	0	0	0
Average	0	58	1	1	0	6	0	0	0
Standard deviation	0.0	10.4	1.2	1.2	0.0	2.0	0.0	0.0	0.0
Enterococci (CFU/100 mL)	4	4	0	20	36	62	0	0	0
	2	4	2	14	38	38	0	0	0
	0	10	14	2	24	16	0	0	0
Average	2	6	6	12	33	39	0	0	0
Standard deviation	2.0	3.5	7.6	9.2	7.6	23.0	0.0	0.0	0.0
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (6th. test cycle : 2013. 07. 22) - Basic water parameters

Test item	Control water			Treated water		
	B	M	E	B	M	E
Water temperature (℃)	26.77	26.97	27.00	26.46	26.54	26.66
	26.71	26.87	26.98	26.44	26.51	26.52
	26.81	26.87	27.00	26.41	26.49	26.52
Average	26.76	26.90	26.99	26.44	26.51	26.57
Standard deviation	0.05	0.06	0.01	0.03	0.03	0.08
pH	7.50	7.50	7.50	7.65	7.66	7.61
	7.50	7.52	7.51	7.66	7.67	7.68
	7.51	7.52	7.52	7.67	7.66	7.68
Average	7.50	7.51	7.51	7.66	7.66	7.66
Standard deviation	0.01	0.01	0.01	0.01	0.01	0.04
ORP (mV)	350	350	350	356	356	373
	342	339	336	351	345	351
	339	335	332	348	341	340
Average	344	341	339	352	347	355
Standard deviation	6	8	9	4	8	17
Salinity (PSU)	33.47	33.27	33.46	33.56	33.56	33.51
	33.48	33.40	33.40	33.63	33.57	33.62
	33.52	33.39	33.41	33.60	33.60	33.61
Average	33.49	33.35	33.42	33.60	33.58	33.58
Standard deviation	0.03	0.07	0.03	0.04	0.02	0.06
DO (mg/L)	6.12	6.13	6.27	6.97	6.92	6.82
	6.12	6.11	6.21	6.91	6.93	6.79
	6.13	6.13	6.15	6.91	6.93	6.80
Average	6.12	6.12	6.21	6.93	6.93	6.80
Standard deviation	0.01	0.01	0.06	0.03	0.01	0.02
Turbidity (NTU)	4.36	4.37	4.19	4.01	3.54	4.06
	4.50	4.65	4.29	4.24	3.92	3.94
	4.38	4.46	4.45	3.80	3.89	3.76
Average	4.41	4.49	4.31	4.02	3.78	3.92
Standard deviation	0.08	0.14	0.13	0.22	0.21	0.15
TSS (mg/L)	21.2	28.8	20.4	28.8	23.2	25.6
	25.6	26.0	19.6	25.2	29.6	26.0
	23.2	26.8	19.2	26.0	26.4	24.4
Average	23.3	27.2	19.7	26.7	26.4	25.3
Standard deviation	2.20	1.44	0.61	1.89	3.20	0.83
DOC (mg/L)	2.14	2.21	2.10	1.85	1.78	1.76
POC (mg/L)	1.15	1.17	0.85	1.71	1.46	1.76

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (6th. test cycle : 2013. 07. 22) - Viable organisms (Plankton)

Test item	Control water			Treated water		
	B	M	E	B	M	E
≥ 50 μm (inds./m³)	1 000	500	500	0*	0*	0*
	1 500	500	1 000			
	500	0	500			
Average	1 000	334	667			
Standard deviation	500.0	288.7	288.7			
≥ 10 μm and < 50 μm (inds./mL)	193	171	196	0.0	0.0	0.1
	107	126	249	0.0	0.0	0.1
	98	156	168	0.0	0.0	0.0
Average	133	151	205	0.0	0.0	0.1
Standard deviation	52.4	22.9	41.1	0.0	0.0	0.1

* Analysed entire sample volume

- de-Ballasting (6th. test cycle : 2013. 07. 22) - Viable organisms (Bacteria)

Test item	Control water			Treated water		
	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	23 900	45 300	25 100	4 360	4 620	5 260
	30 700	34 000	20 000	4 340	3 940	4 550
	24 000	39 600	21 600	4 990	3 560	4 690
Average	26 200	39 634	22 234	4 564	4 040	4 834
Standard deviation	3 897.4	5 650.1	2 608.3	369.6	537.0	376.1
Coliform (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	TNTC*	TNTC*	TNTC*	0	0	0
	TNTC*	TNTC*	TNTC*	0	0	0
	TNTC*	TNTC*	TNTC*	0	0	0
Average				0	0	0
Standard deviation				0.0	0.0	0.0
Enterococci (CFU/100 mL)	TNTC*	TNTC*	TNTC*	76	86	82
	TNTC*	TNTC*	TNTC*	58	87	57
	TNTC*	TNTC*	TNTC*	68	52	63
Average				68	75	68
Standard deviation				9.0	19.9	13.1
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count

CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (7th. test cycle : 2013. 07. 24) - Basic water parameters

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Water temperature (℃)	25.18	25.24	25.12	25.10	25.43	25.29	25.37	25.13	25.30
	25.03	25.23	25.07	25.20	25.36	25.24	25.26	25.08	25.31
	25.07	25.28	25.18	25.07	25.41	25.24	25.29	25.15	25.36
Average	25.09	25.25	25.12	25.12	25.40	25.26	25.31	25.12	25.32
Standard deviation	0.08	0.03	0.06	0.07	0.04	0.03	0.06	0.04	0.03
pH	7.96	7.99	7.99	7.97	7.99	8.00	8.06	8.09	8.10
	7.97	7.97	8.00	7.97	7.99	8.00	8.06	8.09	8.11
	7.97	7.98	7.99	7.98	7.99	8.00	8.07	8.08	8.10
Average	7.97	7.98	7.99	7.97	7.99	8.00	8.06	8.09	8.10
Standard deviation	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01
ORP (mV)	264	261	259	263	262	261	720	747	758
	263	261	260	263	263	261	728	745	759
	263	261	260	263	263	262	734	744	758
Average	263	261	260	263	263	261	727	745	758
Standard deviation	1	0	1	0	1	1	7	2	1
Salinity (PSU)	33.58	33.52	33.67	33.60	33.43	33.49	33.76	33.87	33.86
	33.71	33.56	33.69	33.61	33.52	33.59	33.81	33.89	33.85
	33.70	33.14	33.50	33.67	33.58	33.56	33.82	33.87	33.84
Average	33.66	33.41	33.62	33.63	33.51	33.55	33.80	33.88	33.85
Standard deviation	0.07	0.23	0.10	0.04	0.08	0.05	0.03	0.01	0.01
DO (mg/L)	6.79	6.80	6.78	6.81	6.82	6.82	7.77	7.85	7.98
	6.81	6.79	6.82	6.80	6.83	6.86	7.80	7.79	7.98
	6.80	6.82	6.82	6.81	6.83	6.82	7.77	7.94	8.10
Average	6.80	6.80	6.81	6.81	6.83	6.83	7.78	7.86	8.02
Standard deviation	0.01	0.02	0.02	0.01	0.01	0.02	0.02	0.08	0.07
Turbidity (NTU)	4.28	5.31	5.66	4.54	5.16	4.93	4.03	3.46	3.70
	4.39	4.63	4.56	4.71	4.89	5.18	4.35	3.92	3.46
	4.86	4.60	5.28	4.31	4.53	5.24	3.92	3.64	3.68
Average	4.51	4.85	5.17	4.52	4.86	5.12	4.10	3.67	3.61
Standard deviation	0.31	0.40	0.56	0.20	0.32	0.16	0.22	0.23	0.13
TSS (mg/L)	24.0	26.8	23.2	23.2	27.6	29.2	26.0	22.8	23.6
	26.0	27.6	24.4	24.4	31.2	31.2	17.6	24.8	22.8
	24.8	25.6	22.8	24.4	32.0	28.0	19.6	24.0	35.8
Average	24.9	26.7	23.5	24.0	30.3	29.5	21.1	23.9	27.4
Standard deviation	1.01	1.01	0.83	0.69	2.34	1.62	4.39	1.01	7.29
DOC (mg/L)	3.15	3.01	2.92	2.98	3.06	3.01	3.14	3.09	3.02
POC (mg/L)	1.26	1.77	1.01	1.74	2.00	2.19	2.06	1.59	1.72

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (7th. test cycle : 2013. 07. 24) - Viable organisms (Plankton)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
≥ 50 μm (inds/m³)	149 000	140 500	161 500	96 500	111 500	91 000	4 120	3 520	5 320
	124 500	119 000	138 500	96 500	103 000	98 500	2 960	5 120	4 880
	121 000	158 000	135 000	103 000	113 000	104 500	2 640	6 200	4 000
Average	131 500	139 167	145 000	98 667	109 167	98 000	3 240	4 947	4 734
Standard deviation	15 256.1	19 534.2	14 396.2	3 752.8	5 392.9	6 763.9	778.7	1 348.4	672.1
≥ 10 μm and < 50 μm (inds/mL)	1 421	2 540	1 930	1 858	2 297	1 877	0.0	0.0	0.0
	1 764	2 236	1 817	1 798	2 031	1 758	0.0	0.0	0.0
	1 382	2 470	1 838	1 696	2 272	1 685	0.0	0.0	0.0
Average	1 523	2 416	1 862	1 784	2 200	1 774	0.0	0.0	0.0
Standard deviation	210.2	159.2	60.1	81.9	146.9	96.9	0.0	0.0	0.0

- Ballasting (7th. test cycle : 2013. 07. 24) - Viable organisms (Bacteria)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	50	10
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	0	0
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	0	0
Average							0	17	4
Standard deviation							0.0	28.9	5.8
Coliform (CFU/100 mL)	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	0	0
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	0	0
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	0	0
Average							0	0	0
Standard deviation							0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	4	8	2	8	4	4	0	0	0
	4	6	8	8	4	4	0	0	0
	6	6	6	6	4	6	0	0	0
Average	5	7	6	8	4	5	0	0	0
Standard deviation	1.2	1.2	3.1	1.2	0.0	1.2	0.0	0.0	0.0
Enterococci (CFU/100 mL)	0	0	4	2	12	12	0	0	1
	4	0	0	2	10	12	0	0	0
	10	0	8	6	20	16	0	0	0
Average	5	0	4	4	14	14	0	0	1
Standard deviation	5.0	0.0	4.0	2.3	5.3	2.3	0.0	0.0	0.6
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count
CFU. Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (7th. test cycle : 2013. 07. 29) - Basic water parameters

Test item	Control water			Treated water		
	B	M	E	B	M	E
Water temperature (℃)	26.86	26.75	26.83	26.41	26.35	26.48
	27.22	26.63	26.83	26.26	26.30	26.37
	26.64	26.65	26.74	26.23	26.29	26.32
Average	26.91	26.68	26.80	26.30	26.31	26.39
Standard deviation	0.29	0.06	0.05	0.10	0.03	0.08
pH	7.57	7.58	7.58	7.68	7.69	7.70
	7.60	7.57	7.59	7.68	7.70	7.71
	7.58	7.58	7.58	7.69	7.70	7.70
Average	7.58	7.58	7.58	7.68	7.70	7.70
Standard deviation	0.02	0.01	0.01	0.01	0.01	0.01
ORP (mV)	272	268	273	288	282	275
	268	267	270	286	279	274
	268	266	269	285	278	273
Average	269	267	271	286	280	274
Standard deviation	2	1	2	2	2	1
Salinity (PSU)	33.25	33.70	33.59	33.68	33.80	33.52
	33.20	33.72	33.68	33.83	33.79	33.76
	33.60	33.79	33.71	33.87	33.86	33.78
Average	33.35	33.74	33.66	33.79	33.82	33.69
Standard deviation	0.22	0.05	0.06	0.10	0.04	0.14
DO (mg/L)	5.95	5.96	5.89	6.64	6.60	6.60
	5.94	5.99	5.89	6.66	6.63	6.64
	5.96	5.99	5.90	6.66	6.63	6.63
Average	5.95	5.98	5.89	6.65	6.62	6.62
Standard deviation	0.01	0.02	0.01	0.01	0.02	0.02
Turbidity (NTU)	4.95	4.52	4.97	3.75	3.47	3.52
	4.44	4.21	5.06	3.42	3.86	3.72
	4.65	4.62	4.97	3.31	3.75	3.79
Average	4.68	4.45	5.00	3.49	3.69	3.68
Standard deviation	0.26	0.21	0.05	0.23	0.20	0.14
TSS (mg/L)	23.6	22.8	30.8	21.6	26.0	26.4
	24.8	24.0	23.2	22.8	23.2	24.8
	25.2	24.4	30.8	26.0	23.2	23.6
Average	24.5	23.7	28.3	23.5	24.1	24.9
Standard deviation	0.83	0.83	4.39	2.27	1.62	1.40
DOC (mg/L)	1.99	1.95	1.94	2.18	1.95	1.93
POC (mg/L)	0.62	0.92	1.48	0.84	0.94	1.16

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (7th. test cycle : 2013. 07. 29) - Viable organisms (Plankton)

Test item	Control water			Treated water		
	B	M	E	B	M	E
≥ 50 μm (inds/m^3)	500	500	500	0*	0*	0*
	500	500	500			
	500	1 000	500			
Average	500	667	500			
Standard deviation	0.0	288.7	0.0			
≥ 10 μm and < 50 μm (inds/mL)	256	207	183	0.0	0.0	0.0
	238	109	152	0.0	0.0	0.0
	204	110	114	0.0	0.0	0.0
Average	233	142	150	0.0	0.0	0.0
Standard deviation	26.4	56.3	34.6	0.0	0.0	0.0

* Analysed entire sample volume

- de-Ballasting (7th. test cycle : 2013. 07. 29) - Viable organisms (Bacteria)

Test item	Control water			Treated water		
	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	TNTC*	TNTC*	TNTC*	2 760	3 180	3 170
	TNTC*	TNTC*	TNTC*	2 740	2 980	2 910
	TNTC*	TNTC*	TNTC*	2 710	2 700	2 760
Average				2 737	2 954	2 947
Standard deviation				25.2	241.1	207.4
Coliform (CFU/100 mL)	0	8	0	0	0	0
	0	6	0	0	0	0
	0	16	0	0	0	0
Average	0	10	0	0	0	0
Standard deviation	0.0	5.3	0.0	0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	0	0	4	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	2	0	0	0
Standard deviation	0.0	0.0	2.3	0.0	0.0	0.0
Enterococci (CFU/100 mL)	TNTC*	TNTC*	TNTC*	74	61	86
	TNTC*	TNTC*	TNTC*	38	86	111
	TNTC*	TNTC*	TNTC*	29	82	111
Average				47	77	103
Standard deviation				23.8	13.4	14.4
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count

CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (8th. test cycle : 2013. 08. 07) - Basic water parameters

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Water temperature (℃)	26.89	26.97	27.53	27.32	27.49	27.39	27.24	27.04	27.35
	26.91	26.98	27.71	27.05	27.30	27.54	26.98	26.84	27.46
	27.08	26.99	28.20	27.16	27.15	27.73	27.07	26.98	27.34
Average	26.96	26.98	27.81	27.18	27.31	27.55	27.10	26.95	27.38
Standard deviation	0.10	0.01	0.35	0.14	0.17	0.17	0.13	0.10	0.07
pH	7.92	7.93	7.94	7.93	7.95	7.95	8.02	8.06	8.08
	7.92	7.93	7.93	7.94	7.94	7.95	8.02	8.06	8.07
	7.92	7.93	7.93	7.94	7.94	7.95	8.03	8.05	8.07
Average	7.92	7.93	7.93	7.94	7.94	7.95	8.02	8.06	8.07
Standard deviation	0.00	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.01
ORP (mV)	230	236	227	221	226	238	631	755	763
	228	238	230	221	226	241	719	760	762
	233	240	233	224	231	244	733	759	761
Average	230	238	230	222	228	241	694	758	762
Standard deviation	3	2	3	2	3	3	55	3	1
Salinity (PSU)	34.11	34.15	34.03	33.78	33.67	34.03	34.25	34.37	34.13
	34.06	34.15	34.04	33.98	33.28	33.90	34.27	34.36	34.07
	34.07	34.17	33.92	33.87	33.58	33.74	34.32	34.36	34.18
Average	34.08	34.16	34.00	33.88	33.51	33.89	34.28	34.36	34.13
Standard deviation	0.03	0.01	0.07	0.10	0.20	0.15	0.04	0.01	0.06
DO (mg/L)	6.61	6.60	6.49	6.50	6.51	6.57	7.54	7.81	8.81
	6.59	6.59	6.52	7.01	6.58	6.57	7.44	7.83	8.87
	6.58	6.59	6.47	7.86	6.59	6.56	7.48	7.83	8.79
Average	6.59	6.59	6.49	7.12	6.56	6.57	7.49	7.82	8.82
Standard deviation	0.02	0.01	0.03	0.69	0.04	0.01	0.05	0.01	0.04
Turbidity (NTU)	3.67	3.45	3.50	4.00	4.76	4.17	3.34	2.79	4.05
	3.88	3.61	3.75	4.14	4.26	4.29	3.21	2.83	4.66
	3.59	4.02	3.75	4.15	3.87	4.02	3.51	2.59	3.63
Average	3.71	3.69	3.67	4.10	4.30	4.16	3.35	2.74	4.11
Standard deviation	0.15	0.29	0.14	0.08	0.45	0.14	0.15	0.13	0.52
TSS (mg/L)	34.0	24.0	13.6	28.0	27.2	24.8	26.8	28.0	26.4
	33.2	24.8	19.2	26.0	26.4	27.2	26.0	28.0	27.6
	28.8	27.6	24.8	27.2	28.0	28.0	28.4	26.8	30.0
Average	32.0	25.5	19.2	27.1	27.2	26.7	27.1	27.6	28.0
Standard deviation	2.80	1.89	5.60	1.01	0.80	1.67	1.22	0.69	1.83
DOC (mg/L)	3.04	3.05	3.08	3.08	2.93	2.89	3.10	2.90	2.97
POC (mg/L)	1.76	1.99	1.32	1.11	1.74	1.62	1.61	1.40	1.75

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

IV. To be continued

- Ballasting (8th. test cycle : 2013. 08. 07) - Viable organisms (Plankton)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
≥ 50 μm (inds/m^3)	222 000	188 000	215 000	315 000	191 500	147 500	5 250	6 350	4 950
	228 000	198 500	198 000	385 000	183 000	165 500	5 550	6 900	6 400
	213 500	199 000	209 500	375 000	188 500	169 500	6 150	7 450	6 300
Average	221 167	195 167	207 500	358 334	187 667	160 834	5 650	6 900	5 884
Standard deviation	7 285.8	6 211.5	8 674.7	37 859.4	4 310.8	11 718.9	458.3	550.0	809.8
≥ 10 μm and < 50 μm (inds/mL)	1 870	1 434	1 412	1 235	1 059	975	0.0	0.0	0.0
	1 872	1 624	1 100	1 052	965	1 040	0.0	0.1	0.1
	1 626	1 260	1 478	1 074	1 103	1 232	0.0	0.0	0.0
Average	1 790	1 440	1 330	1 121	1 043	1 083	0.0	0.1	0.1
Standard deviation	141.5	182.1	201.9	99.9	70.5	133.6	0.0	0.1	0.1

- Ballasting (8th. test cycle : 2013. 08. 07) - Viable organisms (Bacteria)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	15 400	10 600	17 500	7 700	6 900	8 500	20	0	50
	12 800	15 000	16 000	8 600	8 400	5 100	0	0	0
	14 300	15 100	15 100	6 400	6 300	4 400	0	0	0
Average	14 167	13 567	16 200	7 567	7 200	6 000	7	0	17
Standard deviation	1 305.1	2 569.7	1 212.4	1 106.0	1 081.7	2 193.2	11.5	0.0	28.9
Coliform (CFU/100 mL)	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Enterococci (CFU/100 mL)	6	2	2	2	0	2	0	0	1
	2	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	3	1	1	1	0	1	0	0	1
Standard deviation	3.1	1.2	1.2	1.2	0.0	1.2	0.0	0.0	0.6
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count

CFU. Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

IV. To be continued

- de-Ballasting (8th. test cycle : 2013. 08. 12) - Basic water parameters

Test item	Control water			Treated water		
	B	M	E	B	M	E
Water temperature (℃)	28.34	28.63	28.64	28.28	28.37	28.31
	28.37	28.46	28.74	28.24	28.19	28.37
	28.34	28.44	28.66	28.23	28.24	28.29
Average	28.35	28.51	28.68	28.25	28.27	28.32
Standard deviation	0.02	0.10	0.05	0.03	0.09	0.04
pH	7.45	7.46	7.44	7.55	7.56	7.57
	7.45	7.45	7.46	7.55	7.56	7.57
	7.44	7.45	7.46	7.55	7.56	7.57
Average	7.45	7.45	7.45	7.55	7.56	7.57
Standard deviation	0.01	0.01	0.01	0.00	0.00	0.00
ORP (mV)	321	324	326	326	326	319
	316	319	318	323	317	313
	315	317	316	321	316	312
Average	317	320	320	323	320	315
Standard deviation	3	4	5	3	6	4
Salinity (PSU)	34.04	33.93	33.94	34.01	33.90	33.93
	34.08	34.02	33.95	34.07	34.10	33.95
	34.06	34.08	33.98	34.08	34.08	34.03
Average	34.06	34.01	33.96	34.05	34.03	33.97
Standard deviation	0.02	0.08	0.02	0.04	0.11	0.05
DO (mg/L)	6.06	5.96	5.89	6.41	6.40	6.42
	6.01	5.88	5.83	6.41	6.42	6.41
	5.95	5.89	5.80	6.41	6.41	6.40
Average	6.01	5.91	5.84	6.41	6.41	6.41
Standard deviation	0.06	0.04	0.05	0.00	0.01	0.01
Turbidity (NTU)	3.79	3.77	4.43	3.59	3.49	3.18
	3.99	3.52	4.72	3.40	3.19	3.72
	3.79	3.78	4.53	3.67	3.22	3.37
Average	3.86	3.69	4.56	3.55	3.30	3.42
Standard deviation	0.12	0.15	0.15	0.14	0.17	0.27
TSS (mg/L)	20.8	20.4	21.6	27.6	20.8	22.8
	21.2	22.8	27.6	22.4	21.6	24.4
	19.6	21.2	25.2	21.2	23.6	22.8
Average	20.5	21.5	24.8	23.7	22.0	23.3
Standard deviation	0.83	1.22	3.02	3.40	1.44	0.92
DOC (mg/L)	2.10	2.19	2.12	2.08	2.12	2.09
POC (mg/L)	0.51	0.39	0.90	1.23	1.56	1.23

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

IV. To be continued

- de-Ballasting (8th. test cycle : 2013. 08. 12) - Viable organisms (Plankton)

Test item	Control water			Treated water		
	B	M	E	B	M	E
≥ 50 μm (inds/m^3)	2 500	2 500	4 000	0*	0*	0*
	2 500	1 000	3 000			
	1 500	2 500	2 000			
Average	2 167	2 000	3 000			
Standard deviation	577.4	866.0	1 000.0			
≥ 10 μm and < 50 μm (inds/mL)	172	132	165	0.1	0.1	0.2
	108	159	149	0.1	0.1	0.1
	143	202	134	0.0	0.0	0.3
Average	141	165	150	0.1	0.1	0.2
Standard deviation	32.0	35.3	15.5	0.1	0.1	0.1

* Analysed entire sample volume.

- de-Ballasting (8th. test cycle : 2013. 08. 12) - Viable organisms (Bacteria)

Test item	Control water			Treated water		
	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	8 400	6 800	8 400	2 120	2 040	2 640
	6 800	8 000	15 600	2 160	1 920	2 920
	7 600	6 800	9 600	2 440	2 120	3 240
Average	7 600	7 200	11 200	2 240	2 027	2 934
Standard deviation	800.0	692.8	3 857.5	174.4	100.7	300.2
Coliform (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0
Enterococci (CFU/100 mL)	2	4	2	TNTC*	TNTC*	TNTC*
	2	0	2	TNTC*	TNTC*	TNTC*
	0	2	2	TNTC*	TNTC*	TNTC*
Average	2	2	2			
Standard deviation	1.2	2.0	0.0			
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count

CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (9th. test cycle : 2013. 08. 21) - Basic water parameters

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Water temperature (℃)	25.25	25.13	25.31	25.38	25.12	25.05	25.33	25.20	25.65
	25.11	25.04	25.25	25.30	25.45	25.09	25.26	25.25	25.43
	25.06	25.01	25.24	25.39	25.20	25.15	25.14	25.18	25.35
Average	25.14	25.06	25.27	25.36	25.26	25.10	25.24	25.21	25.48
Standard deviation	0.10	0.06	0.04	0.05	0.17	0.05	0.10	0.04	0.16
pH	7.99	7.92	7.93	8.01	7.91	7.92	7.83	8.01	8.01
	7.99	7.92	7.92	8.01	7.91	7.92	7.83	8.01	8.00
	7.99	7.91	7.92	8.02	7.91	7.93	7.83	8.01	8.01
Average	7.99	7.92	7.92	8.01	7.91	7.92	7.83	8.01	8.01
Standard deviation	0.00	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.01
ORP (mV)	242	258	254	241	274	265	687	687	706
	242	262	257	241	279	266	723	715	711
	242	269	261	240	281	268	733	732	734
Average	242	263	257	241	278	266	714	711	717
Standard deviation	0	6	4	1	4	2	24	23	15
Salinity (PSU)	33.98	33.96	33.91	34.01	33.85	33.96	33.76	34.12	33.85
	34.19	33.98	33.93	34.06	33.65	33.95	33.85	34.14	34.04
	34.18	33.97	33.77	34.03	33.86	33.94	33.90	34.15	34.08
Average	34.12	33.97	33.87	34.03	33.79	33.95	33.84	34.14	33.99
Standard deviation	0.12	0.01	0.09	0.03	0.12	0.01	0.07	0.02	0.12
DO (mg/L)	6.68	6.78	6.77	6.74	6.81	6.82	8.80	8.40	8.77
	6.73	6.79	6.79	6.75	6.76	6.82	8.61	8.55	8.76
	6.74	6.82	6.81	6.75	6.83	6.82	8.61	8.54	8.75
Average	6.72	6.80	6.79	6.75	6.80	6.82	8.67	8.50	8.76
Standard deviation	0.03	0.02	0.02	0.01	0.04	0.00	0.11	0.08	0.01
Turbidity (NTU)	4.48	3.55	4.36	4.82	3.66	4.44	4.53	3.37	4.44
	4.99	4.10	3.88	4.22	4.23	3.58	3.55	3.47	4.38
	4.34	3.98	4.27	4.96	3.44	4.14	3.51	3.37	4.09
Average	4.60	3.88	4.17	4.67	3.78	4.05	3.86	3.40	4.30
Standard deviation	0.34	0.29	0.26	0.39	0.41	0.44	0.58	0.06	0.19
TSS (mg/L)	10.8	18.4	14.4	17.6	18.4	15.6	15.2	15.6	16.8
	18.4	15.6	19.6	18.8	19.6	20.4	20.4	13.6	19.6
	20.0	16.8	18.0	20.0	15.2	15.6	16.4	20.4	22.0
Average	16.4	16.9	17.3	18.8	17.7	17.2	17.3	16.5	19.5
Standard deviation	4.92	1.40	2.66	1.20	2.27	2.77	2.72	3.49	2.60
DOC (mg/L)	3.06	2.96	2.93	2.98	2.98	2.98	3.37	3.34	3.06
POC (mg/L)	1.54	2.05	2.35	2.03	2.08	1.93	2.09	2.02	2.46

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (9th. test cycle : 2013. 08. 21) - Viable organisms (Plankton)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
≥ 50 μm (inds/m³)	248 000	228 000	274 000	180 000	206 000	121 000	4 360	5 320	5 680
	235 000	229 000	295 000	187 000	197 000	142 000	3 960	4 560	4 880
	224 000	220 000	291 000	182 000	236 000	148 000	3 680	5 480	4 560
Average	235 667	225 667	286 667	183 000	213 000	137 000	4 000	5 120	5 040
Standard deviation	12 013.9	4 932.9	11 150.5	3 605.6	20 420.6	14 177.4	341.8	491.5	576.9
≥ 10 μm and < 50 μm (inds/mL)	1 360	1 151	1 398	1 567	1 973	752	0.7	2.7	0.2
	1 075	1 117	1 023	1 290	1 770	817	0.4	1.6	0.7
	1 329	1 113	1 270	1 361	1 753	726	0.7	1.1	0.3
Average	1 255	1 127	1 231	1 406	1 832	765	0.6	1.8	0.4
Standard deviation	156.4	20.9	190.6	143.9	122.4	46.9	0.2	0.8	0.3

- Ballasting (9th. test cycle : 2013. 08. 21) - Viable organisms (Bacteria)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	4 000	3 100	4 500	4 300	2 700	2 600	0	0	0
	1 900	3 400	4 800	3 200	3 100	3 300	0	0	0
	3 700	3 000	5 000	4 000	2 400	1 900	0	0	0
Average	3 200	3 167	4 767	3 834	2 734	2 600	0	0	0
Standard deviation	1 135.8	208.2	251.7	568.6	351.2	700.0	0.0	0.0	0.0
Coliform (CFU/100 mL)	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	2	0	0	0	0	2	0	0	0
	2	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	2	0	0	0	0	1	0	0	0
Standard deviation	1.2	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0
Enterococci (CFU/100 mL)	2	2	0	0	2	0	0	0	0
	2	0	0	0	2	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	2	1	0	0	2	0	0	0	0
Standard deviation	1.2	1.2	0.0	0.0	1.2	0.0	0.0	0.0	0.0
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

CFU. Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (9th. test cycle : 2013. 08. 26) - Basic water parameters

Test item	Control water			Treated water		
	B	M	E	B	M	E
Water temperature (℃)	25.94	25.68	25.94	25.87	25.66	25.85
	25.82	25.69	26.63	25.89	25.63	25.78
	25.79	25.64	26.18	25.86	25.62	25.74
Average	25.85	25.67	26.25	25.87	25.64	25.79
Standard deviation	0.08	0.03	0.35	0.02	0.02	0.06
pH	7.48	7.48	7.47	7.56	7.59	7.62
	7.48	7.48	7.48	7.58	7.59	7.62
	7.47	7.47	7.49	7.58	7.59	7.64
Average	7.48	7.48	7.48	7.57	7.59	7.63
Standard deviation	0.01	0.01	0.01	0.01	0.00	0.01
ORP (mV)	306	299	299	322	309	302
	301	296	295	314	305	299
	297	293	292	310	301	296
Average	301	296	295	315	305	299
Standard deviation	5	3	4	6	4	3
Salinity (PSU)	33.64	34.08	34.02	33.65	34.21	33.83
	33.83	34.07	33.76	33.65	34.25	33.97
	33.93	34.13	33.48	33.74	34.24	34.03
Average	33.80	34.09	33.75	33.68	34.23	33.94
Standard deviation	0.15	0.03	0.27	0.05	0.02	0.10
DO (mg/L)	5.96	6.14	5.98	6.75	6.74	6.67
	5.96	6.05	5.96	6.76	6.72	6.68
	5.98	6.10	5.94	6.74	6.71	6.66
Average	5.97	6.10	5.96	6.75	6.72	6.67
Standard deviation	0.01	0.05	0.02	0.01	0.02	0.01
Turbidity (NTU)	4.17	3.85	4.10	4.32	3.95	3.31
	3.96	3.77	4.13	4.26	3.12	3.35
	4.05	4.08	3.93	4.63	3.00	3.62
Average	4.06	3.90	4.05	4.40	3.36	3.43
Standard deviation	0.11	0.16	0.11	0.20	0.52	0.17
TSS (mg/L)	18.8	20.0	22.0	22.8	24.0	21.6
	20.0	21.6	20.8	26.4	22.0	23.2
	18.0	19.6	20.8	24.4	22.4	24.8
Average	18.9	20.4	21.2	24.5	22.8	23.2
Standard deviation	1.01	1.06	0.69	1.80	1.06	1.60
DOC (mg/L)	1.81	1.78	1.74	1.99	2.23	2.06
POC (mg/L)	0.53	0.60	0.85	1.62	1.36	1.42

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (9th. test cycle : 2013. 08. 26) - Viable organisms (Plankton)

Test item	Control water			Treated water		
	B	M	E	B	M	E
≥ 50 μm (inds/m³)	1 000	1 500	1 000	0*	0*	0*
	500	500	1 500			
	1 000	1 000	500			
Average	834	1 000	1 000			
Standard deviation	288.7	500.0	500.0			
≥ 10 μm and < 50 μm (inds/mL)	32	109	66	0.8	0.4	0.9
	29	82	60	0.3	0.4	0.6
	21	70	84	0.0	0.2	0.4
Average	28	87	70	0.4	0.4	0.7
Standard deviation	5.7	20.0	12.5	0.4	0.1	0.3

* Analysed entire sample volume

- de-Ballasting (9th. test cycle : 2013. 08. 26) - Viable organisms (Bacteria)

Test item	Control water			Treated water		
	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*
Average						
Standard deviation						
Coliform (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	0	2	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	1	0	0	0	0
Standard deviation	0.0	1.2	0.0	0.0	0.0	0.0
Enterococci (CFU/100 mL)	34	42	28	0	1	2
	16	72	30	0	1	1
	28	66	34	0	0	0
Average	26	60	31	0	1	1
Standard deviation	9.2	15.9	3.1	0.0	0.6	1.0
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count

CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

IV. To be continued

- Ballasting (10th. test cycle : 2013. 08. 28) - Basic water parameters

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Water temperature (℃)	25.06	25.07	25.10	25.24	25.14	25.20	25.72	25.23	25.37
	25.02	25.08	25.18	25.23	25.32	25.58	25.48	25.11	25.95
	25.04	25.08	25.05	25.28	25.22	25.54	25.25	25.06	25.74
Average	25.04	25.08	25.11	25.25	25.23	25.44	25.48	25.13	25.69
Standard deviation	0.02	0.01	0.07	0.03	0.09	0.21	0.24	0.09	0.29
pH	7.90	7.92	7.94	7.94	7.96	7.96	8.06	8.11	8.13
	7.92	7.93	7.95	7.92	7.96	7.97	8.05	8.11	8.13
	7.92	7.94	7.94	7.92	7.96	7.97	8.07	8.11	8.13
Average	7.91	7.93	7.94	7.93	7.96	7.97	8.06	8.11	8.13
Standard deviation	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.00	0.00
ORP (mV)	329	320	317	324	318	310	734	773	775
	328	320	316	323	317	308	732	773	773
	327	319	316	322	316	307	740	773	772
Average	328	320	316	323	317	308	735	773	773
Standard deviation	1	1	1	1	1	2	4	0	2
Salinity (PSU)	33.65	33.67	33.61	33.56	33.07	33.47	33.86	33.75	33.51
	33.76	33.75	33.74	33.62	33.12	33.61	33.88	33.79	33.23
	33.75	33.76	33.74	33.62	33.32	33.33	33.88	33.86	33.53
Average	33.72	33.73	33.70	33.60	33.17	33.47	33.87	33.80	33.42
Standard deviation	0.06	0.05	0.08	0.03	0.13	0.14	0.01	0.06	0.17
DO (mg/L)	6.85	6.84	6.86	6.85	6.84	6.87	8.85	8.65	9.03
	6.85	6.85	6.87	6.86	6.87	6.85	8.87	8.62	8.96
	6.87	6.86	6.86	6.86	6.88	6.85	8.86	8.56	9.01
Average	6.86	6.85	6.86	6.86	6.86	6.86	8.86	8.61	9.00
Standard deviation	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.05	0.04
Turbidity (NTU)	4.30	4.06	4.07	4.28	4.02	4.06	4.42	4.19	4.42
	3.96	4.66	3.85	4.36	4.08	4.58	4.66	3.99	4.42
	3.76	5.00	4.04	4.19	3.84	4.67	4.78	3.87	3.92
Average	4.01	4.57	3.99	4.28	3.98	4.44	4.62	4.02	4.25
Standard deviation	0.27	0.48	0.12	0.09	0.12	0.33	0.18	0.16	0.29
TSS (mg/L)	20.8	20.8	18.4	16.4	17.6	18.8	19.6	16.4	22.8
	19.6	20.4	16.8	18.4	17.6	18.4	16.4	18.8	21.2
	20.0	20.4	18.8	16.4	19.6	19.2	20.0	19.6	19.2
Average	20.1	20.5	18.0	17.1	18.3	18.8	18.7	18.3	21.1
Standard deviation	0.61	0.23	1.06	1.15	1.15	0.40	1.97	1.67	1.80
DOC (mg/L)	3.27	3.21	3.27	3.29	3.41	3.33	3.33	3.43	3.38
POC (mg/L)	1.17	1.31	1.83	1.60	1.34	1.95	1.67	1.66	2.04

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

IV. To be continued

- Ballasting (10th. test cycle : 2013. 08. 28) - Viable organisms (Plankton)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
≥ 50 μm (inds./m³)	165 000	195 000	180 000	168 000	128 000	148 000	440	480	360
	155 000	189 000	170 000	155 000	102 000	142 000	440	380	560
	173 000	155 000	209 000	133 000	145 000	117 000	500	440	640
Average	164 334	179 667	186 334	152 000	125 000	135 667	460	434	520
Standard deviation	9 018.5	21 571.6	20 256.7	17 691.8	21 656.4	16 441.8	34.6	50.3	144.2
≥ 10 μm and < 50 μm (inds./mL)	1 365	1 386	1 473	2 764	2 730	2 592	0.1	0.1	0.5
	1 025	1 199	1 475	2 267	2 854	2 423	0.0	0.2	0.2
	1 118	1 152	1 098	2 172	2 496	2 193	0.3	0.3	0.1
Average	1 170	1 246	1 349	2 401	2 694	2 403	0.2	0.2	0.3
Standard deviation	175.7	123.8	217.1	317.9	181.8	200.3	0.2	0.1	0.2

- Ballasting (10th. test cycle : 2013. 08. 28) - Viable organisms (Bacteria)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	10 300	11 200	14 400	8 200	9 800	9 100	0	0	0
	10 900	12 700	13 100	8 500	7 100	9 900	0	0	0
	11 500	9 800	13 200	7 300	7 900	8 200	0	0	0
Average	10 900	11 234	13 567	8 000	8 267	9 067	0	0	0
Standard deviation	600.0	1 450.3	723.4	624.5	1 386.8	850.5	0.0	0.0	0.0
Coliform (CFU/100 mL)	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	1	0
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	0	0
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	0	0
Average							0	1	0
Standard deviation							0.0	0.6	0.0
Escherichia coli (CFU/100 mL)	84	92	64	74	72	64	0	0	0
	60	90	72	76	66	56	0	0	0
	94	78	84	76	66	82	0	0	0
Average	80	87	74	76	68	68	0	0	0
Standard deviation	17.5	7.6	10.1	1.2	3.5	13.3	0.0	0.0	0.0
Enterococci (CFU/100 mL)	96	78	110	70	90	98	0	0	0
	100	76	88	82	68	74	0	0	0
	52	70	58	76	76	92	0	0	0
Average	83	75	86	76	78	88	0	0	0
Standard deviation	26.6	4.2	26.1	6.0	11.1	12.5	0.0	0.0	0.0
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count

CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (10th. test cycle : 2013. 09. 02) - Basic water parameters

Test item	Control water			Treated water		
	B	M	E	B	M	E
Water temperature (℃)	25.71	25.68	25.97	25.76	25.47	25.76
	25.65	25.75	25.99	25.75	25.38	25.60
	25.92	25.53	26.05	25.85	25.34	25.62
Average	25.76	25.65	26.00	25.79	25.40	25.66
Standard deviation	0.14	0.11	0.04	0.06	0.07	0.09
pH	7.49	7.50	7.52	7.60	7.60	7.63
	7.51	7.52	7.52	7.62	7.61	7.67
	7.51	7.52	7.53	7.63	7.61	7.71
Average	7.50	7.51	7.52	7.62	7.61	7.67
Standard deviation	0.01	0.01	0.01	0.02	0.01	0.04
ORP (mV)	294	285	280	316	314	285
	284	274	276	299	295	276
	282	271	273	297	291	274
Average	287	277	276	304	300	278
Standard deviation	6	7	4	10	12	6
Salinity (PSU)	33.52	33.39	33.03	33.91	33.74	33.61
	33.57	33.30	33.03	33.52	33.75	33.81
	33.09	33.51	33.05	33.83	33.82	33.77
Average	33.39	33.40	33.04	33.75	33.77	33.73
Standard deviation	0.26	0.11	0.01	0.21	0.04	0.11
DO (mg/L)	5.59	6.01	5.94	6.67	6.66	6.61
	5.81	5.91	5.92	6.65	6.65	6.62
	5.83	5.94	5.97	6.66	6.64	6.64
Average	5.76	5.95	5.94	6.66	6.65	6.62
Standard deviation	0.15	0.05	0.03	0.01	0.01	0.02
Turbidity (NTU)	4.01	4.34	5.12	3.73	2.90	3.26
	4.28	4.48	4.53	4.48	3.19	3.11
	4.72	4.10	4.43	3.87	2.73	3.13
Average	4.34	4.31	4.69	4.03	2.94	3.17
Standard deviation	0.36	0.19	0.37	0.40	0.23	0.08
TSS (mg/L)	24.0	13.8	18.0	15.6	14.0	13.2
	24.0	18.0	18.4	12.4	11.6	16.0
	21.6	18.0	17.6	10.4	16.8	16.4
Average	23.2	18.3	18.0	12.8	14.1	15.2
Standard deviation	1.39	0.46	0.40	2.62	2.60	1.74
DOC (mg/L)	1.85	2.04	1.81	2.03	1.90	2.01
POC (mg/L)	0.59	0.60	1.14	0.76	0.98	0.84

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

IV. To be continued

- de-Ballasting (10th. test cycle : 2013. 09. 02) - Viable organisms (Plankton)

Test item	Control water			Treated water		
	B	M	E	B	M	E
≥ 50 μm (inds/m³)	500	1 000	500	0*	2*	0*
	1 500	500	1 000			
	500	500	1 000			
Average	834	667	834			
Standard deviation	577.4	288.7	288.7			
≥ 10 μm and < 50 μm (inds/mL)	118	135	112	0.4	0.0	0.0
	81	109	102	0.3	0.2	0.0
	100	108	150	0.0	0.0	0.2
Average	100	118	122	0.3	0.1	0.1
Standard deviation	18.5	15.3	25.3	0.2	0.1	0.1

* Analysed entire sample volume

- de-Ballasting (10th. test cycle : 2013. 09. 02) - Viable organisms (Bacteria)

Test item	Control water			Treated water		
	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	11 400	7 600	16 800	TNTC*	TNTC*	TNTC*
	11 400	9 400	13 700	TNTC*	TNTC*	TNTC*
	10 200	15 500	13 500	TNTC*	TNTC*	TNTC*
Average	11 000	10 834	14 667			
Standard deviation	692.8	4 140.5	1 850.2			
Coliform (CFU/100 mL)	TNTC*	TNTC*	TNTC*	0	0	0
	TNTC*	TNTC*	TNTC*	0	0	0
	TNTC*	TNTC*	TNTC*	0	0	0
Average				0	0	0
Standard deviation				0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	2	10	14	0	0	0
	6	8	6	0	0	0
	8	14	6	0	0	0
Average	6	11	9	0	0	0
Standard deviation	3.1	3.1	4.6	0.0	0.0	0.0
Enterococci (CFU/100 mL)	16	4	4	2	4	1
	12	6	8	1	8	1
	4	6	12	2	1	3
Average	11	6	8	2	5	2
Standard deviation	6.1	1.2	4.0	0.6	3.5	1.2
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count

CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (11th. test cycle : 2013. 09. 04) - Basic water parameters

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Water temperature (℃)	24.11	24.20	24.32	24.28	24.12	24.31	24.13	24.22	24.62
	24.33	24.26	24.23	24.30	24.14	24.15	24.33	24.23	24.50
	24.03	24.44	24.18	24.20	24.10	24.16	24.32	24.41	24.79
Average	24.16	24.30	24.24	24.26	24.12	24.21	24.26	24.29	24.64
Standard deviation	0.16	0.12	0.07	0.05	0.02	0.09	0.11	0.11	0.15
pH	7.90	7.91	7.91	7.94	7.93	7.94	7.90	7.87	7.90
	7.93	7.92	7.93	7.94	7.94	7.94	7.94	7.91	7.90
	7.92	7.93	7.93	7.95	7.94	7.94	7.91	7.89	7.90
Average	7.92	7.92	7.92	7.94	7.94	7.94	7.92	7.89	7.90
Standard deviation	0.02	0.01	0.01	0.01	0.01	0.00	0.02	0.02	0.00
ORP (mV)	267	270	265	265	279	273	651	702	784
	265	275	267	265	281	275	690	754	784
	265	277	271	266	282	276	696	746	724
Average	266	274	268	265	281	275	679	734	764
Standard deviation	1	4	3	1	2	2	24	28	35
Salinity (PSU)	32.94	33.04	32.53	32.46	33.09	33.11	32.46	32.98	32.29
	32.53	33.05	32.80	32.56	32.98	33.11	33.08	32.64	32.46
	32.96	33.01	32.83	32.61	33.06	33.11	33.09	32.48	32.02
Average	32.81	33.03	32.72	32.54	33.04	33.11	32.88	32.70	32.26
Standard deviation	0.24	0.02	0.17	0.08	0.06	0.00	0.36	0.26	0.22
DO (mg/L)	6.93	6.83	6.86	6.92	6.92	6.89	8.27	8.41	8.73
	6.89	6.89	6.90	6.93	6.91	6.91	8.74	8.89	8.78
	6.93	6.89	6.91	6.92	6.93	6.91	8.55	9.11	8.95
Average	6.92	6.87	6.89	6.92	6.92	6.90	8.52	8.80	8.82
Standard deviation	0.02	0.03	0.03	0.01	0.01	0.01	0.24	0.36	0.12
Turbidity (NTU)	4.63	5.15	4.66	5.59	4.53	4.34	4.26	3.97	4.15
	4.85	4.58	4.65	5.10	4.97	3.92	4.30	4.47	3.76
	4.31	5.01	4.44	5.15	4.26	4.70	4.70	4.94	3.53
Average	4.60	4.91	4.58	5.28	4.59	4.32	4.42	4.46	3.81
Standard deviation	0.27	0.30	0.12	0.27	0.36	0.39	0.24	0.49	0.31
TSS (mg/L)	19.2	25.2	26.8	30.4	24.8	28.8	21.2	25.2	25.6
	23.6	21.6	24.8	26.4	24.8	24.0	27.2	25.2	21.2
	23.6	24.0	23.6	26.4	26.0	24.0	22.0	25.6	21.2
Average	22.1	23.6	25.1	27.7	25.2	25.6	23.5	25.3	22.7
Standard deviation	2.54	1.83	1.62	2.31	0.69	2.77	3.26	0.23	2.54
DOC (mg/L)	3.39	3.51	3.27	3.38	3.77	3.22	3.83	3.86	4.68
POC (mg/L)	1.80	1.93	1.87	1.70	1.43	1.83	1.62	1.97	1.44

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (11th. test cycle : 2013. 09. 04) - Viable organisms (Plankton)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
≥ 50 μm (inds/m³)	225 000	205 000	236 000	172 000	208 000	211 000	12 050	12 850	10 800
	203 000	190 000	236 000	191 000	212 000	179 000	11 600	12 050	11 200
	222 000	209 000	248 000	183 000	230 000	240 000	11 700	10 550	10 050
Average	216 667	201 334	240 000	182 000	216 667	210 000	11 784	11 817	10 684
Standard deviation	11 930.4	10 016.7	6 928.2	9 539.4	11 718.9	30 512.3	236.3	1 167.6	583.8
≥ 10 μm and < 50 μm (inds/mL)	1 541	1 475	1 835	2 470	3 487	3 408	0.0	0.1	0.2
	1 622	2 007	1 593	2 242	3 272	3 144	0.1	0.0	0.0
	1 954	2 196	1 666	2 101	3 268	2 789	0.0	0.1	0.0
Average	1 706	1 893	1 698	2 271	3 343	3 114	0.1	0.1	0.1
Standard deviation	218.8	373.9	124.1	186.2	125.3	310.6	0.1	0.1	0.1

- Ballasting (11th. test cycle : 2013. 09. 04) - Viable organisms (Bacteria)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	11 200	12 000	10 100	8 000	9 900	10 000	150	20	0
	11 100	11 600	10 000	9 000	9 900	8 200	40	0	0
	12 800	11 300	10 400	7 800	8 800	8 400	10	0	0
Average	11 700	11 634	10 167	8 267	9 534	8 867	67	7	0
Standard deviation	953.9	351.2	208.2	642.9	635.1	986.6	73.7	11.5	0.0
Coliform (CFU/100 mL)	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	1	1	0
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	0	0
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	0	0
Average							1	1	0
Standard deviation							0.6	0.6	0.0
Escherichia coli (CFU/100 mL)	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	0	0
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	0	0
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	0	0
Average							0	0	0
Standard deviation							0.0	0.0	0.0
Enterococci (CFU/100 mL)	46	28	22	22	28	30	0	0	0
	48	36	20	22	42	50	0	0	0
	26	42	24	16	44	36	0	0	0
Average	40	36	22	20	38	39	0	0	0
Standard deviation	12.2	7.0	2.0	3.5	8.7	10.3	0.0	0.0	0.0
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count
CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (11th. test cycle : 2013. 09. 09) - Basic water parameters

Test item	Control water			Treated water		
	B	M	E	B	M	E
Water temperature (℃)	23.86	23.83	24.19	23.84	24.05	24.22
	23.87	23.86	24.09	23.95	23.92	24.43
	23.87	23.93	24.13	23.86	23.95	24.08
Average	23.87	23.87	24.14	23.88	23.97	24.24
Standard deviation	0.01	0.05	0.05	0.06	0.07	0.18
pH	7.40	7.40	7.40	7.46	7.46	7.48
	7.35	7.41	7.41	7.48	7.47	7.49
	7.46	7.40	7.49	7.47	7.44	7.48
Average	7.40	7.40	7.43	7.47	7.46	7.48
Standard deviation	0.06	0.01	0.05	0.01	0.02	0.01
ORP (mV)	341	332	322	357	356	352
	338	330	320	353	353	347
	335	327	318	352	349	345
Average	338	330	320	354	353	348
Standard deviation	3	3	2	3	4	4
Salinity (PSU)	33.02	33.02	32.85	32.96	32.85	32.84
	33.10	33.07	33.01	32.94	32.93	32.88
	33.03	33.06	32.94	33.01	32.99	33.07
Average	33.05	33.05	32.93	32.97	32.92	32.93
Standard deviation	0.04	0.03	0.08	0.04	0.07	0.12
DO (mg/L)	6.16	6.16	6.22	6.74	6.72	6.73
	6.18	6.12	6.20	6.75	6.78	6.71
	6.22	6.10	6.27	6.73	6.75	6.77
Average	6.19	6.13	6.23	6.74	6.75	6.74
Standard deviation	0.03	0.03	0.04	0.01	0.03	0.03
Turbidity (NTU)	3.75	4.05	4.59	3.26	3.00	3.27
	3.42	4.07	4.01	3.26	3.07	3.18
	3.45	4.56	4.82	3.25	2.84	3.06
Average	3.54	4.23	4.47	3.26	2.97	3.17
Standard deviation	0.18	0.29	0.42	0.01	0.12	0.11
TSS (mg/L)	14.8	12.4	22.8	8.0	9.6	11.6
	11.6	15.2	22.0	15.2	11.6	13.2
	18.8	13.2	18.0	10.0	13.6	13.6
Average	15.1	13.6	20.9	11.1	11.6	12.8
Standard deviation	3.61	1.44	2.57	3.72	2.00	1.06
DOC (mg/L)	1.69	1.68	1.67	1.81	1.90	1.90
POC (mg/L)	0.61	1.25	1.23	1.35	1.09	1.28

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (11th. test cycle : 2013. 09. 09) - Viable organisms (Plankton)

Test item	Control water			Treated water		
	B	M	E	B	M	E
≥ 50 μm (inds/m³)	500	500	500	0*	0	0
	1 500	1 500	2 000			
	500	500	2 500			
Average	834	834	1 667			
Standard deviation	577.4	577.4	1 040.8			
≥ 10 μm and < 50 μm (inds/mL)	128	64	103	0.1	0.2	0.2
	112	37	94	0.2	0.3	0.1
	73	69	73	0.0	0.1	0.0
Average	105	57	90	0.1	0.2	0.1
Standard deviation	28.3	17.2	15.4	0.1	0.1	0.1

* Analysed entire sample volume.

- de-Ballasting (11th. test cycle : 2013. 09. 09) - Viable organisms (Bacteria)

Test item	Control water			Treated water		
	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	12 300	23 300	20 200	TNTC*	TNTC*	TNTC*
	12 000	25 800	17 900	TNTC*	TNTC*	TNTC*
	17 400	27 100	18 300	TNTC*	TNTC*	TNTC*
Average	13 900	25 400	18 800			
Standard deviation	3 034.8	1 931.3	1 228.8			
Coliform (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	176	148	28	3	3	10
	182	156	32	2	2	7
	176	162	42	1	1	8
Average	178	156	34	3	3	9
Standard deviation	3.5	7.0	7.2	1.0	1.0	1.5
Enterococci (CFU/100 mL)	8	16	8	3	2	2
	2	14	8	3	3	1
	2	14	2	1	1	1
Average	4	15	6	3	2	2
Standard deviation	3.5	1.2	3.5	1.2	1.0	0.6
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count
CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (12th. test cycle : 2013. 09. 11) - Basic water parameters

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Water temperature (℃)	24.84	23.50	24.85	24.71	24.75	24.91	24.90	24.76	25.02
	24.80	24.58	25.00	24.68	24.84	25.06	24.86	24.95	25.45
	24.73	24.61	24.86	24.60	24.86	25.42	24.94	24.99	25.43
Average	24.79	24.23	24.90	24.66	24.82	25.13	24.90	24.90	25.30
Standard deviation	0.06	0.63	0.08	0.06	0.06	0.26	0.04	0.12	0.24
pH	7.98	7.89	7.97	8.01	7.99	7.99	7.99	8.00	7.99
	7.99	7.97	7.98	8.01	8.00	7.99	7.99	7.98	7.98
	7.99	7.98	7.98	8.00	8.00	7.99	7.99	7.98	7.98
Average	7.99	7.95	7.98	8.01	8.00	7.99	7.99	7.99	7.98
Standard deviation	0.01	0.05	0.01	0.01	0.01	0.00	0.00	0.01	0.01
ORP (mV)	174	391	338	155	362	326	659	698	696
	165	382	339	152	351	313	692	707	700
	158	374	335	150	344	307	704	711	708
Average	166	382	337	152	352	315	685	705	701
Standard deviation	8	9	2	3	9	10	23	7	6
Salinity (PSU)	33.32	33.78	33.40	33.46	33.51	33.52	33.48	33.64	33.55
	33.42	33.49	33.54	33.47	33.51	33.55	33.47	33.50	33.56
	33.44	33.48	33.52	33.55	33.55	33.57	33.48	33.49	33.54
Average	33.39	33.58	33.49	33.49	33.52	33.55	33.48	33.54	33.55
Standard deviation	0.06	0.17	0.08	0.05	0.02	0.03	0.01	0.08	0.01
DO (mg/L)	7.22	7.41	7.21	7.25	7.24	7.26	8.73	9.29	9.27
	7.24	7.25	7.23	7.24	7.24	7.27	8.62	9.27	9.28
	7.22	7.24	7.23	7.30	7.25	7.28	8.39	9.43	9.28
Average	7.23	7.30	7.22	7.26	7.24	7.27	8.58	9.33	9.28
Standard deviation	0.01	0.10	0.01	0.03	0.01	0.01	0.17	0.09	0.01
Turbidity (NTU)	4.70	4.89	4.93	4.32	4.12	4.47	3.93	3.63	3.31
	4.36	4.30	4.47	4.25	4.70	4.67	3.24	3.46	3.60
	4.94	4.25	4.33	4.34	4.29	4.61	3.48	3.97	3.56
Average	4.67	4.48	4.58	4.30	4.37	4.58	3.55	3.69	3.49
Standard deviation	0.29	0.36	0.31	0.05	0.30	0.10	0.35	0.26	0.16
TSS (mg/L)	28.8	31.2	21.6	26.4	28.0	30.8	32.8	28.4	44.0
	30.8	29.6	28.4	26.4	30.8	33.6	38.4	29.6	35.2
	43.6	34.0	28.0	24.4	30.8	33.2	32.8	34.4	34.4
Average	34.4	31.6	26.0	25.7	29.9	32.5	34.7	30.8	37.9
Standard deviation	8.03	2.23	3.82	1.15	1.62	1.51	3.23	3.17	5.33
DOC (mg/L)	2.94	3.01	2.98	3.02	3.13	3.06	3.16	3.11	3.13
POC (mg/L)	1.77	1.66	2.39	2.08	2.26	1.83	2.55	2.41	1.88

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (12th. test cycle : 2013. 09. 11) - Viable organisms (Plankton)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
≥ 50 μm (inds/m³)	218 000	232 000	215 000	176 000	191 000	184 000	2 800	2 700	3 200
	199 000	225 000	227 000	185 000	158 000	161 000	3 200	3 100	3 050
	213 000	216 000	200 000	160 000	173 000	192 000	3 000	2 650	3 450
Average	210 000	224 334	214 000	173 667	174 000	179 000	3 000	2 817	3 234
Standard deviation	9 848.9	8 020.8	13 527.7	12 662.3	16 522.7	16 093.5	200.0	246.6	202.1
≥ 10 μm and < 50 μm (inds/mL)	1 285	1 335	1 107	2 473	1 929	1 329	0.3	0.6	2.2
	1 200	1 181	1 004	1 866	1 865	1 115	0.9	0.7	1.8
	1 340	1 302	1 070	2 103	1 496	1 427	0.8	0.3	3.4
Average	1 275	1 273	1 061	2 148	1 764	1 291	0.7	0.6	2.5
Standard deviation	70.5	81.1	52.2	305.9	233.7	159.6	0.3	0.2	0.8

- Ballasting (12th. test cycle : 2013. 09. 11) - Viable organisms (Bacteria)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	13 100	11 300	15 200	11 100	15 200	14 000	0	0	10
	14 800	11 100	14 900	12 100	11 400	12 900	0	0	10
	12 900	14 000	14 800	12 100	14 300	12 900	0	0	10
Average	13 600	12 134	14 967	11 767	13 634	13 267	0	0	10
Standard deviation	1 044.0	1 619.7	208.2	577.4	1 985.8	635.1	0.0	0.0	0.0
Coliform (CFU/100 mL)	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	1	1	0
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	0	0
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	0	0
Average							1	1	0
Standard deviation							0.6	0.6	0.0
Escherichia coli (CFU/100 mL)	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	0	0
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	0	0
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	0	0
Average							0	0	0
Standard deviation							0.0	0.0	0.0
Enterococci (CFU/100 mL)	100	100	76	80	68	88	18	12	12
	60	132	86	102	104	64	9	12	12
	44	110	110	84	82	54	9	9	9
Average	68	114	91	89	85	69	12	11	11
Standard deviation	28.8	16.4	17.5	11.7	18.1	17.5	5.2	1.7	1.7
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count
CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

IV. To be continued

- de-Ballasting (12th. test cycle : 2013. 09. 16) - Basic water parameters

Test item	Control water			Treated water		
	B	M	E	B	M	E
Water temperature (℃)	25.23	25.30	25.60	25.42	25.35	25.44
	25.23	25.27	25.51	25.42	25.37	25.43
	25.25	25.29	25.44	25.47	25.30	25.49
Average	25.24	25.29	25.52	25.44	25.34	25.45
Standard deviation	0.01	0.02	0.08	0.03	0.04	0.03
pH	7.43	7.46	7.51	7.51	7.57	7.58
	7.44	7.46	7.49	7.54	7.59	7.58
	7.46	7.46	7.50	7.54	7.60	7.56
Average	7.44	7.46	7.50	7.53	7.59	7.57
Standard deviation	0.02	0.00	0.01	0.02	0.02	0.01
ORP (mV)	252	264	261	266	244	263
	245	260	259	259	243	259
	240	257	257	251	243	257
Average	246	260	259	259	243	260
Standard deviation	6	4	2	8	1	3
Salinity (PSU)	33.56	33.57	33.47	33.43	33.54	33.51
	33.62	33.62	33.58	33.56	33.63	33.60
	33.60	33.61	33.61	33.58	33.60	33.62
Average	33.59	33.60	33.55	33.52	33.59	33.58
Standard deviation	0.03	0.03	0.07	0.08	0.05	0.06
DO (mg/L)	6.22	6.25	6.18	6.61	6.56	6.58
	6.22	6.24	6.18	6.61	6.58	6.59
	6.18	6.18	6.22	6.62	6.58	6.58
Average	6.21	6.22	6.19	6.61	6.57	6.58
Standard deviation	0.02	0.04	0.02	0.01	0.01	0.01
Turbidity (NTU)	4.17	3.93	3.94	3.29	3.51	2.94
	4.79	4.11	3.92	3.19	3.60	3.60
	4.57	3.94	4.08	3.13	3.84	3.74
Average	4.51	3.99	3.98	3.20	3.65	3.43
Standard deviation	0.31	0.10	0.09	0.08	0.17	0.43
TSS (mg/L)	18.8	22.0	23.6	25.6	15.6	25.2
	21.2	15.2	33.2	21.2	20.4	22.4
	22.4	22.4	36.4	24.0	24.8	26.0
Average	20.8	19.9	31.1	23.6	20.3	24.5
Standard deviation	1.83	4.05	6.66	2.23	4.60	1.89
DOC (mg/L)	1.49	1.57	1.69	1.91	1.85	1.84
POC (mg/L)	0.30	0.34	0.23	1.33	1.14	1.21

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (12th. test cycle : 2013. 09. 16) - Viable organisms (Plankton)

Test item	Control water			Treated water		
	B	M	E	B	M	E
≥ 50 μm (inds/m^3)	1 000	500	1 500	0*	0*	1*
	1 000	1 500	1 000			
	500	2 000	1 000			
Average	834	1 334	1 167			
Standard deviation	288.7	763.8	288.7			
≥ 10 μm and < 50 μm (inds/mL)	233	276	192	0.0	0.0	0.0
	129	198	204	0.2	0.0	0.1
	215	192	160	0.0	0.0	0.0
Average	193	222	186	0.1	0.0	0.1
Standard deviation	55.6	46.9	22.7	0.1	0.0	0.1

* Analysed entire sample volume

- de-Ballasting (12th. test cycle : 2013. 09. 16) - Viable organisms (Bacteria)

Test item	Control water			Treated water		
	B	M	E	B	M	E
HeterotrophicBacteria (CFU/mL)	TNTC*	TNTC*	TNTC*	40	0	190
	TNTC*	TNTC*	TNTC*	60	0	20
	TNTC*	TNTC*	TNTC*	10	0	110
Average				37	0	107
Standard deviation				25.2	0.0	85.0
Coliform (CFU/100 mL)	TNTC*	TNTC*	TNTC*	0	0	0
	TNTC*	TNTC*	TNTC*	0	0	0
	TNTC*	TNTC*	TNTC*	0	0	0
Average				0	0	0
Standard deviation				0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	2	4	2	0	1	1
	0	0	0	0	0	0
	0	2	0	0	0	0
Average	1	2	1	0	1	1
Standard deviation	1.2	2.0	1.2	0.0	0.6	0.6
Enterococci (CFU/100 mL)	32	50	8	20	6	12
	50	76	8	10	4	8
	74	74	2	8	7	10
Average	52	67	6	13	6	10
Standard deviation	21.1	14.5	3.5	6.4	1.5	2.0
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count

CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

IV. To be continued

- Ballasting (13th. test cycle : 2013. 09. 25) - Basic water parameters

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Water temperature (℃)	24.91	24.94	24.67	24.80	24.79	24.73	24.85	24.90	24.86
	24.87	24.84	24.65	24.80	24.77	24.68	24.34	24.87	24.77
	24.81	24.85	24.64	24.78	24.78	24.84	24.79	24.83	24.74
Average	24.86	24.88	24.65	24.79	24.78	24.75	24.66	24.87	24.79
Standard deviation	0.05	0.06	0.02	0.01	0.01	0.08	0.28	0.04	0.06
pH	8.21	8.20	8.24	8.23	8.24	8.24	7.85	8.12	8.14
	8.22	8.23	8.24	8.23	8.24	8.24	7.88	8.13	8.14
	8.22	8.23	8.24	8.23	8.24	8.24	7.80	8.11	8.13
Average	8.22	8.22	8.24	8.23	8.24	8.24	7.84	8.12	8.14
Standard deviation	0.01	0.02	0.00	0.00	0.00	0.00	0.04	0.01	0.01
ORP (mV)	268	267	257	265	258	261	670	723	736
	267	265	256	265	258	260	705	720	742
	266	263	256	264	259	260	712	725	742
Average	267	265	256	265	258	260	696	723	740
Standard deviation	1	2	1	1	1	1	23	3	3
Salinity (PSU)	21.11	21.05	21.13	21.15	21.18	21.13	21.21	21.25	21.24
	21.15	21.16	21.11	21.15	21.17	21.14	21.52	21.24	21.27
	21.16	21.16	21.11	21.15	21.16	21.11	21.21	21.24	21.26
Average	21.14	21.12	21.12	21.15	21.17	21.13	21.31	21.24	21.26
Standard deviation	0.03	0.06	0.01	0.00	0.01	0.02	0.18	0.01	0.02
DO (mg/L)	7.24	7.21	7.25	7.25	7.24	7.25	8.66	9.20	9.30
	7.24	7.24	7.26	7.25	7.24	7.26	8.66	9.21	9.27
	7.26	7.25	7.26	7.25	7.27	7.22	8.69	9.39	9.26
Average	7.25	7.23	7.26	7.25	7.25	7.24	8.67	9.27	9.28
Standard deviation	0.01	0.02	0.01	0.00	0.02	0.02	0.02	0.11	0.02
Turbidity (NTU)	14.8	17.7	17.0	15.6	15.1	16.9	14.2	18.5	17.2
	16.5	16.0	17.7	16.1	15.2	16.4	14.1	19.8	17.5
	14.6	16.6	17.2	16.4	14.8	16.5	13.3	18.7	17.0
Average	15.3	16.8	17.3	16.0	15.0	16.6	13.9	19.0	17.2
Standard deviation	1.04	0.86	0.36	0.40	0.21	0.26	0.49	0.70	0.25
TSS (mg/L)	50.0	59.2	66.5	52.0	57.6	53.2	52.0	64.0	48.0
	56.5	55.5	50.5	61.5	46.5	55.0	60.0	52.8	48.5
	50.0	50.0	69.2	52.5	44.5	52.5	55.5	55.5	52.0
Average	52.2	54.9	62.1	55.3	49.5	53.6	55.8	57.4	49.5
Standard deviation	3.75	4.63	10.11	5.35	7.06	1.29	4.01	5.84	2.18
DOC (mg/L)	8.17	8.08	8.06	9.09	8.87	8.83	8.19	8.32	8.13
POC (mg/L)	7.23	7.64	7.48	9.06	7.82	8.71	9.03	13.9	9.17

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (13th. test cycle : 2013. 09. 25) - Viable organisms (Plankton)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
≥ 50 μm (inds/m^3)	317 000	295 000	327 000	226 000	240 000	211 000	70 400	51 200	48 600
	296 000	281 000	316 000	210 000	253 000	212 000	60 400	56 000	44 000
	290 000	239 000	296 000	249 000	217 000	223 000	64 000	52 600	51 600
Average	301 000	271 667	313 000	228 334	236 667	215 334	64 934	53 267	48 067
Standard deviation	14 177.4	29 143.3	15 716.2	19 604.4	18 230.0	6 658.3	5 064.9	2 468.5	3 828.0
≥ 10 μm and < 50 μm (inds/mL)	1 806	2 008	1 320	1 920	3 735	1 828	0.3	0.2	0.2
	1 484	1 942	1 468	1 830	3 938	1 641	0.1	0.1	0.1
	1 654	1 832	1 376	1 385	3 583	1 691	0.3	0.0	0.1
Average	1 648	1 928	1 388	1 712	3 752	1 720	0.3	0.1	0.2
Standard deviation	161.1	88.9	74.7	286.5	178.1	96.8	0.1	0.1	0.1

- Ballasting (13th. test cycle : 2013. 09. 25) - Viable organisms (Bacteria)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	11 800	13 700	12 000	12 000	10 200	11 100	0	10	0
	10 200	10 300	12 100	10 300	9 300	10 100	0	10	0
	10 500	11 200	12 100	10 200	10 800	10 000	0	10	0
Average	10 834	11 734	12 067	10 834	10 100	10 400	0	10	0
Standard deviation	850.5	1 761.6	577	1 011.6	755.0	608.3	0.0	0.0	0.0
Coliform (CFU/100 mL)	10	10	12	18	30	12	0	0	0
	8	4	4	10	20	16	0	0	0
	8	4	8	8	14	20	0	0	0
Average	9	6	8	12	22	16	0	0	0
Standard deviation	1.2	3.5	4.0	5.3	8.1	4.0	0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	18	4	10	14	12	6	0	0	0
	10	4	4	8	4	10	0	0	0
	12	2	8	6	2	2	0	0	0
Average	14	4	8	10	6	6	0	0	0
Standard deviation	4.2	1.2	3.1	4.2	5.3	4.0	0.0	0.0	0.0
Enterococci (CFU/100 mL)	36	32	40	44	34	38	1	0	0
	32	42	40	36	32	22	1	0	0
	52	46	22	42	20	32	1	0	0
Average	40	40	34	41	29	31	1	0	0
Standard deviation	10.6	7.2	10.4	4.2	7.6	8.1	0.0	0.0	0.0
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (13th. test cycle : 2013. 09. 30) - Basic water parameters

Test item	Control water			Treated water		
	B	M	E	B	M	E
Water temperature (℃)	23.68	23.94	24.06	23.89	23.86	23.97
	23.75	23.74	24.14	23.80	23.82	23.84
	23.63	23.69	23.85	23.81	23.79	23.84
Average	23.69	23.79	24.02	23.83	23.82	23.88
Standard deviation	0.06	0.13	0.15	0.05	0.04	0.08
pH	7.13	7.12	7.15	7.09	7.09	7.13
	7.14	7.12	7.15	7.09	7.11	7.14
	7.13	7.13	7.16	7.08	7.11	7.15
Average	7.13	7.12	7.15	7.09	7.10	7.14
Standard deviation	0.01	0.01	0.01	0.01	0.01	0.01
ORP (mV)	204	204	219	263	263	264
	199	199	217	268	262	263
	193	196	212	267	262	263
Average	199	200	216	268	262	263
Standard deviation	6	4	4	1	1	1
Salinity (PSU)	21.15	21.07	21.08	21.13	21.12	21.11
	21.13	21.10	21.14	21.14	21.13	21.14
	21.13	21.10	21.11	21.13	21.13	21.14
Average	21.14	21.09	21.11	21.13	21.13	21.13
Standard deviation	0.01	0.02	0.03	0.01	0.01	0.02
DO (mg/L)	6.44	6.41	6.45	6.37	6.17	6.41
	6.47	6.45	6.52	6.33	6.25	6.50
	6.47	6.48	6.54	6.33	6.47	6.50
Average	6.46	6.45	6.50	6.34	6.30	6.47
Standard deviation	0.02	0.04	0.05	0.02	0.16	0.05
Turbidity (NTU)	16.0	15.7	15.8	15.2	14.9	14.6
	14.8	15.1	16.0	14.0	14.5	14.3
	16.0	16.3	16.0	13.4	15.3	14.4
Average	15.6	15.7	15.9	14.2	14.9	14.4
Standard deviation	0.69	0.60	0.12	0.92	0.40	0.15
TSS (mg/L)	50.0	48.0	45.2	47.2	60.5	42.0
	46.4	50.0	49.2	45.2	54.0	56.5
	50.4	50.8	50.0	47.2	51.0	60.0
Average	48.9	49.6	48.1	46.5	55.2	52.8
Standard deviation	2.20	1.44	2.57	1.15	4.86	9.54
DOC (mg/L)	4.95	4.94	4.95	3.28	3.37	3.34
POC (mg/L)	5.17	5.05	5.21	4.36	3.95	4.72

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (13th. test cycle : 2013. 09. 30) - Viable organisms (Plankton)

Test item	Control water			Treated water		
	B	M	E	B	M	E
≥ 50 μm (inds/m^3)	500	0	0	0*	0*	0*
	0	1 000	1 000			
	0	0	0			
Average	167	334	334			
Standard deviation	288.7	577.4	577.4			
≥ 10 μm and < 50 μm (inds/mL)	118	106	105	2.1	0.7	2.7
	97	129	98	2.2	3.6	2.0
	103	142	112	1.9	2.5	1.9
Average	106	126	105	2.1	2.3	2.2
Standard deviation	10.8	18.2	7.0	0.2	1.5	0.4

* Analysed entire sample volume.

- de-Ballasting (13th. test cycle : 2013. 09. 30) - Viable organisms (Bacteria)

Test item	Control water			Treated water		
	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*
Average						
Standard deviation						
Coliform (CFU/100 mL)	20	30	4	0	0	0
	22	32	8	0	0	0
	16	42	0	0	0	0
Average	20	35	4	0	0	0
Standard deviation	3.1	6.4	4.0	0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	TNTC*	8	2	2	2	2
	TNTC*	10	6	1	1	0
	TNTC*	14	4	0	0	2
Average		11	4	1	1	2
Standard deviation		3.1	2.0	1.0	1.0	1.2
Enterococci (CFU/100 mL)	TNTC*	TNTC*	TNTC*	61	23	20
	TNTC*	TNTC*	TNTC*	70	88	168
	TNTC*	TNTC*	TNTC*	81	165	55
Average				71	92	81
Standard deviation				10.0	71.1	77.3
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count

CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (14th. test cycle : 2013. 10. 02) - Basic water parameters

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Water temperature (℃)	24.12	23.88	24.06	24.20	23.96	24.05	24.13	24.05	24.13
	24.04	23.84	24.08	24.02	24.01	24.05	24.09	24.05	24.12
	24.01	24.06	24.06	24.03	23.96	24.00	24.10	24.06	24.10
Average	24.06	23.93	24.07	24.08	23.98	24.03	24.11	24.05	24.12
Standard deviation	0.06	0.12	0.01	0.10	0.03	0.03	0.02	0.01	0.02
pH	8.17	8.25	8.25	8.21	8.26	8.27	8.25	8.25	8.26
	8.22	8.25	8.26	8.24	8.26	8.27	8.25	8.25	8.27
	8.24	8.25	8.26	8.25	8.26	8.27	8.24	8.25	8.27
Average	8.21	8.25	8.26	8.23	8.26	8.27	8.25	8.25	8.27
Standard deviation	0.04	0.00	0.01	0.02	0.00	0.00	0.01	0.00	0.01
ORP (mV)	319	517	562	291	509	553	699	729	739
	301	513	560	287	505	550	719	718	727
	293	510	558	284	502	545	725	726	737
Average	304	513	560	287	505	549	714	724	734
Standard deviation	13	4	2	4	4	4	14	6	6
Salinity (PSU)	21.14	21.09	21.14	21.17	21.15	21.16	21.18	21.17	21.17
	21.15	21.15	21.17	21.16	21.17	21.17	21.17	21.17	21.17
	21.16	21.18	21.17	21.16	21.16	21.17	21.15	21.17	21.16
Average	21.15	21.14	21.16	21.16	21.16	21.17	21.17	21.17	21.17
Standard deviation	0.01	0.05	0.02	0.01	0.01	0.01	0.02	0.00	0.01
DO (mg/L)	7.37	7.38	7.37	7.38	7.38	7.38	9.35	8.98	9.49
	7.37	7.40	7.39	7.38	7.38	7.37	9.17	9.43	9.68
	7.38	7.38	7.38	7.38	7.38	7.38	9.25	9.19	9.60
Average	7.37	7.39	7.38	7.38	7.38	7.38	9.26	9.20	9.59
Standard deviation	0.01	0.01	0.01	0.00	0.00	0.01	0.09	0.23	0.10
Turbidity (NTU)	18.4	17.0	21.0	16.1	14.0	15.5	12.7	15.7	14.0
	19.0	15.2	17.5	15.9	13.6	16.9	13.1	13.0	15.1
	17.9	16.6	17.0	15.9	16.8	17.6	14.3	15.9	14.6
Average	18.4	16.3	18.5	16.0	14.8	16.7	13.4	14.9	14.6
Standard deviation	0.55	0.95	2.18	0.12	1.74	1.07	0.83	1.62	0.55
TSS (mg/L)	69.2	86.4	83.2	59.2	58.8	66.0	54.0	57.2	54.8
	61.6	69.6	62.8	56.4	58.0	62.8	53.2	49.2	51.6
	56.0	69.2	55.6	54.0	52.4	55.6	52.8	53.6	50.0
Average	62.3	75.1	67.2	56.5	56.4	61.5	53.3	53.3	52.1
Standard deviation	6.63	9.82	14.3	2.60	3.49	5.33	0.61	4.01	2.44
DOC (mg/L)	8.44	8.36	9.03	9.04	9.16	9.14	7.09	8.43	8.46
POC (mg/L)	9.53	9.48	8.95	8.84	8.99	9.95	6.26	6.80	7.44

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (14th. test cycle : 2013. 10. 02) - Viable organisms (Plankton)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
≥ 50 μm (inds/m³)	230 000	246 000	249 000	211 000	221 000	243 000	19 700	19 400	24 600
	220 000	243 000	248 000	226 000	212 000	245 000	23 300	22 100	25 800
	238 000	241 000	226 000	205 000	231 000	246 000	21 900	22 700	23 100
Average	229 334	243 334	241 000	214 000	221 334	244 667	21 634	21 400	24 500
Standard deviation	9 018.5	2 516.6	13 000.0	10 816.7	9 504.4	1 527.5	1 814.8	1 757.8	1 352.8
≥ 10 μm and < 50 μm (inds/mL)	1 810	1 522	1 313	2 903	3 828	1 320	1.5	0.9	0.8
	2 036	1 303	1 450	2 876	3 784	1 151	0.5	0.8	0.4
	1 704	1 265	1 163	2 784	3 733	1 491	1.3	0.6	0.4
Average	1 850	1 364	1 309	2 855	3 782	1 321	1.1	0.8	0.6
Standard deviation	169.6	138.7	143.5	62.4	47.5	170.0	0.5	0.2	0.2

- Ballasting (14th. test cycle : 2013. 10. 02) - Viable organisms (Bacteria)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	22 100	22 200	19 900	18 500	13 700	20 200	10	30	20
	22 200	22 000	20 900	19 000	15 200	21 800	0	10	10
	20 500	20 300	23 600	17 100	19 100	20 200	10	10	20
Average	21 600	21 500	21 467	18 200	16 000	20 734	7	17	17
Standard deviation	953.9	1 044.0	1 914.0	984.9	2 787.5	923.8	5.8	11.5	5.8
Coliform (CFU/100 mL)	60	42	36	32	46	18	0	0	0
	62	16	36	60	38	24	0	0	0
	28	18	22	24	62	36	0	0	0
Average	50	26	32	39	49	26	0	0	0
Standard deviation	19.1	14.5	8.1	18.9	12.2	9.2	0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	4	4	4	4	10	2	0	0	0
	4	2	2	0	4	4	0	1	0
	4	0	0	0	0	0	0	0	0
Average	4	2	2	2	5	2	0	1	0
Standard deviation	0.0	2.0	2.0	2.3	5.0	2.0	0.0	0.6	0.0
Enterococci (CFU/100 mL)	96	70	80	88	78	96	0	0	1
	64	96	64	102	96	82	0	0	1
	62	96	102	106	90	62	0	0	0
Average	74	88	82	99	88	80	0	0	1
Standard deviation	19.1	15.0	19.1	9.5	9.2	17.1	0.0	0.0	0.6
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

CFU. Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (14th. test cycle : 2013. 10. 07) - Basic water parameters

Test item	Control water			Treated water		
	B	M	E	B	M	E
Water temperature (℃)	23.45	23.45	23.56	23.41	23.43	23.47
	23.44	23.40	23.50	23.36	23.36	23.43
	23.50	23.42	23.51	23.35	23.36	23.53
Average	23.46	23.42	23.52	23.37	23.38	23.48
Standard deviation	0.03	0.03	0.03	0.03	0.04	0.05
pH	7.08	7.09	7.15	7.05	7.00	7.07
	7.12	7.09	7.12	7.06	7.01	7.09
	7.13	7.10	7.11	7.06	7.00	7.09
Average	7.11	7.09	7.13	7.06	7.00	7.08
Standard deviation	0.03	0.01	0.02	0.01	0.01	0.01
ORP (mV)	139	116	143	298	295	291
	121	106	131	296	293	289
	114	105	124	295	291	286
Average	125	109	133	296	293	289
Standard deviation	13	6	10	2	2	3
Salinity (PSU)	21.02	21.06	21.06	21.14	21.14	21.12
	21.11	21.12	21.12	21.19	21.19	21.20
	21.12	21.14	21.13	21.10	21.19	21.19
Average	21.08	21.11	21.10	21.14	21.17	21.17
Standard deviation	0.06	0.04	0.04	0.05	0.03	0.04
DO (mg/L)	6.65	6.54	6.77	6.61	6.49	6.64
	6.73	6.53	6.75	6.56	6.47	6.60
	6.72	6.62	6.71	6.55	6.48	6.55
Average	6.70	6.56	6.74	6.57	6.48	6.60
Standard deviation	0.04	0.05	0.03	0.03	0.01	0.05
Turbidity (NTU)	16.9	16.5	18.7	14.0	13.9	12.7
	16.4	16.7	17.6	13.4	13.8	13.7
	16.6	17.3	18.8	12.5	13.2	11.9
Average	16.6	16.8	18.4	13.3	13.6	12.8
Standard deviation	0.25	0.42	0.67	0.75	0.38	0.90
TSS (mg/L)	52.0	73.0	65.0	70.0	75.0	80.0
	40.0	67.0	64.0	66.0	66.0	61.0
	49.0	60.0	62.0	57.0	66.0	58.0
Average	47.0	66.7	63.7	64.3	69.0	66.3
Standard deviation	6.24	6.51	1.53	6.66	5.20	11.9
DOC (mg/L)	5.44	5.56	4.90	3.62	3.64	4.00
POC (mg/L)	5.00	4.75	2.59	4.24	4.62	3.70

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (14th. test cycle : 2013. 10. 07) - Viable organisms (Plankton)

Test item	Control water			Treated water		
	B	M	E	B	M	E
≥ 50 μm (inds./m³)	500	2 500	1 000	0*	0*	0*
	0	1 000	500			
	1 000	2 500	500			
Average	500	2 000	667			
Standard deviation	500.0	866.0	288.7			
≥ 10 μm and < 50 μm (inds./mL)	146	94	116	2.2	1.4	1.6
	157	141	116	3.8	0.9	0.6
	95	116	126	2.6	1.3	2.2
Average	133	117	120	2.9	1.2	1.5
Standard deviation	33.1	23.5	5.8	0.8	0.3	0.8

* Analysed entire sample volume

- de-Ballasting (14th. test cycle : 2013. 10. 07) - Viable organisms (Bacteria)

Test item	Control water			Treated water		
	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*
Average						
Standard deviation						
Coliform (CFU/100 mL)	4	14	14	0	0	0
	2	8	4	0	0	0
	0	2	16	0	0	0
Average	2	8	12	0	0	0
Standard deviation	2.0	6.0	6.4	0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	0	6	2	1	0	1
	0	2	0	0	0	0
	0	0	0	1	0	2
Average	0	3	1	1	0	1
Standard deviation	0.0	3.1	1.2	0.6	0.0	1.0
Enterococci (CFU/100 mL)	TNTC*	58	66	100	314	196
	TNTC*	74	70	108	305	200
	TNTC*	44	62	110	295	211
Average		59	66	106	305	203
Standard deviation		15.0	4.0	5.3	9.5	7.8
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count

CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (15th. test cycle : 2013. 10. 11) - Basic water parameters

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Water temperature (℃)	23.83	23.87	23.91	23.95	23.89	23.79	24.23	24.05	24.11
	23.83	23.94	23.89	23.89	23.81	23.68	24.21	24.05	24.10
	23.91	23.92	23.94	23.84	23.72	23.75	24.22	24.05	23.96
Average	23.86	23.91	23.91	23.92	23.81	23.74	24.22	24.05	24.06
Standard deviation	0.05	0.04	0.03	0.04	0.09	0.06	0.01	0.00	0.08
pH	7.61	7.59	7.59	7.61	7.59	7.61	8.09	8.18	8.15
	7.60	7.59	7.60	7.61	7.60	7.61	8.11	8.18	8.15
	7.59	7.59	7.60	7.62	7.60	7.61	8.12	8.17	8.15
Average	7.60	7.59	7.60	7.61	7.60	7.61	8.11	8.18	8.15
Standard deviation	0.01	0.00	0.01	0.01	0.01	0.00	0.02	0.01	0.00
ORP (mV)	246	245	243	251	252	239	708	771	768
	245	244	241	249	248	237	720	772	767
	244	243	239	247	247	237	746	772	768
Average	245	244	241	249	249	238	725	772	768
Standard deviation	1	1	2	2	3	1	19	1	1
Salinity (PSU)	21.51	21.61	21.62	21.58	21.58	21.64	20.99	21.27	21.25
	21.63	21.63	21.62	21.61	21.61	21.64	21.00	21.27	21.26
	21.63	21.64	21.63	21.63	21.64	21.63	21.01	21.27	21.25
Average	21.59	21.63	21.62	21.61	21.61	21.64	21.00	21.27	21.25
Standard deviation	0.07	0.02	0.01	0.03	0.03	0.01	0.01	0.00	0.01
DO (mg/L)	8.69	8.35	8.34	8.50	8.66	8.89	9.36	9.41	8.68
	8.46	8.66	8.40	8.52	8.75	8.70	9.06	9.51	8.67
	8.45	8.45	8.44	8.58	8.53	8.23	9.11	9.65	8.64
Average	8.53	8.49	8.39	8.53	8.65	8.61	9.18	9.52	8.66
Standard deviation	0.14	0.16	0.05	0.04	0.11	0.34	0.16	0.12	0.02
Turbidity (NTU)	19.9	20.1	20.1	20.2	19.2	21.3	18.5	17.6	20.5
	20.2	20.9	19.7	20.1	17.5	23.9	20.0	19.0	19.4
	19.8	20.7	22.0	19.7	19.0	21.9	19.9	17.1	19.8
Average	20.0	20.6	20.6	20.0	18.6	22.4	19.5	17.9	19.9
Standard deviation	0.21	0.42	1.23	0.26	0.93	1.36	0.84	0.98	0.56
TSS (mg/L)	54.4	60.8	62.0	58.4	54.4	60.4	50.0	55.2	50.8
	56.8	68.0	55.2	54.8	53.2	62.0	47.6	52.8	48.0
	60.4	51.6	54.4	52.0	56.8	60.8	48.8	50.8	48.4
Average	57.2	60.1	57.2	55.1	54.8	61.1	48.8	52.9	49.1
Standard deviation	3.02	8.22	4.18	3.21	1.83	0.83	1.20	2.20	1.51
DOC (mg/L)	7.51	8.51	7.61	7.61	7.65	7.72	7.91	7.82	7.88
POC (mg/L)	6.62	6.93	7.32	6.78	6.54	6.87	6.84	7.50	6.92

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (15th. test cycle : 2013. 10. 11) - Viable organisms (Plankton)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
≥ 50 μm (inds/m³)	277 000	279 000	278 000	299 000	244 000	273 000	24 400	22 400	35 200
	239 000	275 000	289 000	222 000	230 000	223 000	25 200	22 400	27 800
	231 000	221 000	269 000	211 000	227 000	242 000	25 600	19 200	28 000
Average	249 000	258 334	278 667	244 000	233 667	246 000	25 067	21 334	30 334
Standard deviation	24 576.4	32 393.4	10 016.7	47 947.9	9 073.8	25 238.9	611.0	1 847.5	4 215.8
≥ 10 μm and < 50 μm (inds/mL)	1 064	1 184	1 325	1 277	1 054	1 148	0.0	0.0	0.0
	1 162	1 137	1 119	1 123	1 007	1 092	0.0	0.0	0.0
	1 319	1 187	1 045	1 232	1 064	1 249	0.0	0.0	0.0
Average	1 182	1 170	1 163	1 211	1 042	1 163	0.0	0.0	0.0
Standard deviation	128.6	28.0	145.1	79.2	30.4	79.6	0.0	0.0	0.0

- Ballasting (15th. test cycle : 2013. 10. 11) - Viable organisms (Bacteria)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	17 600	18 300	15 500	14 000	13 900	15 000	0	0	0
	19 000	14 900	14 700	16 500	12 400	13 000	0	0	0
	15 600	14 000	16 300	14 600	12 100	12 700	0	0	0
Average	17 400	15 734	15 500	15 034	12 800	13 567	0	0	0
Standard deviation	1 708.8	2 267.9	800.0	1 305.1	964.4	1 250.3	0.0	0.0	0.0
Coliform (CFU/100 mL)	6	2	6	0	4	2	0	0	0
	2	4	6	2	8	6	0	0	0
	4	6	6	2	6	6	0	0	0
Average	4	4	6	2	6	5	0	0	0
Standard deviation	2.0	2.0	0.0	1.2	2.0	2.3	0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	6	2	0	4	2	0	0	0	0
	0	4	0	4	4	4	0	0	0
	6	0	0	0	0	0	0	0	0
Average	4	2	0	3	2	2	0	0	0
Standard deviation	3.5	2.0	0.0	2.3	2.0	2.3	0.0	0.0	0.0
Enterococci (CFU/100 mL)	20	62	70	24	2	12	0	0	0
	28	30	38	40	10	32	0	0	0
	10	36	92	32	18	26	0	0	0
Average	20	43	67	32	10	24	0	0	0
Standard deviation	9.0	17.0	27.2	8.0	8.0	10.3	0.0	0.0	0.0
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

CFU. Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (15th. test cycle : 2013. 10. 16) - Basic water parameters

Test item	Control water			Treated water		
	B	M	E	B	M	E
Water temperature (℃)	21.04	21.10	21.28	21.32	21.35	21.32
	21.04	21.05	21.44	21.22	21.28	21.27
	21.02	21.13	21.33	21.10	21.33	21.31
Average	21.03	21.09	21.35	21.21	21.32	21.30
Standard deviation	0.01	0.04	0.08	0.11	0.04	0.03
pH	6.60	6.59	6.61	6.63	6.59	6.67
	6.61	6.59	6.62	6.65	6.59	6.67
	6.61	6.60	6.62	6.67	6.58	6.65
Average	6.61	6.59	6.62	6.65	6.59	6.66
Standard deviation	0.01	0.01	0.01	0.02	0.01	0.01
ORP (mV)	215	215	233	303	301	275
	192	205	226	296	293	274
	169	193	217	292	287	273
Average	192	204	225	297	294	274
Standard deviation	23	11	8	6	7	1
Salinity (PSU)	21.50	21.47	21.51	21.50	21.58	21.58
	21.57	21.55	21.56	21.57	21.62	21.57
	21.59	21.52	21.49	21.59	21.61	21.57
Average	21.55	21.51	21.52	21.55	21.60	21.57
Standard deviation	0.05	0.04	0.04	0.05	0.02	0.01
DO (mg/L)	6.64	6.39	6.71	6.45	6.81	6.56
	6.60	6.34	6.49	6.72	6.74	6.67
	6.52	6.58	7.07	6.40	6.76	6.60
Average	6.59	6.44	6.76	6.52	6.77	6.61
Standard deviation	0.06	0.13	0.29	0.17	0.04	0.06
Turbidity (NTU)	13.4	17.9	19.9	20.5	17.8	18.6
	13.2	17.0	19.9	19.9	17.9	18.1
	13.7	17.0	19.3	18.0	16.7	18.7
Average	13.4	17.3	19.7	19.5	17.5	18.5
Standard deviation	0.25	0.52	0.35	1.31	0.67	0.32
TSS (mg/L)	49.0	48.0	57.0	105.2	70.0	68.0
	45.0	52.0	69.0	78.0	71.0	67.0
	34.0	56.0	57.0	82.0	69.0	72.0
Average	42.7	52.0	61.0	88.4	70.0	69.0
Standard deviation	7.77	4.00	6.93	14.7	1.00	2.65
DOC (mg/L)	4.25	4.17	4.05	2.50	2.60	2.66
POC (mg/L)	4.03	4.70	5.47	6.95	6.91	7.07

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (15th. test cycle : 2013. 10. 16) - Viable organisms (Plankton)

Test item	Control water			Treated water		
	B	M	E	B	M	E
≥ 50 μm (inds/m^3)	1 000	1 500	0	0*	0*	0*
	1 500	2 000	1 000			
	1 500	1 000	0			
Average	1 334	1 500	334			
Standard deviation	288.7	500.0	577.4			
≥ 10 μm and < 50 μm (inds/mL)	125	108	173	0.1	2.2	2.9
	121	132	138	0.5	3.0	3.3
	107	117	113	2.1	2.9	3.1
Average	118	119	142	0.9	2.7	3.1
Standard deviation	9.5	12.1	30.1	1.1	0.4	0.2

* Analysed entire sample volume

- de-Ballasting (15th. test cycle : 2013. 10. 16) - Viable organisms (Bacteria)

Test item	Control water			Treated water		
	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*
Average						
Standard deviation						
Coliform (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0
Enterococci (CFU/100 mL)	160	138	204	63	19	43
	170	208	256	58	70	59
	242	238	284	54	17	28
Average	191	195	248	59	36	44
Standard deviation	44.7	51.3	40.6	4.5	30.0	15.5
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count

CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (16th. test cycle : 2013. 10. 17) - Basic water parameters

Test Item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Water temperature (℃)	21.51	21.20	21.10	21.10	21.16	21.25	21.56	21.54	21.54
	21.28	20.99	21.13	21.17	21.13	21.18	21.51	21.50	21.53
	21.20	21.08	21.12	21.31	21.18	21.31	21.50	21.43	21.54
Average	21.33	21.09	21.12	21.19	21.16	21.25	21.52	21.49	21.54
Standard deviation	0.16	0.11	0.02	0.11	0.03	0.07	0.03	0.06	0.01
pH	7.66	7.66	7.62	7.69	7.68	7.67	8.22	8.24	8.23
	7.67	7.67	7.66	7.70	7.69	7.67	8.22	8.23	8.24
	7.68	7.69	7.66	7.70	7.69	7.67	8.22	8.23	8.23
Average	7.67	7.67	7.65	7.70	7.69	7.67	8.22	8.23	8.23
Standard deviation	0.01	0.02	0.02	0.01	0.01	0.00	0.00	0.01	0.01
ORP (mV)	259	251	266	255	248	248	731	753	740
	257	250	257	254	247	245	735	756	743
	256	249	252	253	246	244	739	757	746
Average	257	250	258	254	247	246	735	755	743
Standard deviation	2	1	7	1	1	2	4	2	3
Salinity (PSU)	21.42	21.49	21.50	21.44	21.62	21.62	21.19	21.24	21.22
	21.58	21.55	21.56	21.45	21.62	21.61	21.19	21.23	21.23
	21.57	21.54	21.59	21.47	21.62	21.62	21.21	21.23	21.22
Average	21.52	21.53	21.55	21.45	21.62	21.62	21.20	21.23	21.22
Standard deviation	0.09	0.03	0.05	0.02	0.00	0.01	0.01	0.01	0.01
DO (mg/L)	6.56	6.41	6.62	6.69	6.63	6.52	9.58	10.38	9.31
	6.99	6.46	6.46	6.50	6.83	6.59	9.53	10.28	9.37
	6.65	6.73	6.69	6.47	6.84	6.74	9.40	10.20	9.26
Average	6.73	6.53	6.59	6.55	6.77	6.62	9.50	10.29	9.31
Standard deviation	0.23	0.17	0.12	0.12	0.12	0.11	0.09	0.09	0.06
Turbidity (NTU)	20.1	19.5	16.7	17.2	17.6	18.1	14.6	14.5	16.0
	18.9	18.9	17.2	17.7	17.6	17.0	14.9	14.9	15.1
	19.2	19.6	17.6	16.9	16.9	17.0	14.6	14.6	16.1
Average	19.4	19.3	17.2	17.3	17.4	17.4	14.7	14.7	15.7
Standard deviation	0.62	0.38	0.45	0.40	0.40	0.64	0.17	0.21	0.55
TSS (mg/L)	59.6	64.0	52.8	54.8	61.6	52.8	47.6	43.6	49.2
	58.8	61.2	54.0	55.2	57.2	54.8	49.6	48.0	48.0
	57.6	62.4	55.2	57.2	58.8	52.0	49.2	47.6	58.8
Average	58.7	62.5	54.0	55.7	59.2	53.2	48.8	46.4	52.0
Standard deviation	1.01	1.40	1.20	1.29	2.23	1.44	1.06	2.43	5.92
DOC (mg/L)	8.07	8.86	8.49	8.96	8.94	8.91	8.78	8.35	8.22
POC (mg/L)	6.37	6.99	8.19	6.93	6.87	5.56	8.13	7.96	7.59

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (16th. test cycle : 2013. 10. 17) - Viable organisms (Plankton)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
≥ 50 μm (inds./m³)	253 000	182 000	219 000	160 000	235 000	135 000	7 200	8 200	11 600
	248 000	165 000	200 000	137 000	207 000	131 000	8 800	9 200	9 400
	225 000	178 000	211 000	142 000	212 000	145 000	8 100	10 900	10 000
Average	242 000	175 000	210 000	146 334	218 000	137 000	8 034	9 434	10 334
Standard deviation	14 933.2	8 888.2	9 539.4	12 096.8	14 933.2	7 211.1	802.1	1 365.0	1 137.2
≥ 10 μm and < 50 μm (inds./mL)	1 657	1 142	1 290	1 732	1 803	1 420	0.0	0.0	0.0
	1 386	1 240	1 094	1 673	2 150	1 416	0.0	0.0	0.0
	1 459	1 280	1 103	1 615	1 945	1 494	0.0	0.1	0.0
Average	1 501	1 221	1 163	1 674	1 966	1 444	0.0	0.1	0.0
Standard deviation	140.2	71.0	110.7	58.5	174.5	43.9	0.0	0.1	0.0

- Ballasting (16th. test cycle : 2013. 10. 17) - Viable organisms (Bacteria)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	19 400	15 100	15 300	15 400	16 500	15 800	0	0	0
	18 700	17 800	16 900	17 800	15 500	16 100	0	0	0
	16 000	18 900	15 500	15 500	15 600	15 200	0	0	0
Average	18 034	17 267	15 900	16 234	15 867	15 700	0	0	0
Standard deviation	1 795.4	1 955.3	871.8	1 357.7	550.8	458.3	0.0	0.0	0.0
Coliform (CFU/100 mL)	28	62	42	52	64	38	1	1	2
	34	56	58	32	66	56	0	1	3
	24	40	64	42	78	42	0	2	1
Average	29	53	55	42	70	46	1	2	2
Standard deviation	5.0	11.4	11.4	10.0	7.6	9.5	0.6	0.6	1.0
Escherichia coli (CFU/100 mL)	2	0	0	2	4	0	0	0	0
	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0
Average	2	0	0	1	2	0	0	0	0
Standard deviation	1.2	0.0	0.0	1.2	2.3	0.0	0.0	0.0	0.0
Enterococci (CFU/100 mL)	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	0	0
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	0	0
	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	TNTC*	0	0	0
Average							0	0	0
Standard deviation							0.0	0.0	0.0
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count

CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (16th. test cycle : 2013. 10. 22) - Basic water parameters

Test item	Control water			Treated water		
	B	M	E	B	M	E
Water temperature (℃)	19.87	19.91	19.75	20.07	19.99	20.01
	19.80	19.80	19.71	20.04	19.96	19.98
	19.81	19.80	19.68	20.02	19.93	19.96
Average	19.83	19.84	19.71	20.04	19.96	19.98
Standard deviation	0.04	0.06	0.04	0.03	0.03	0.03
pH	6.74	6.73	6.73	6.62	6.64	6.69
	6.73	6.73	6.74	6.63	6.64	6.69
	6.71	6.73	6.75	6.64	6.66	6.70
Average	6.73	6.73	6.74	6.63	6.65	6.69
Standard deviation	0.02	0.00	0.01	0.01	0.01	0.01
ORP (mV)	217	204	217	301	284	281
	201	195	210	293	281	277
	188	187	206	289	279	273
Average	202	195	211	294	281	277
Standard deviation	15	9	6	6	3	4
Salinity (PSU)	21.49	21.53	21.56	21.55	21.54	21.56
	21.56	21.60	21.59	21.55	21.58	21.58
	21.54	21.59	21.59	21.56	21.57	21.58
Average	21.53	21.57	21.58	21.55	21.56	21.57
Standard deviation	0.04	0.04	0.02	0.01	0.02	0.01
DO (mg/L)	6.03	5.94	5.89	6.01	5.76	5.95
	5.76	5.68	5.61	6.23	5.90	5.72
	5.74	5.91	5.73	5.91	5.86	5.88
Average	5.84	5.84	5.74	6.05	5.84	5.85
Standard deviation	0.16	0.14	0.14	0.16	0.07	0.12
Turbidity (NTU)	14.1	15.0	15.8	16.4	16.8	16.3
	14.1	14.9	15.8	15.3	17.0	15.5
	14.5	15.2	15.9	15.5	17.6	15.6
Average	14.2	15.0	15.8	15.7	17.1	15.8
Standard deviation	0.23	0.15	0.06	0.59	0.42	0.44
TSS (mg/L)	91.6	94.0	98.0	100.0	109.2	106.4
	92.8	93.6	97.6	108.4	118.4	106.4
	104.8	98.4	99.6	107.2	120.0	108.4
Average	96.4	95.3	98.4	105.2	115.9	107.1
Standard deviation	7.30	2.66	1.06	4.54	5.83	1.15
DOC (mg/L)	6.13	6.07	6.12	2.65	2.68	2.50
POC (mg/L)	5.00	4.80	5.82	5.52	4.97	5.27

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (16th. test cycle : 2013. 10. 22) - Viable organisms (Plankton)

Test item	Control water			Treated water		
	B	M	E	B	M	E
≥ 50 μm (inds./m³)	346 000	437 000	256 000	3*	6*	1*
	385 000	403 000	239 000			
	381 000	411 000	239 000			
Average	370 667	417 000	244 667			
Standard deviation	21 455.4	17 776.4	9 815.0			
≥ 10 μm and < 50 μm (inds./mL)	1 569	1 765	1 938	8.4	8.5	9.8
	1 806	1 834	1 938	8.1	7.4	11.0
	1 830	1 662	2 012	8.1	7.5	7.1
Average	1 735	1 754	1 963	8.2	7.8	9.3
Standard deviation	144.3	86.6	42.7	0.2	0.6	2.0

* Analysed entire sample volume

- de-Ballasting (16th. test cycle : 2013. 10. 22) - Viable organisms (Bacteria)

Test item	Control water			Treated water		
	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	30 800	39 600	29 600	2 560	2 480	2 560
	31 600	34 800	24 400	2 700	2 810	2 580
	33 200	35 200	28 400	2 610	2 480	2 900
Average	31 867	36 534	27 467	2 624	2 590	2 680
Standard deviation	1 222.0	2 663.3	2 722.7	70.9	190.5	190.8
Coliform (CFU/100 mL)	52	36	36	36	38	35
	42	42	34	25	39	26
	38	50	38	27	45	29
Average	44	43	36	30	41	30
Standard deviation	7.2	7.0	2.0	5.9	3.8	4.6
Escherichia coli (CFU/100 mL)	2	0	2	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	1	0	1	0	0	0
Standard deviation	1.2	0.0	1.2	0.0	0.0	0.0
Enterococci (CFU/100 mL)	TNTC*	TNTC*	TNTC*	131	142	114
	TNTC*	TNTC*	TNTC*	92	122	72
	TNTC*	TNTC*	TNTC*	107	92	82
Average				110	119	90
Standard deviation				19.7	25.2	21.9
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count

CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (17th. test cycle : 2013. 10. 23) - Basic water parameters

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Water temperature (℃)	21.46	21.27	21.21	21.43	21.25	21.17	21.45	21.44	21.66
	21.39	21.25	21.25	21.24	21.17	21.25	21.48	21.38	21.58
	21.43	21.28	21.47	21.44	21.38	21.37	21.49	21.44	21.54
Average	21.43	21.27	21.31	21.37	21.27	21.26	21.47	21.42	21.59
Standard deviation	0.04	0.02	0.14	0.11	0.11	0.10	0.02	0.03	0.06
pH	8.20	8.19	8.19	8.19	8.22	8.21	7.39	7.44	7.47
	8.19	8.21	8.20	8.20	8.21	8.21	7.33	7.43	7.47
	8.21	8.21	8.20	8.22	8.21	8.21	7.31	7.41	7.46
Average	8.20	8.20	8.20	8.20	8.21	8.21	7.34	7.43	7.47
Standard deviation	0.01	0.01	0.01	0.02	0.01	0.00	0.04	0.02	0.01
ORP (mV)	264	256	251	259	251	246	483	680	687
	261	254	250	254	249	245	510	682	689
	255	252	248	253	248	245	541	684	690
Average	260	254	250	255	249	245	511	682	689
Standard deviation	5	2	2	3	2	1	29	2	2
Salinity (PSU)	21.19	21.13	21.24	21.27	21.33	21.28	21.66	21.70	21.66
	21.23	21.30	21.29	21.26	21.33	21.29	21.68	21.72	21.71
	21.27	21.30	21.26	21.27	21.34	21.27	21.69	21.72	21.70
Average	21.25	21.24	21.26	21.27	21.33	21.28	21.68	21.71	21.69
Standard deviation	0.05	0.10	0.03	0.01	0.01	0.01	0.02	0.01	0.03
DO (mg/L)	7.80	7.81	7.82	7.83	7.83	7.86	6.69	6.77	7.04
	7.83	7.84	7.83	7.86	7.86	7.85	6.87	6.88	7.10
	7.87	7.82	7.82	7.85	7.84	7.82	6.65	6.96	6.99
Average	7.83	7.82	7.82	7.85	7.84	7.84	6.74	6.87	7.04
Standard deviation	0.04	0.02	0.01	0.02	0.02	0.02	0.12	0.10	0.06
Turbidity (NTU)	17.2	20.4	18.3	17.1	19.0	18.0	15.3	17.5	15.0
	17.5	20.1	17.5	16.5	19.7	18.4	15.0	17.1	16.3
	16.4	19.7	19.3	17.5	18.9	18.6	14.3	16.8	15.4
Average	17.0	20.1	18.4	17.0	19.2	18.3	14.9	17.1	15.6
Standard deviation	0.57	0.35	0.90	0.50	0.44	0.31	0.51	0.35	0.67
TSS (mg/L)	94.0	133.6	110.4	106.0	102.4	106.8	94.4	100.0	96.4
	105.2	119.6	109.2	116.8	103.2	107.6	97.2	102.0	100.0
	105.6	139.6	114.4	122.4	117.2	111.6	100.4	101.2	99.2
Average	101.6	130.9	111.3	115.1	107.6	108.7	97.3	101.1	98.5
Standard deviation	6.58	10.3	2.72	8.34	8.32	2.57	3.00	1.01	1.89
DOC (mg/L)	7.60	7.57	7.53	7.50	7.71	7.63	7.76	7.45	7.38
POC (mg/L)	6.39	6.86	5.68	5.96	5.45	5.29	6.93	6.61	6.30

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- Ballasting (17th. test cycle : 2013. 10. 23) - Viable organisms (Plankton)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
≥ 50 μm (inds/m³)	267 000	250 000	264 000	182 000	190 000	174 000	7 800	14 800	13 300
	258 000	240 000	243 000	173 000	182 000	172 000	9 000	13 200	13 900
	262 000	226 000	244 000	187 000	187 000	179 000	7 400	14 000	14 100
Average	262 334	238 667	250 334	180 667	186 334	175 000	8 067	14 000	13 767
Standard deviation	4 509.2	12 055.4	11 846.2	7 094.6	4 041.5	3 605.6	832.7	800.0	416.3
≥ 10 μm and < 50 μm (inds/mL)	1 780	1 342	1 422	1 898	1 673	1 615	0.0	0.0	0.0
	1 345	1 222	1 196	1 747	1 624	1 419	0.1	0.0	0.0
	1 389	1 264	1 370	1 692	1 452	1 634	0.0	0.0	0.0
Average	1 505	1 276	1 330	1 779	1 583	1 556	0.1	0.0	0.0
Standard deviation	239.5	60.9	118.4	106.7	116.1	119.0	0.1	0.0	0.0

- Ballasting (17th. test cycle : 2013. 10. 23) - Viable organisms (Bacteria)

Test item	Test water			Control water			Treated water		
	B	M	E	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	24 600	25 600	23 500	27 100	24 600	24 800	10	10	0
	21 600	24 100	26 000	22 100	25 700	21 600	0	0	0
	23 900	22 200	26 200	22 800	26 600	21 800	0	0	0
Average	23 434	23 967	25 234	24 000	25 634	22 734	4	4	0
Standard deviation	1 650.3	1 703.9	1 504.4	2 707.4	1 001.7	1 792.6	5.8	5.8	0.0
Coliform (CFU/100 mL)	16	26	16	30	12	16	0	0	0
	6	12	22	24	14	8	0	0	0
	4	18	24	18	18	10	0	0	0
Average	9	19	21	24	15	12	0	0	0
Standard deviation	6.4	7.0	4.2	6.0	3.1	4.2	0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	4	0	0	0	2	2	0	0	0
	0	0	0	0	0	4	0	0	0
	0	0	0	0	0	4	0	0	0
Average	2	0	0	0	1	4	0	0	0
Standard deviation	2.3	0.0	0.0	0.0	1.2	1.2	0.0	0.0	0.0
Enterococci (CFU/100 mL)	216	162	226	220	258	220	0	0	0
	188	148	188	184	216	242	0	0	0
	222	192	176	226	222	216	0	0	0
Average	209	168	197	210	232	226	0	0	0
Standard deviation	18.1	22.5	26.1	22.7	22.7	14.0	0.0	0.0	0.0
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=

IV. To be continued

- de-Ballasting (17th. test cycle : 2013. 10. 28) - Basic water parameters

Test item	Control water			Treated water		
	B	M	E	B	M	E
Water temperature (℃)	19.02	18.97	19.15	18.67	18.95	18.55
	18.56	18.99	19.18	18.69	18.60	18.74
	18.69	18.75	18.83	18.62	18.64	18.57
Average	18.76	18.90	19.05	18.66	18.73	18.62
Standard deviation	0.24	0.13	0.19	0.04	0.19	0.10
pH	7.20	7.18	7.30	7.14	7.09	7.10
	7.12	7.21	7.27	7.19	7.10	7.14
	7.15	7.19	7.27	7.15	7.09	7.13
Average	7.16	7.19	7.28	7.16	7.09	7.12
Standard deviation	0.04	0.02	0.02	0.03	0.01	0.02
ORP (mV)	293	312	294	276	306	296
	290	300	290	275	303	292
	286	294	287	274	301	290
Average	290	302	290	275	303	293
Standard deviation	4	9	4	1	3	3
Salinity (PSU)	21.13	21.18	21.06	21.21	21.14	21.21
	21.25	21.19	21.27	21.21	21.24	20.97
	21.19	21.24	21.27	21.20	21.25	21.25
Average	21.19	21.20	21.20	21.21	21.21	21.14
Standard deviation	0.06	0.03	0.12	0.01	0.06	0.15
DO (mg/L)	6.83	7.23	7.09	7.02	7.00	7.21
	6.91	7.03	7.18	7.11	7.09	7.23
	6.83	7.04	7.24	7.11	7.09	7.24
Average	6.86	7.10	7.17	7.08	7.06	7.23
Standard deviation	0.05	0.11	0.08	0.05	0.05	0.02
Turbidity (NTU)	13.2	15.9	19.2	17.4	18.3	16.1
	12.5	16.4	18.3	18.5	17.4	17.2
	13.7	15.4	18.2	17.3	18.0	16.5
Average	13.1	15.9	18.6	17.7	17.9	16.6
Standard deviation	0.60	0.50	0.55	0.67	0.46	0.56
TSS (mg/L)	43.6	45.6	50.0	53.6	55.2	54.4
	41.6	46.4	50.4	54.4	50.8	55.2
	40.4	47.2	51.2	62.8	56.0	56.4
Average	41.9	46.4	50.5	56.9	54.0	55.3
Standard deviation	1.62	0.80	0.61	5.10	2.80	1.01
DOC (mg/L)	5.06	4.85	4.93	2.18	2.22	2.24
POC (mg/L)	3.77	4.84	5.08	6.09	6.09	5.72

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTuIE=

IV. To be continued

- de-Ballasting (17th. test cycle : 2013. 10. 28) - Viable organisms (Plankton)

Test item	Control water			Treated water		
	B	M	E	B	M	E
≥ 50 μm (inds/m^3)	19 500	16 000	22 000	6*	12*	1*
	18 000	12 000	22 500			
	16 000	12 500	16 500			
Average	17 834	13 500	20 334			
Standard deviation	1 755.9	2 179.4	3 329.2			
≥ 10 μm and < 50 μm (inds/mL)	1 340	1 461	1 512	2.0	2.7	2.7
	1 371	1 404	1 287	2.4	2.0	1.9
	1 496	1 468	1 418	4.4	1.8	1.9
Average	1 403	1 445	1 406	3.0	2.2	2.2
Standard deviation	82.6	35.1	113.0	1.3	0.5	0.5

* Analysed entire sample volume

- de-Ballasting (17th. test cycle : 2013. 10. 28) - Viable organisms (Bacteria)

Test item	Control water			Treated water		
	B	M	E	B	M	E
Heterotrophic Bacteria (CFU/mL)	14 400	17 700	15 200	1 260	1 870	1 500
	15 000	13 600	17 500	1 440	1 660	1 550
	14 800	16 900	14 300	1 140	1 600	2 080
Average	14 734	16 067	15 667	1 280	1 710	1 710
Standard deviation	305.5	2 173.3	1 650.3	151.0	141.8	321.4
Coliform (CFU/100 mL)	6	2	2	0	0	0
	0	0	10	0	0	0
	0	0	0	0	0	0
Average	2	1	4	0	0	0
Standard deviation	3.5	1.2	5.3	0.0	0.0	0.0
Escherichia coli (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0
Enterococci (CFU/100 mL)	TNTC*	TNTC*	TNTC*	1	5	9
	TNTC*	TNTC*	TNTC*	6	10	5
	TNTC*	TNTC*	TNTC*	6	9	5
Average				5	8	7
Standard deviation				2.9	2.6	2.3
Toxicogenic *Vibrio cholerae* (O1, O139) (CFU/100 mL)	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Average	0	0	0	0	0	0
Standard deviation	0.0	0.0	0.0	0.0	0.0	0.0

* Too Numerous To Count

CFU, Colony Forming Unit

G4B(www.g4b.go.kr)진위확인코드 : bVbrDRVTulE=