

ภาคผนวก ค

หนังสือรับรองผลการตรวจวัดและวิเคราะห์



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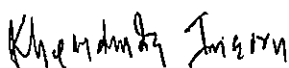
239 ถนนริมคลองประปา แขวงบางซื่อ เขตบางซื่อ กรุงเทพมหานคร 10800
239 RIMKLONGPRAPA ROAD, BANGSUE, BANGKOK 10800, THAILAND
TEL. (662) 959-3600 FAX (662) 959-3535 Website : secot.co.th E-mail : envserv@secot.co.th

GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd. (Feeder Line Project)	REQUEST SERVICE No.	: 1822/68
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: -
SAMPLING DATE	: 25/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 11:17-11:48
ANALYTICAL DATE	: 25,27/09/2025-01/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: -
SAMPLE CONDITION	: เหลือingใส	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS	ND	STATION
		METHODS	(non-detectable)	MW-2
Depth	m	-	-	4.03
Temperature	°C	2550 B	< 0.5	30.3
Color	Unit	2120 B	< 5.0	5.0
Conductivity	µS/cm	2510 B	< 1.0	2,504
Total Dissolved Solids	mg/l	2540 C	< 25	1,376
Total Suspended Solids	mg/l	2540 D	< 2.5	90

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA, APHA, WEF)



(Miss Khemchuda Insorn)

Analyst



(Mrs. Araya Tipparuk)

Technical Management Team

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3. - Not available.



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ANALYTICAL DATE	: 25,27/09/2025-02/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: 7-239-ท-0025
SAMPLE CONDITION	: เหลือใน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND	STATION	STANDARD ¹⁾
			(non-detectable)	MW-2	
pH	-	4500-H ⁺ B	< 0.10	5.48	-
Benzene	mg/l	6200 B	< 0.0002	ND	≤ 0.2
Carbon tetrachloride	mg/l	6200 B	< 0.0002	ND	≤ 0.4
1,2-Dichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.5
Dichloromethane	mg/l	6200 B	< 0.0002	ND	≤ 6.0
1,1-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.1
cis-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
trans-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
Ethylbenzene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
Styrene	mg/l	6200 B	< 0.0002	ND	≤ 24
Tetrachloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.9
Toluene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
1,1,1-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.2
1,1,2-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.8
Trichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 4.4
m-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
o-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
p-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
Total Xylenes	mg/l	6200 B	< 0.0006	ND	≤ 24
Vinyl Chloride	mg/l	6200 B	< 0.0005	ND	≤ 0.03

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA, APHA, WEF)

Jutarat Jaemruen

(Miss Jutarat Jaemruen)

Analyst

REG. NO. 7-239-ท-0022

(Mrs. Araya Tipparuk)

Technical Management Team

REG. NO. 7-239-ท-0004

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SAMPLE CONDITION	: เหลืองใส		

PARAMETER	UNIT	ANALYSIS METHODS	ND	STATION	STANDARD ^{1/}
			(non-detectable)	MW-2	
<u>Total Petroleum Hydrocarbons</u>					
- C ₅ -C ₈	mg/l	5030 C / 8260 D	< 0.003	ND	≤ 1.4
- Pentane					
- Benzene					
- Toluene					
- m,p-Xylene					
- o-Xylene					
-C ₉ -C ₁₆	mg/l	3510 C / 8015 D	< 0.025	ND	≤ 1.7
- n-Nonane					
- n-Decane					
- n-Dodecane					
- n-Tetradecane					
- n-Hexadecane					
-C ₁₇ -C ₃₅	mg/l	3510 C / 8015 D	< 0.050	ND	≤ 0.1
- n-Octadecane					
- n-Eicosane					
- n-Docosane					
- n-Tetracosane					
- n-Hexacosane					
- n-Octacosane					
- n-Triacontane					
- n-Dotriacontane					
- n-Tetratriacontane					
- Pentatriacontane					

REFERENCE : US EPA SW 846 TEST METHODS FOR EVALUATING WATER AND SOLID WASTE, 3rd ED., 2020

Jutarat Jaemruen

(Miss Jutarat Jaemruen)

Analyst

REG. NO. 7-239-0-0022

Araya Tipparuk

(Mrs. Araya Tipparuk)

Technical Management Team

REG. NO. 7-239-0-0004

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SAMPLING DATE	: 25/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 13:24-13:36
ANALYTICAL DATE	: 25,27/09/2025-01/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: -
SAMPLE CONDITION	: เหลืองใส	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS	ND	STATION
		METHODS	(non-detectable)	MW-4
Depth	m	-	-	3.61
Temperature	°C	2550 B	< 0.5	31.7
Color	Unit	2120 B	< 5.0	35
Conductivity	µS/cm	2510 B	< 1.0	733
Total Dissolved Solids	mg/l	2540 C	< 25	424
Total Suspended Solids	mg/l	2540 D	< 2.5	88

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA, APHA, WEF)

(Miss Khemchuda Insorn)

Analyst

(Mrs. Araya Tipparuk)

Technical Management Team

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REPORT DATE	: 08/10/2025		: จ-239-จ-0025
SAMPLE CONDITION	: เหลืองใส	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION	STANDARD ¹⁾
				MW-4	
pH	-	4500-H ¹ B	< 0.10	6.62	-
Benzene	mg/l	6200 B	< 0.0002	ND	≤ 0.2
Carbon tetrachloride	mg/l	6200 B	< 0.0002	ND	≤ 0.4
1,2-Dichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.5
Dichloromethane	mg/l	6200 B	< 0.0002	ND	≤ 6.0
1,1-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.1
cis-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
trans-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
Ethylbenzene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
Styrene	mg/l	6200 B	< 0.0002	ND	≤ 24
Tetrachloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.9
Toluene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
1,1,1-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.2
1,1,2-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.8
Trichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 4.4
m-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
o-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
p-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
Total Xylenes	mg/l	6200 B	< 0.0006	ND	≤ 24
Vinyl Chloride	mg/l	6200 B	< 0.0005	ND	≤ 0.03

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA APHA WEF)

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(Miss Jutarat Jaemruen)

Analyst

REG. NO. จ-239-จ-0022

AR

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SAMPLE CONDITION	: เหลือองไข่	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION MW-4	STANDARD ¹⁾
Total Petroleum Hydrocarbons					
- C ₅ -C ₈	mg/l	5030 C / 8260 D	< 0.003	ND	≤ 1.4
- Pentane					
- Benzene					
- Toluene					
- m,p-Xylene					
- o-Xylene					
- C ₉ -C ₁₆	mg/l	3510 C / 8015 D	< 0.025	ND	≤ 1.7
- n-Nonane					
- n-Decane					
- n-Dodecane					
- n-Tetradecane					
- n-Hexadecane					
- C ₁₆ -C ₃₅	mg/l	3510 C / 8015 D	< 0.050	ND	≤ 0.1
- n-Octadecane					
- n-Eicosane					
- n-Docosane					
- n-Tetracosane					
- n-Hexacosane					
- n-Octacosane					
- n-Triacontane					
- n-Dotriacontane					
- n-Tetracontane					
- Pentatriacontane					

REFERENCE : US EPA SW 846 TEST METHODS FOR EVALUATING WATER AND SOLID WASTE, 3rd ED., 2020

Jutarat Jaemruen

(Miss Jutarat Jaemruen)

Analyst

REG. NO. 7-239-0-0022

(Mrs. Araya Tipparuk)

(Mrs. Araya Tipparuk)

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SAMPLING DATE	: 26/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
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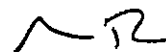
PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION
				MW-6
Depth	m	-	-	4.20
Temperature	°C	2550 B	< 0.5	31.4
Color	Unit	2120 B	< 5.0	90
Conductivity	µS/cm	2510 B	< 1.0	1,009
Total Dissolved Solids	mg/l	2540 C	< 25	600
Total Suspended Solids	mg/l	2540 D	< 2.5	31

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA, APHA, WEF)



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PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION	STANDARD ^{1/}
				MW-6	
pH	-	4500-H ⁺ B	<0.10	6.56	-
Benzene	mg/l	6200 B	<0.0002	ND	≤0.2
Carbon tetrachloride	mg/l	6200 B	<0.0002	ND	≤0.4
1,2-Dichloroethane	mg/l	6200 B	<0.0002	ND	≤0.5
Dichloromethane	mg/l	6200 B	<0.0002	ND	≤6.0
1,1-Dichloroethylene	mg/l	6200 B	<0.0002	ND	≤0.1
cis-1,2-Dichloroethylene	mg/l	6200 B	<0.0002	ND	≤2.0
trans-1,2-Dichloroethylene	mg/l	6200 B	<0.0002	ND	≤5.0
Ethylbenzene	mg/l	6200 B	<0.0002	ND	≤2.0
Styrene	mg/l	6200 B	<0.0002	ND	≤24
Tetrachloroethylene	mg/l	6200 B	<0.0002	ND	≤0.9
Toluene	mg/l	6200 B	<0.0002	ND	≤5.0
1,1,1-Trichloroethane	mg/l	6200 B	<0.0002	ND	≤0.2
1,1,2-Trichloroethane	mg/l	6200 B	<0.0002	ND	≤0.8
Trichloroethylene	mg/l	6200 B	<0.0002	ND	≤4.4
m-Xylene	mg/l	6200 B	<0.0002	0.0006	≤24
o-Xylene	mg/l	6200 B	<0.0002	0.0003	≤24
p-Xylene	mg/l	6200 B	<0.0002	0.0002	≤24
Total Xylenes	mg/l	6200 B	<0.0006	0.0011	≤24
Vinyl Chloride	mg/l	6200 B	<0.0005	ND	≤0.03

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED., 2017 (AWWA, APHA, WEF)

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PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION MW-6	STANDARD ^{1/}
Total Petroleum Hydrocarbons					
- C ₅ -C ₈	mg/l	5030 C / 8260 D	< 0.003	0.013	≤ 1.4
- Pentane					
- Benzene					
- Toluene					
- m,p-Xylene					
- o-Xylene					
- C ₉ -C ₁₆	mg/l	3510 C / 8015 D	< 0.025	0.118	≤ 1.7
- n-Nonane					
- n-Decane					
- n-Dodecane					
- n-Tetradecane					
- n-Hexadecane					
- C ₁₆ -C ₃₅	mg/l	3510 C / 8015 D	< 0.050	ND	≤ 0.1
- n-Octadecane					
- n-Eicosane					
- n-Docosane					
- n-Tetracosane					
- n-Hexacosane					
- n-Octacosane					
- n-Triacontane					
- n-Dotriacontane					
- n-Tetatriacontane					
- Pentatriacontane					

REFERENCE : US EPA SW 846 TEST METHODS FOR EVALUATING WATER AND SOLID WASTE. 3rd ED., 2020

Jutarat Jaemruen

(Miss Jutarat Jaemruen)

Analyst

REG. NO. 7-239-7-0022

Araya Tipparuk

(Mrs. Araya Tipparuk)

Technical Management Team

REG. NO. 7-239-7-0004

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GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd. (Feeder Line Project)	REQUEST SERVICE No.	: 1822/68
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: -
SAMPLING DATE	: 26/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 13:15-13:38
ANALYTICAL DATE	: 26,27/09/2025-01/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: -
SAMPLE CONDITION	: เหลือองุ่น	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS	ND	STATION
		METHODS	(non-detectable)	MW-7
Depth	m	-	-	2.40
Temperature	°C	2550 B	< 0.5	32.3
Color	Unit	2120 B	< 5.0	25
Conductivity	µS/cm	2510 B	< 1.0	261
Total Dissolved Solids	mg/l	2540 C	< 25	192
Total Suspended Solids	mg/l	2540 D	< 2.5	22

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED., 2017 (AWWA, APHA, WEF)

(Miss Khemchuda Insorn)

Analyst

(Mrs. Araya Tipparuk)

Technical Management Team

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GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd.	REQUEST SERVICE No.	: 1822/68
	(Feeder Line Project)		
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: 7-239
SAMPLING DATE	: 26/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 13:15-13:38
ANALYTICAL DATE	: 26,27/09/2025-02/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: 7-239-9-0025
SAMPLE CONDITION	: เหลือไอศ	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION	STANDARD ^{1/}
				MW-7	
pH	-	4500-H ⁺ B	< 0.10	6.99	-
Benzene	mg/l	6200 B	< 0.0002	ND	≤ 0.2
Carbon tetrachloride	mg/l	6200 B	< 0.0002	ND	≤ 0.4
1,2-Dichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.5
Dichloromethane	mg/l	6200 B	< 0.0002	ND	≤ 6.0
1,1-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.1
cis-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
trans-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
Ethylbenzene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
Styrene	mg/l	6200 B	< 0.0002	ND	≤ 24
Tetrachloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.9
Toluene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
1,1,1-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.2
1,1,2-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.8
Trichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 4.4
m-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
o-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
p-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
Total Xylenes	mg/l	6200 B	< 0.0006	ND	≤ 24
Vinyl Chloride	mg/l	6200 B	< 0.0005	ND	≤ 0.03

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA, APHA, WEF)

Jutarat Jaemruen

(Miss Jutarat Jaemruen)

Analyst

REG. NO. 7-239-9-0022

(Signature)

(Mrs. Araya Tipparuk)

Technical Management Team

REG. NO. 7-239-9-0004

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SAMPLE CONDITION	: เหลือียงใส	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION MW-7	STANDARD ¹⁾
<u>Total Petroleum Hydrocarbons</u>					
- C ₅ -C ₈	mg/l	5030 C / 8260 D	< 0.003	ND	≤ 1.4
- Pentane					
- Benzene					
- Toluene					
- m,p-Xylene					
- o-Xylene					
- C ₉ -C ₁₆	mg/l	3510 C / 8015 D	< 0.025	ND	≤ 1.7
- n-Nonane					
- n-Decane					
- n-Dodecane					
- n-Tetradecane					
- n-Hexadecane					
- C ₁₇ -C ₃₅	mg/l	3510 C / 8015 D	< 0.050	ND	≤ 0.1
- n-Octadecane					
- n-Eicosane					
- n-Docosane					
- n-Tetracosane					
- n-Hexacosane					
- n-Octacosane					
- n-Triacontane					
- n-Dotriacontane					
- n-Tetracontane					
- Pentatriacontane					

REFERENCE : US EPA SW 846 TEST METHODS FOR EVALUATING WATER AND SOLID WASTE, 3rd ED., 2020

Jutarat Jaemruen

(Miss Jutarat Jaemruen)

Analyst

REG. NO. 7-239-9-0022

Araya Tipparuk

(Mrs. Araya Tipparuk)

Technical Management Team

REG. NO. 7-239-9-0004

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GROUND WATER ANALYSIS REPORT

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SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: -
SAMPLING DATE	: 25/10/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 15:03-16:07
ANALYTICAL DATE	: 25,27/09/2025-01/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: -
SAMPLE CONDITION	: เหลืองใต้มีตะกอนเล็กน้อย	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS	ND	STATION
		METHODS	(non-detectable)	MW-8
Depth	m	-	-	4.63
Temperature	°C	2550 B	< 0.5	34.2
Color	Unit	2120 B	< 5.0	10
Conductivity	µS/cm	2510 B	< 1.0	5,468
Total Dissolved Solids	mg/l	2540 C	< 25	3,412
Total Suspended Solids	mg/l	2540 D	< 2.5	155

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA, APHA, WEF)

(Miss Khemchuda Insorn)

Analyst

(Mrs. Araya Tipparuk)

Technical Management Team

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REPORT DATE	: 08/10/2025		: 7-239-0-0025
SAMPLE CONDITION	: เหลือถังเก็บตะกอนเล็กน้อย	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION	STANDARD ¹⁾
				MW-8	
pH	-	4500-H ⁺ B	< 0.10	5.15	-
Benzene	mg/l	6200 B	< 0.0002	ND	≤ 0.2
Carbon tetrachloride	mg/l	6200 B	< 0.0002	ND	≤ 0.4
1,2-Dichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.5
Dichloromethane	mg/l	6200 B	< 0.0002	ND	≤ 6.0
1,1-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.1
cis-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
trans-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
Ethylbenzene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
Styrene	mg/l	6200 B	< 0.0002	ND	≤ 24
Tetrachloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.9
Toluene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
1,1,1-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.2
1,1,2-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.8
Trichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 4.4
m-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
o-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
p-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
Total Xylenes	mg/l	6200 B	< 0.0006	ND	≤ 24
Vinyl Chloride	mg/l	6200 B	< 0.0005	ND	≤ 0.03

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA, APHA, WEF)

Jutarat Jaemruen

(Miss Jutarat Jaemruen)

Analyst

REG. NO. 7-239-0-0022

Araya Tipparuk

(Mrs. Araya Tipparuk)

Technical Management Team

REG. NO. 7-239-0-0004

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SAMPLE CONDITION	: เหลืองใสมีตะกอนเล็กน้อย	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION MW-8	STANDARD ^{1/}
Total Petroleum Hydrocarbons					
- C ₅ -C ₈	mg/l	5030 C / 8260 D	< 0.003	ND	≤ 1.4
- Pentane					
- Benzene					
- Toluene					
- m,p-Xylene					
- o-Xylene					
- C ₉ -C ₁₆	mg/l	3510 C / 8015 D	< 0.025	ND	≤ 1.7
- n-Nonane					
- n-Decane					
- n-Dodecane					
- n-Tetradecane					
- n-Hexadecane					
- C ₁₇ -C ₃₅	mg/l	3510 C / 8015 D	< 0.050	ND	≤ 0.1
- n-Octadecane					
- n-Eicosane					
- n-Docosane					
- n-Tetracosane					
- n-Hexacosane					
- n-Octacosane					
- n-Triacontane					
- n-Dotriacontane					
- n-Tetratriacontane					
- Pentatriacontane					

REFERENCE : US EPA SW 846 TEST METHODS FOR EVALUATING WATER AND SOLID WASTE, 3rd ED., 2020

Jutarat Jaemruen
(Miss Jutarat Jaemruen)

Analyst

REG. NO. 2-239-2-0022

(Mrs. Araya Tipparuk)
(Mrs. Araya Tipparuk)

Technical Management Team

REG. NO. 2-239-2-0004

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SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: -
SAMPLING DATE	: 26/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 09:24-09:49
ANALYTICAL DATE	: 26,27/09/2025-01/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: -
SAMPLE CONDITION	: เหลืองใส	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS	ND	STATION
		METHODS	(non-detectable)	MW-10
Depth	m	-	-	3.45
Temperature	°C	2550 B	< 0.5	33.5
Color	Unit	2120 B	< 5.0	80
Conductivity	µS/cm	2510 B	< 1.0	520
Total Dissolved Solids	mg/l	2540 C	< 25	338
Total Suspended Solids	mg/l	2540 D	< 2.5	49

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED., 2017 (AWWA, APHA, WEF)

(Miss Khemchuda Insorn)

Analyst

(Mrs. Araya Tipparuk)

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SAMPLE CONDITION	: เหลือใส	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION	STANDARD ^{1/}
				MW-10	
pH	-	4500-H ⁺ B	< 0.10	6.61	-
Benzene	mg/l	6200 B	< 0.0002	ND	≤ 0.2
Carbon tetrachloride	mg/l	6200 B	< 0.0002	ND	≤ 0.4
1,2-Dichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.5
Dichloromethane	mg/l	6200 B	< 0.0002	ND	≤ 6.0
1,1-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.1
cis-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
trans-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
Ethylbenzene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
Styrene	mg/l	6200 B	< 0.0002	ND	≤ 24
Tetrachloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.9
Toluene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
1,1,1-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.2
1,1,2-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.8
Trichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 4.4
m-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
o-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
p-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
Total Xylenes	mg/l	6200 B	< 0.0006	ND	≤ 24
Vinyl Chloride	mg/l	6200 B	< 0.0005	ND	≤ 0.03

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA, APHA, WEF)

Jutarat Jaemruen

(Miss Jutarat Jaemruen)

Analyst

REG. NO. 2-239-0-0022

(Mrs. Araya Tipparuk)

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SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: ๓-239
SAMPLING DATE	: 26/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 09:24-09:49
ANALYTICAL DATE	: 29/09/2025-02/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: ๓-239-๑-0025
SAMPLE CONDITION	: เหลือองใส่	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION MW-10	STANDARD ^{1/}
Total Petroleum Hydrocarbons					
- C ₅ -C ₈	mg/l	5030 C / 8260 D	< 0.003	ND	≤ 1.4
- Pentane					
- Benzene					
- Toluene					
- m,p-Xylene					
- o-Xylene					
- C ₉ -C ₁₆	mg/l	3510 C / 8015 D	< 0.025	ND	≤ 1.7
- n-Nonane					
- n-Decane					
- n-Dodecane					
- n-Tetradecane					
- n-Hexadecane					
- C ₁₆ -C ₃₅	mg/l	3510 C / 8015 D	< 0.050	ND	≤ 0.1
- n-Octadecane					
- n-Eicosane					
- n-Docosane					
- n-Tetracosane					
- n-Hexacosane					
- n-Octacosane					
- n-Triacontane					
- n-Dotriacontane					
- n-Tetracontane					
- Pentatriacontane					

REFERENCE : US EPA SW 846 TEST METHODS FOR EVALUATING WATER AND SOLID WASTE, 3rd ED., 2020

Jutarat Jaemruen

(Miss Jutarat Jaemruen)

Analyst

REG. NO. ๓-239-๑-0022

Araya Tipparuk

(Mrs. Araya Tipparuk)

Technical Management Team

REG. NO. ๓-239-๑-0004

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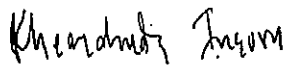
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TEL. (662) 959-3600 FAX (662) 959-3535 Website : secot.co.th E-mail : envserv@secot.co.th

GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd. (Feeder Line Project)	REQUEST SERVICE No.	: 1822/68
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: -
SAMPLING DATE	: 26/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 14:06-14:25
ANALYTICAL DATE	: 26,27/09/2025-01/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: -
SAMPLE CONDITION	: เหลืองใสมีตะกอนเล็กน้อย	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION
				MW-16
Depth	m	-	-	4.23
Temperature	°C	2550 B	< 0.5	30.7
Color	Unit	2120 B	< 5.0	30
Conductivity	µS/cm	2510 B	< 1.0	570
Total Dissolved Solids	mg/l	2540 C	< 25	362
Total Suspended Solids	mg/l	2540 D	< 2.5	118

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA, APHA, WEF)



(Miss Khemchuda Insorn)

Analyst



(Mrs. Araya Tipparuk)

Technical Management Team

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GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd. (Feeder Line Project)	REQUEST SERVICE No.	: 1822/68
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: 7-239
SAMPLING DATE	: 26/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 14:06-14:25
ANALYTICAL DATE	: 26,27/09/2025-02/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: 7-239-0-0025
SAMPLE CONDITION	: เหลืองใสมีตะกอนเล็กน้อย	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION	STANDARD ^{1/}
				MW-16	
pH	-	4500-H ⁺ B	< 0.10	6.66	-
Benzene	mg/l	6200 B	< 0.0002	ND	≤ 0.2
Carbon tetrachloride	mg/l	6200 B	< 0.0002	ND	≤ 0.4
1,2-Dichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.5
Dichloromethane	mg/l	6200 B	< 0.0002	ND	≤ 6.0
1,1-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.1
cis-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
trans-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
Ethylbenzene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
Styrene	mg/l	6200 B	< 0.0002	ND	≤ 24
Tetrachloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.9
Toluene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
1,1,1-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.2
1,1,2-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.8
Trichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 4.4
m-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
o-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
p-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
Total Xylenes	mg/l	6200 B	< 0.0006	ND	≤ 24
Vinyl Chloride	mg/l	6200 B	< 0.0005	ND	≤ 0.03

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA, APHA, WEF)

Jutarat Jaemruen

(Miss Jutarat Jaemruen)

Analyst

REG. NO. 7-239-0-0022

(Signature)

(Mrs. Araya Tipparuk)

Technical Management Team

REG. NO. 7-239-0-0004

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GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd. (Feeder Line Project)	REQUEST SERVICE No.	: 1822/68
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: 2-239
SAMPLING DATE	: 26/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 14:06-14:25
ANALYTICAL DATE	: 29/09/2025-02/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: 2-239-0-0025
SAMPLE CONDITION	: เหลืองใสมีตะกอนเล็กน้อย	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION MW-16	STANDARD ^{1/}
Total Petroleum Hydrocarbons					
- C ₅ -C ₈	mg/l	5030 C / 8260 D	< 0.003	ND	≤ 1.4
- Pentane					
- Benzene					
- Toluene					
- m,p-Xylene					
- o-Xylene					
- C ₉ -C ₁₆	mg/l	3510 C / 8015 D	< 0.025	ND	≤ 1.7
- n-Nonane					
- n-Decane					
- n-Dodecane					
- n-Tetradecane					
- n-Hexadecane					
- C ₁₆ -C ₃₅	mg/l	3510 C / 8015 D	< 0.050	ND	≤ 0.1
- n-Octadecane					
- n-Eicosane					
- n-Docosane					
- n-Tetracosane					
- n-Hexacosane					
- n-Octacosane					
- n-Triacontane					
- n-Dotriacontane					
- n-Tetracontane					
- Pentatriacontane					

REFERENCE : US EPA SW 846 TEST METHODS FOR EVALUATING WATER AND SOLID WASTE, 3rd ED., 2020

Jutarat Jaemruen
(Miss Jutarat Jaemruen)

Analyst

REG. NO. 2-239-0-0022

Araya Tipparuk

(Mrs. Araya Tipparuk)

Technical Management Team

REG. NO. 2-239-0-0004

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239 RIMKLONGPRAPA ROAD, BANGSUE, BANGKOK 10800, THAILAND
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GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd. (Feeder Line Project)	REQUEST SERVICE No.	: 1822/68
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: -
SAMPLING DATE	: 26/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 10:26-11:07
ANALYTICAL DATE	: 26,27/09/2025-01/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: -
SAMPLE CONDITION	: เหลืองใสมีตะกอน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS	ND	STATION
		METHODS	(non-detectable)	GW-1
Depth	m	-	-	3.90
Temperature	°C	2550 B	< 0.5	31.8
Color	Unit	2120 B	< 5.0	10
Conductivity	µS/cm	2510 B	< 1.0	5,392
Total Dissolved Solids	mg/l	2540 C	< 25	3,756
Total Suspended Solids	mg/l	2540 D	< 2.5	70

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA, APHA, WEF)

(Miss Khemchuda Insorn)

Analyst

(Mrs. Araya Tipparuk)

Technical Management Team

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GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd.	REQUEST SERVICE No.	: 1822/68
	(Feeder Line.Project)		
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: 7-239
SAMPLING DATE	: 26/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 10:26-11:07
ANALYTICAL DATE	: 26,27/09/2025-02/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: 7-239-จ-0025
SAMPLE CONDITION	: เหลืองใสมีตะกอน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION	STANDARD ¹⁾
				GW-1	
pH	-	4500-H ⁺ B	< 0.10	5.05	-
Benzene	mg/l	6200 B	< 0.0002	ND	≤ 0.2
Carbon tetrachloride	mg/l	6200 B	< 0.0002	ND	≤ 0.4
1,2-Dichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.5
Dichloromethane	mg/l	6200 B	< 0.0002	ND	≤ 6.0
1,1-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.1
cis-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
trans-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
Ethylbenzene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
Styrene	mg/l	6200 B	< 0.0002	ND	≤ 24
Tetrachloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.9
Toluene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
1,1,1-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.2
1,1,2-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.8
Trichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 4.4
m-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
o-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
p-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
Total Xylenes	mg/l	6200 B	< 0.0006	ND	≤ 24
Vinyl Chloride	mg/l	6200 B	< 0.0005	ND	≤ 0.03

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA APHA WEF)

Jutarat Jaemruen
(Miss Jutarat Jaemruen)

Analyst

REG. NO. 7-239-จ-0022

(Mrs. Araya Tipparuk)

Technical Management Team

REG. NO. 7-239-ท-0004

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GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd. (Feeder Line Project)	REQUEST SERVICE No.	: 1822/68
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: 3-239
SAMPLING DATE	: 26/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 10:26-11:07
ANALYTICAL DATE	: 29/09/2025-02/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: 3-239-0-0025
SAMPLE CONDITION	: เหลือถังไม่มีตะกอน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION GW-1	STANDARD ¹⁾
Total Petroleum Hydrocarbons					
- C ₅ -C ₈	mg/l	5030 C / 8260 D	< 0.003	ND	≤ 1.4
- Pentane					
- Benzene					
- Toluene					
- m,p-Xylene					
- o-Xylene					
- C ₉ -C ₁₆	mg/l	3510 C / 8015 D	< 0.025	ND	≤ 1.7
- n-Nonane					
- n-Decane					
- n-Dodecane					
- n-Tetradecane					
- n-Hexadecane					
- C ₁₆ -C ₃₅	mg/l	3510 C / 8015 D	< 0.050	ND	≤ 0.1
- n-Octadecane					
- n-Eicosane					
- n-Docosane					
- n-Tetracosane					
- n-Hexacosane					
- n-Octacosane					
- n-Triacontane					
- n-Dotriacontane					
- n-Tetratriacontane					
- Pentatriacontane					

REFERENCE : US EPA SW 846 TEST METHODS FOR EVALUATING WATER AND SOLID WASTE, 3rd ED., 2020

Jutarat Jaemruen
(Miss Jutarat Jaemruen)

Analyst

REG. NO. 3-239-0-0022

Araya Tipparuk

(Mrs. Araya Tipparuk)

Technical Management Team

REG. NO. 3-239-0-0004

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SECOT CO., LTD.

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GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd. (Feeder Line Project)	REQUEST SERVICE No.	: 1822/68
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: -
SAMPLING DATE	: 25/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 13:58-14:28
ANALYTICAL DATE	: 25,27/09/2025-01/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: -
SAMPLE CONDITION	: เหลืองใสมีตะกอน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS	ND	STATION
		METHODS	(non-detectable)	GW-4
Depth	m	-	-	3.50
Temperature	°C	2550 B	< 0.5	33.2
Color	Unit	2120 B	< 5.0	150
Conductivity	µS/cm	2510 B	< 1.0	606
Total Dissolved Solids	mg/l	2540 C	< 25	388
Total Suspended Solids	mg/l	2540 D	< 2.5	34

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA.APHA.WEF)

(Miss Khemchuda Insorn)

Analyst

(Mrs. Araya Tipparuk)

Technical Management Team

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GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd.	REQUEST SERVICE No.:	1822/68
	(Feeder Line Project)		
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	ว-239
SAMPLING DATE	: 25/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 13:58-14:28
ANALYTICAL DATE	: 25,27/09/2025-02/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: ว-239-ก-0025
SAMPLE CONDITION	: เหลืองใสมีตะกอน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION GW-4	STANDARD ¹⁾
pH	-	4500-H ⁺ B	< 0.10	6.74	-
Benzene	mg/l	6200 B	< 0.0002	ND	≤ 0.2
Carbon tetrachloride	mg/l	6200 B	< 0.0002	ND	≤ 0.4
1,2-Dichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.5
Dichloromethane	mg/l	6200 B	< 0.0002	ND	≤ 6.0
1,1-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.1
cis-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
trans-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
Ethylbenzene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
Styrene	mg/l	6200 B	< 0.0002	ND	≤ 24
Tetrachloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.9
Toluene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
1,1,1-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.2
1,1,2-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.8
Trichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 4.4
m-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
o-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
p-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
Total Xylenes	mg/l	6200 B	< 0.0006	ND	≤ 24
Vinyl Chloride	mg/l	6200 B	< 0.0005	ND	≤ 0.03

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA APHA WEF)

Jutarat Jaemruen

(Miss Jutarat Jaemruen)

Analyst

REG. NO. ว-239-ก-0022

Araya Tippasuk

(Mrs. Araya Tippasuk)

Technical Management Team

REG. NO. ว-239-ก-0004

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4. - Not available.



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TEL. (662) 959-3600 FAX (662) 959-3535 Website : secot.co.th E-mail : envserv@secot.co.th

GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd. (Feeder Line Project)	REQUEST SERVICE No.	: 1822/68
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: 7-239
SAMPLING DATE	: 25/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 13:58-14:28
ANALYTICAL DATE	: 29/09/2025-02/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: 7-239-7-0025
SAMPLE CONDITION	: เหลือในถังตะกอน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION GW-4	STANDARD ^{1/}
<u>Total Petroleum Hydrocarbons</u>					
- C ₅ -C ₈	mg/l	5030 C / 8260 D	< 0.003	ND	≤ 1.4
- Pentane					
- Benzene					
- Toluene					
- m,p-Xylene					
- o-Xylene					
- C ₉ -C ₁₆	mg/l	3510 C / 8015 D	< 0.025	ND	≤ 1.7
- n-Nonane					
- n-Decane					
- n-Dodecane					
- n-Tetradecane					
- n-Hexadecane					
- C ₁₇ -C ₃₅	mg/l	3510 C / 8015 D	< 0.050	ND	≤ 0.1
- n-Octadecane					
- n-Eicosane					
- n-Docosane					
- n-Tetracosane					
- n-Hexacosane					
- n-Octacosane					
- n-Triacontane					
- n-Dotriacontane					
- n-Tetracontane					
- Pentatriacontane					

REFERENCE : US EPA SW 846 TEST METHODS FOR EVALUATING WATER AND SOLID WASTE, 3rd ED. 2020

Jutarat Jaemruen
(Miss Jutarat Jaemruen)

Analyst

REG. NO. 7-239-7-0022

Araya Tipparuk
(Mrs. Araya Tipparuk)

Technical Management Team

REG. NO. 7-239-7-0004

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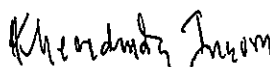
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GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd. (Feeder Line Project)	REQUEST SERVICE No.	: 1822/68
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: -
SAMPLING DATE	: 25/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 10:12-10:24
ANALYTICAL DATE	: 25,27/09/2025-01/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: -
SAMPLE CONDITION	: เหลืองใสมีตะกอน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS	ND	STATION
		METHODS	(non-detectable)	GW-5
Depth	m	-	-	2.90
Temperature	°C	2550 B	< 0.5	32.8
Color	Unit	2120 B	< 5.0	200
Conductivity	µS/cm	2510 B	< 1.0	200
Total Dissolved Solids	mg/l	2540 C	< 25	190
Total Suspended Solids	mg/l	2540 D	< 2.5	2.8

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA, APHA, WEF)


(Miss Khemchuda Insorn)
Analyst


(Mrs. Araya Tipparuk)
Technical Management Team

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GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd. (Feeder Line Project)	REQUEST SERVICE No.	: 1822/68
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: 7-239
SAMPLING DATE	: 25/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 10:12-10:24
ANALYTICAL DATE	: 25,27/09/2025-02/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: 7-239-ท-0025
SAMPLE CONDITION	: เหลือถังใส่มีตะกอน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION	STANDARD ^{1/}
				GW-5	
pH	-	4500-H ⁺ B	< 0.10	6.38	-
Benzene	mg/l	6200 B	< 0.0002	ND	≤ 0.2
Carbon tetrachloride	mg/l	6200 B	< 0.0002	ND	≤ 0.4
1,2-Dichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.5
Dichloromethane	mg/l	6200 B	< 0.0002	ND	≤ 6.0
1,1-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.1
cis-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
trans-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
Ethylbenzene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
Styrene	mg/l	6200 B	< 0.0002	ND	≤ 24
Tetrachloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.9
Toluene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
1,1,1-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.2
1,1,2-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.8
Trichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 4.4
m-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
o-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
p-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
Total Xylenes	mg/l	6200 B	< 0.0006	ND	≤ 24
Vinyl Chloride	mg/l	6200 B	< 0.0005	ND	≤ 0.03

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA APHA WEF)

Jutarat Jaemruen
(Miss Jutarat Jaemruen)

Analyst

REG. NO. 7-239-ท-0022

Araya Tipparuk
(Mrs. Araya Tipparuk)

Technical Management Team

REG. NO. 7-239-ท-0004

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GROUND WATER ANALYSIS REPORT

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SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: 7-239
SAMPLING DATE	: 25/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 10:12-10:24
ANALYTICAL DATE	: 29/09/2025-02/10/2025	SITE OPERATOR	: Mr. Jcerawat Khothamhan
REPORT DATE	: 08/10/2025	FILE CODE	: 225100_GW_September
SAMPLE CONDITION	: เหล็กกล้าสีมีตะกอน		

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION GW-5	STANDARD ^{1/}
<u>Total Petroleum Hydrocarbons</u>					
- C ₅ -C ₈	mg/l	5030 C / 8260 D	< 0.003	ND	≤ 1.4
- Pentane					
- Benzene					
- Toluene					
- m,p-Xylene					
- o-Xylene					
- C ₉ -C ₁₆	mg/l	3510 C / 8015 D	< 0.025	ND	≤ 1.7
- n-Nonane					
- n-Decane					
- n-Dodecane					
- n-Tetradecane					
- n-Hexadecane					
- C _{>16} -C ₃₅	mg/l	3510 C / 8015 D	< 0.050	ND	≤ 0.1
- n-Octadecane					
- n-Eicosane					
- n-Docosane					
- n-Tetracosane					
- n-Hexacosane					
- n-Octacosane					
- n-Triacontane					
- n-Dotriacontane					
- n-Tetracontane					
- Pentatriacontane					

REFERENCE : US EPA SW 846 TEST METHODS FOR EVALUATING WATER AND SOLID WASTE, 3rd ED., 2020

Jutarat Jaemruen

(Miss Jutarat Jaemruen)

Analyst

REG. NO. 7-239-0-0022

Araya Tipparuk

(Mrs. Araya Tipparuk)

Technical Management Team

REG. NO. 7-239-0-0004

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GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd.	REQUEST SERVICE No.	: 1822/68
	(Feeder Line Project)		
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: -
SAMPLING DATE	: 25/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 09:49-10:01
ANALYTICAL DATE	: 26,27/09/2025-01/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: -
SAMPLE CONDITION	: เครื่องใช้มีตะกอน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION
				GW-8
Depth	m	-	-	3.17
Temperature	°C	2550 B	< 0.5	32.4
Color	Unit	2120 B	< 5.0	100
Conductivity	µS/cm	2510 B	< 1.0	189
Total Dissolved Solids	mg/l	2540 C	< 25	132
Total Suspended Solids	mg/l	2540 D	< 2.5	11

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED., 2017 (AWWA, APHA, WEF)

(Miss Khemchuda Insorn)

Analyst

(Mrs. Araya Tipparuk)

Technical Management Team

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SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: 7-239
SAMPLING DATE	: 25/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 09:49-10:01
ANALYTICAL DATE	: 25,27/09/2025-02/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: 7-239-0-0025
SAMPLE CONDITION	: เหลือสิ่งมีชีวิตก่อน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION	STANDARD ¹⁾
				GW-8	
pH	-	4500-H ⁺ B	< 0.10	6.77	-
Benzene	mg/l	6200 B	< 0.0002	ND	≤ 0.2
Carbon tetrachloride	mg/l	6200 B	< 0.0002	ND	≤ 0.4
1,2-Dichloroethane	mg/l	6200 B	< 0.0002	0.0003	≤ 0.5
Dichloromethane	mg/l	6200 B	< 0.0002	ND	≤ 6.0
1,1-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.1
cis-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
trans-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
Ethylbenzene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
Styrene	mg/l	6200 B	< 0.0002	ND	≤ 24
Tetrachloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.9
Toluene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
1,1,1-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.2
1,1,2-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.8
Trichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 4.4
m-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
o-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
p-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
Total Xylenes	mg/l	6200 B	< 0.0006	ND	≤ 24
Vinyl Chloride	mg/l	6200 B	< 0.0005	ND	≤ 0.03

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA APHA WEF)

Jutarat Jaemruen

(Miss Jutarat Jaemruen)

Analyst

REG. NO. 7-239-0-0022

AR

(Mrs. Araya Tipparuk)

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SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: 2-239
SAMPLING DATE	: 25/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 09:49-10:01
ANALYTICAL DATE	: 29/09/2025-02/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: 2-239-0-0025
SAMPLE CONDITION	: เครื่องมือมีตะกอน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION GW-8	STANDARD ^{1/}
Total Petroleum Hydrocarbons					
- C ₅ -C ₈	mg/l	5030 C / 8260 D	< 0.003	ND	≤ 1.4
- Pentane					
- Benzene					
- Toluene					
- m,p-Xylene					
- o-Xylene					
- C ₉ -C ₁₆	mg/l	3510 C / 8015 D	< 0.025	ND	≤ 1.7
- n-Nonane					
- n-Decane					
- n-Dodecane					
- n-Tetradecane					
- n-Hexadecane					
- C ₁₆ -C ₃₅	mg/l	3510 C / 8015 D	< 0.050	ND	≤ 0.1
- n-Octadecane					
- n-Eicosane					
- n-Docosane					
- n-Tetracosane					
- n-Hexacosane					
- n-Octacosane					
- n-Triacontane					
- n-Dotriacontane					
- n-Tetratriacontane					
- Pentatriacontane					

REFERENCE : US EPA SW 846 TEST METHODS FOR EVALUATING WATER AND SOLID WASTE, 3rd ED., 2020

Jutarat Jaemruen
(Miss Jutarat Jaemruen)

Analyst

REG. NO. 2-239-0-0022

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SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: -
SAMPLING DATE	: 25/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 10:39-10:51
ANALYTICAL DATE	: 25,27/09/2025-01/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: -
SAMPLE CONDITION	: เหลืองใสมีตะกอน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS	ND	STATION
		METHODS	(non-detectable)	GW-11
Depth	m	-	-	2.90
Temperature	°C	2550 B	< 0.5	35.3
Color	Unit	2120 B	< 5.0	590
Conductivity	µS/cm	2510 B	< 1.0	366
Total Dissolved Solids	mg/l	2540 C	< 25	282
Total Suspended Solids	mg/l	2540 D	< 2.5	52

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA, APHA, WEF)



(Miss Khemchuda Insorn)

Analyst



(Mrs. Araya Tipparuk)

Technical Management Team

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RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 10:39-10:51
ANALYTICAL DATE	: 25,27/09/2025-02/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: 7-239-1-0025
SAMPLE CONDITION	: เหลืองใสมีตะกอน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION	STANDARD ¹⁾
				GW-11	
pH	-	4500-H ⁺ B	< 0.10	6.46	-
Benzene	mg/l	6200 B	< 0.0002	ND	≤ 0.2
Carbon tetrachloride	mg/l	6200 B	< 0.0002	ND	≤ 0.4
1,2-Dichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.5
Dichloromethane	mg/l	6200 B	< 0.0002	ND	≤ 6.0
1,1-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.1
cis-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
trans-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
Ethylbenzene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
Styrene	mg/l	6200 B	< 0.0002	ND	≤ 24
Tetrachloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.9
Toluene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
1,1,1-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.2
1,1,2-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.8
Trichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 4.4
m-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
o-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
p-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
Total Xylenes	mg/l	6200 B	< 0.0006	ND	≤ 24
Vinyl Chloride	mg/l	6200 B	< 0.0005	ND	≤ 0.03

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA,APHA,WEF)

Jutarat Jaemruen

(Miss Jutarat Jaemruen)

Analyst

REG. NO. 7-239-1-0022

Araya Tipparuk

(Mrs. Araya Tipparuk)

Technical Management Team

REG. NO. 7-239-1-0004

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4. - Not available.



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239 RIMKLONGPRAPA ROAD, BANGSUE, BANGKOK 10800, THAILAND

TEL. (662) 959-3600 FAX (662) 959-3535 Website : secot.co.th E-mail : envserv@secot.co.th

GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd. (Feeder Line Project)	REQUEST SERVICE No.	: 1822/68
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: ๓-239
SAMPLING DATE	: 25/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 10:39-10:51
ANALYTICAL DATE	: 29/09/2025-02/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: ๓-239-๓-0025
SAMPLE CONDITION	: เติลียงใสมีตะกอน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION GW-11	STANDARD ^{1/}
Total Petroleum Hydrocarbons					
- C ₅ -C ₈	mg/l	5030 C / 8260 D	< 0.003	ND	≤ 1.4
- Pentane					
- Benzene					
- Toluene					
- m,p-Xylene					
- o-Xylene					
- C ₈ -C ₁₆	mg/l	3510 C / 8015 D	< 0.025	ND	≤ 1.7
- n-Nonane					
- n-Decane					
- n-Dodecane					
- n-Tetradecane					
- n-Hexadecane					
- C ₁₆ -C ₃₅	mg/l	3510 C / 8015 D	< 0.050	ND	≤ 0.1
- n-Octadecane					
- n-Eicosane					
- n-Docosane					
- n-Tetracosane					
- n-Hexacosane					
- n-Octacosane					
- n-Triacontane					
- n-Dotriacontane					
- n-Tetratriacontane					
- Pentatriacontane					

REFERENCE : US EPA SW 846 TEST METHODS FOR EVALUATING WATER AND SOLID WASTE, 3rd ED., 2020

Jutarat Jaemruen

(Miss Jutarat Jaemruen)

Analyst

REG. NO. ๓-239-๓-0022

Araya Tipparuk

(Mrs. Araya Tipparuk)

Technical Management Team

REG. NO. ๓-239-๓-0004

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GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd. (Feeder Line Project)	REQUEST SERVICE No.	: 1822/68
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: -
SAMPLING DATE	: 26/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 14:49-15:02
ANALYTICAL DATE	: 26,27/09/2025-01/10/2025	SITE OPERATOR	: Mr. Jeerawat Khotamhan
REPORT DATE	: 08/10/2025		: -
SAMPLE CONDITION	: เครื่องมือมีตะกอน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS	ND	STATION
		METHODS	(non-detectable)	GW-17
Depth	m	-	-	3.00
Temperature	°C	2550 B	< 0.5	31.4
Color	Unit	2120 B	< 5.0	35
Conductivity	µS/cm	2510 B	< 1.0	2,934
Total Dissolved Solids	mg/l	2540 C	< 25	1,498
Total Suspended Solids	mg/l	2540 D	< 2.5	137

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA, APHA, WEF)

(Miss Khemchuda Insorn)

Analyst

(Mrs. Araya Tipparuk)

Technical Management Team

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GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd.	REQUEST SERVICE No.	: 1822/68
	(Feeder Line Project)		
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: 7-239
SAMPLING DATE	: 26/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 14:49-15:02
ANALYTICAL DATE	: 26,27/09/2025-02/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: 7-239-จ-0025
SAMPLE CONDITION	: เหลือถังใส่ตะกอน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION	STANDARD ¹⁾
				GW-17	
pH	-	4500-H ⁺ B	< 0.10	5.60	-
Benzene	mg/l	6200 B	< 0.0002	ND	≤ 0.2
Carbon tetrachloride	mg/l	6200 B	< 0.0002	ND	≤ 0.4
1,2-Dichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.5
Dichloromethane	mg/l	6200 B	< 0.0002	0.0002	≤ 6.0
1,1-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.1
cis-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
trans-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
Ethylbenzene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
Styrene	mg/l	6200 B	< 0.0002	ND	≤ 24
Tetrachloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.9
Toluene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
1,1,1-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.2
1,1,2-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.8
Trichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 4.4
m-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
o-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
p-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
Total Xylenes	mg/l	6200 B	< 0.0006	ND	≤ 24
Vinyl Chloride	mg/l	6200 B	< 0.0005	ND	≤ 0.03

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA, APHA, WEF)

Jutarat Jaemruen

(Miss Jutarat Jaemruen)

Analyst

REG. NO. 7-239-จ-0022

Araya Tipparuk

(Mrs. Araya Tipparuk)

Technical Management Team

REG. NO. 7-239-ท-0004

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GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd. (Feeder Line Project)	REQUEST SERVICE No.	: 1822/68
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: ๖-239
SAMPLING DATE	: 26/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 14:49-15:02
ANALYTICAL DATE	: 29/09/2025-02/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: ๖-239-๖-0025
SAMPLE CONDITION	: เหลือถังใส่มีตะกอน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION GW-17	STANDARD ¹⁾
Total Petroleum Hydrocarbons					
- C ₅ -C ₈	mg/l	5030 C / 8260 D	< 0.003	ND	≤ 1.4
- Pentane					
- Benzene					
- Toluene					
- m,p-Xylene					
- o-Xylene					
- C ₉ -C ₁₆	mg/l	3510 C / 8015 D	< 0.025	ND	≤ 1.7
- n-Nonane					
- n-Decane					
- n-Dodecane					
- n-Tetradecane					
- n-Hexadecane					
- C _{>16} -C ₃₅	mg/l	3510 C / 8015 D	< 0.050	ND	≤ 0.1
- n-Octadecane					
- n-Eicosane					
- n-Docosane					
- n-Tetracosane					
- n-Hexacosane					
- n-Octacosane					
- n-Triacontane					
- n-Dotriacontane					
- n-Tetracontane					
- Pentatriacontane					

REFERENCE : US EPA SW 846 TEST METHODS FOR EVALUATING WATER AND SOLID WASTE, 1st ED., 2020

Jutarat Jaemruen
(Miss Jutarat Jaemruen)

Analyst

REG. NO. ๖-239-๖-0022

Araya Tipparuk

(Mrs. Araya Tipparuk)

Technical Management Team

REG. NO. ๖-239-๖-0004

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TEL. (662) 959-3600 FAX (662) 959-3535 Website : secot.co.th E-mail : envserv@secot.co.th

GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd. (Feeder Line Project)	REQUEST SERVICE No.	: 1822/68
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: -
SAMPLING DATE	: 26/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 12:50
ANALYTICAL DATE	: 26,27/09/2025-01/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: -
SAMPLE CONDITION	: เหลืองใสมีตะกอน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION
				ป้อน้าบาดาลบริเวณชุมชนบ้านทุ่ง
Temperature	°C	2550 B	< 0.5	34.0
Color	Unit	2120 B	< 5.0	5
Conductivity	µS/cm	2510 B	< 1.0	995
Total Dissolved Solids	mg/l	2540 C	< 25	668
Total Suspended Solids	mg/l	2540 D	< 2.5	< 2.5

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23RD ED. 2017 (AWWA, APHA, WEF)

(Miss Khemchuda Insorn)

Analyst

(Mrs. Araya Tipparuk)

Technical Management Team

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GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd. (Feeder Line Project)	REQUEST SERVICE No.:	1822/68
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: 2-239
SAMPLING DATE	: 26/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 12:50
ANALYTICAL DATE	: 26,27/09/2025-02/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: 2-239-ก-0025
SAMPLE CONDITION	: เหลืองใสมีตะกอน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION	STANDARD ¹⁾
				บ่อน้ำบาดาลบริเวณชุมชนบ้านทุ่ง	
pH	-	4500-H ⁺ B	< 0.10	6.34	-
Benzene	mg/l	6200 B	< 0.0002	ND	≤ 0.2
Carbon tetrachloride	mg/l	6200 B	< 0.0002	ND	≤ 0.4
1,2-Dichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.5
Dichloromethane	mg/l	6200 B	< 0.0002	ND	≤ 6.0
1,1-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.1
cis-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
trans-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
Ethylbenzene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
Styrene	mg/l	6200 B	< 0.0002	ND	≤ 24
Tetrachloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.9
Toluene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
1,1,1-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.2
1,1,2-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.8
Trichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 4.4
m-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
o-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
p-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
Total Xylenes	mg/l	6200 B	< 0.0006	ND	≤ 24
Vinyl Chloride	mg/l	6200 B	< 0.0005	ND	≤ 0.03

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA APHA WEF)

Jutarat Jaemruen

(Miss Jutarat Jaemruen)

Analyst

REG. NO. 2-239-ก-0022

Araya Tipparuk

(Mrs. Araya Tipparuk)

Technical Management Team

REG. NO. 2-239-ก-0004

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239 RIMKLONGPRAPA ROAD, BANGSUE, BANGKOK 10800, THAILAND
TEL. (662) 959-3600 FAX (662) 959-3535 Website : secot.co.th E-mail : envserv@secot.co.th

GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd.	REQUEST SERVICE No.	: 1822/68
	(Feeder Line Project)		
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: ๖-239
SAMPLING DATE	: 26/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 12:50
ANALYTICAL DATE	: 29/09/2025-02/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: ๖-239-๓-0025
SAMPLE CONDITION	: เหลืองใสมีตะกอน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION บ่อน้ำบาดาลบริเวณชุมชนบ้านทุ่ง	STANDARD ^{1/}
Total Petroleum Hydrocarbons					
- C ₅ -C ₈	mg/l	5030 C / 8260 D	< 0.003	ND	≤ 1.4
- Pentane					
- Benzene					
- Toluene					
- m,p-Xylene					
- o-Xylene					
- C ₉ -C ₁₆	mg/l	3510 C / 8015 D	< 0.025	ND	≤ 1.7
- n-Nonane					
- n-Decane					
- n-Dodecane					
- n-Tetradecane					
- n-Hexadecane					
- C ₁₇ -C ₃₅	mg/l	3510 C / 8015 D	< 0.050	ND	≤ 0.1
- n-Octadecane					
- n-Eicosane					
- n-Docosane					
- n-Tetracosane					
- n-Hexacosane					
- n-Octacosane					
- n-Triacontane					
- n-Dotriacontane					
- n-Tetracontane					
- Pentatriacontane					

REFERENCE : US EPA SW-846 TEST METHODS FOR EVALUATING WATER AND SOLID WASTE, 3rd ED., 2020

Jutarat Jaemruen
(Miss Jutarat Jaemruen)

Analyst

REG. NO. ๖-239-๓-0022

(Mrs. Araya Tipparuk)

Technical Management Team

REG. NO. ๖-239-๓-0004

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GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd. (Feeder Line Project)	REQUEST SERVICE No.	: 1822/68
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: -
SAMPLING DATE	: 26/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 12:59
ANALYTICAL DATE	: 26,27/09/2025-01/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: -
SAMPLE CONDITION	: เหลืองใสมีตะกอน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION
				บ่อน้ำบาดาลบริเวณวัดใหม่เนินพยอม
Temperature	°C	2550 B	< 0.5	31.6
Color	Unit	2120 B	< 5.0	10
Conductivity	µS/cm	2510 B	< 1.0	963
Total Dissolved Solids	mg/l	2540 C	< 25	616
Total Suspended Solids	mg/l	2540 D	< 2.5	< 2.5

REFERENCE : STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 21st ED. 2017 (AWWA, APHA, WEF)

(Miss Khemchuda Insorn)

Analyst

(Mrs. Araya Tipparuk)

Technical Management Team

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GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd. REQUEST SERVICE No.: 1822/68		
	(Feeder Line Project)		
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: 7-239
SAMPLING DATE	: 26/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 12:59
ANALYTICAL DATE	: 26,27/09/2025-02/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: 7-239-0-0025
SAMPLE CONDITION	: เหลือไม่ถึงตะกอน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION	STANDARD ^{1/}
				บ่อน้ำบาดาลบริเวณวัดใหม่เนินพยอม	
pH	-	4500-H ⁺ B	< 0.10	6.79	-
Benzene	mg/l	6200 B	< 0.0002	ND	≤ 0.2
Carbon tetrachloride	mg/l	6200 B	< 0.0002	ND	≤ 0.4
1,2-Dichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.5
Dichloromethane	mg/l	6200 B	< 0.0002	ND	≤ 6.0
1,1-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.1
cis-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
trans-1,2-Dichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
Ethylbenzene	mg/l	6200 B	< 0.0002	ND	≤ 2.0
Styrene	mg/l	6200 B	< 0.0002	ND	≤ 24
Tetrachloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 0.9
Toluene	mg/l	6200 B	< 0.0002	ND	≤ 5.0
1,1,1-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.2
1,1,2-Trichloroethane	mg/l	6200 B	< 0.0002	ND	≤ 0.8
Trichloroethylene	mg/l	6200 B	< 0.0002	ND	≤ 4.4
m-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
o-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
p-Xylene	mg/l	6200 B	< 0.0002	ND	≤ 24
Total Xylenes	mg/l	6200 B	< 0.0006	ND	≤ 24
Vinyl Chloride	mg/l	6200 B	< 0.0005	ND	≤ 0.03

REFERENCE: STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER 23rd ED. 2017 (AWWA, APHA, WEF)

Jutarat Jaemruen
(Miss Jutarat Jaemruen)
Analyst
REG. NO. 7-239-0-0022

Araya Tipparuk
(Mrs. Araya Tipparuk)
Technical Management Team
REG. NO. 7-239-0-0004

- Remark : 1. Reported analysis refers to submitted sample only.
2. This report shall not be reproduced, except in full, without official approval.
3. ^{1/} Notification of the Ministry of Industry, B.E.2559 (2016) : Criteria on contamination in soil and groundwater, the examination of soil and groundwater quality, information including making the report of the result of soil and groundwater quality examination.
4. - Not available.



บริษัท ซีคอต จำกัด SECOT CO., LTD.

239 ถนนริมคลองประปา แขวงบางซื่อ เขตบางซื่อ กรุงเทพมหานคร 10800
239 RIMKLONGPRAPA ROAD, BANGSUE, BANGKOK 10800, THAILAND
TEL. (662) 959-3600 FAX (662) 959-3535 Website : secot.co.th E-mail : envserv@secot.co.th

GROUND WATER ANALYSIS REPORT

CLIENT NAME	: Kuwait Petroleum Aviation (Thailand) Ltd. (Feeder Line Project)	REQUEST SERVICE No.	: 1822/68
SAMPLING BY	: SECOT Co., Ltd.	REGISTRATION No.	: ๖-239
SAMPLING DATE	: 26/09/2025	SAMPLING METHOD	: Pneumatic Bladder Pump
RECEIVED DATE	: 27/09/2025	SAMPLING TIME	: 12:59
ANALYTICAL DATE	: 29/09/2025-02/10/2025	SITE OPERATOR	: Mr. Jeerawat Khothamhan
REPORT DATE	: 08/10/2025		: ๖-239-๖-0025
SAMPLE CONDITION	: เหลืองใสมีตะกอน	FILE CODE	: 225100_GW_September

PARAMETER	UNIT	ANALYSIS METHODS	ND (non-detectable)	STATION ป้อมนาบาลบริเวณวัดใหม่เนินพยอม	STANDARD ^{1/}
<u>Total Petroleum Hydrocarbons</u>					
- C ₃ -C ₈	mg/l	5030 C / 8260 D	< 0.003	ND	≤ 1.4
- Pentane					
- Benzene					
- Toluene					
- m,p-Xylene					
- o-Xylene					
- C ₈ -C ₁₆	mg/l	3510 C / 8015 D	< 0.025	ND	≤ 1.7
- n-Nonane					
- n-Decane					
- n-Dodecane					
- n-Tetradecane					
- n-Hexadecane					
- C ₁₆ -C ₃₅	mg/l	3510 C / 8015 D	< 0.050	ND	≤ 0.1
- n-Octadecane					
- n-Eicosane					
- n-Docosane					
- n-Tetracosane					
- n-Hexacosane					
- n-Octacosane					
- n-Triacontane					
- n-Dotriacontane					
- n-Tetratriacontane					
- Pentatriacontane					

REFERENCE : US EPA SW 846 TEST METHODS FOR EVALUATING WATER AND SOLID WASTE, 3rd ED. 2020

Jutarat Jaemruen
(Miss Jutarat Jaemruen)

Analyst

REG. NO. ๖-239-๖-0022

(Mrs. Araya Tipparuk)

Technical Management Team

REG. NO. ๖-239-๖-0004

Remark : 1. Reported analysis refers to submitted sample only.

2. This report shall not be reproduced, except in full, without official approval.

3. ^{1/} Notification of the Ministry of Industry, B.E.2559 (2016) : Criteria on contamination in soil and groundwater, the examination of soil and groundwater quality, information including making the report of the result of soil and groundwater quality examination.

ภาคผนวก ง

ใบแสดงการตรวจเทียบเครื่องมือตรวจวัดและวิเคราะห์



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration


Cert.No.: 25CH1009

Page.: 1 of 3

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : Seven2Go
Serial No. : B924795409
ID No. : ID.12
Condition As-Received: Used Item
Received Date : 26 August 2025
Calibration Date : 27 August 2025
Reference : 2508-0784DN-3
Submitted by : Secot Co.,Ltd.
239 Rimklongprapa Road,
Bangsue, Bangkok 10800

Ambient Temperature : $(25 \pm 2.5) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with DC voltage
standard and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by : Walalak Sirithean

Approved by : 
Approved Signatory

() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Saithip Meangmai

Issue Date : 28 August 2025

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Cert.No.: 25CH1009

Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Document Process Calibrator	58440003	130RC120	24E3731	25 Nov 2025
2) Ref. Standard Thermometer	4982054	110RC044	251708	03 July 2026

- This measurement result is traceable to SI through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.007	CPA chem	1114384	12 June 2027
pH 6.987	CPA chem	1034204	27 Sep 2025
pH 10.010	CPA chem	1114385	08 June 2026

3. This certificate is valid only to the item calibrated on date and place of calibration.

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (\pm mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: B924795409	4.00	177.48	177	4.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-177	10.00	0.58	2.00



Cert.No.: 25CH1009

Page.: 3 of 3

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (\pm)	Coverage factor k
pH Electrode S/N.: 4320459	4.007	4.02	182	0.0071	2.00
	6.987	7.00	6	0.0095	2.00
	10.010	10.01	-167	0.0092	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab Expert Go
- Serial No. : 4320459

Dimension of probe

- Length : 120 mm.
- Diameter : 12 mm.
- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (\pm °C)	Coverage factor k
25.0	24.999	25.1	0.101	0.13	2.00
30.0	30.001	30.2	0.199	0.13	2.00
35.0	35.001	35.2	0.199	0.13	2.00

Remark - UUC* = Unit Under Calibration

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k , providing a level of confidence of approximately 95 %.

-o0o-

Calibration Certificate

Certificate No.: 2503897-001-01
Client name: SECOT CO., LTD.
Address: 239 Rimklongprapa Road,
Bangsue, Bangsue, Bangkok 10800

Page 1 of 3

Equipment: CHAMBER (Incubator)
Manufacturer: MEMMERT
Model: ICP 400
Serial No.: K406.0004
ID No.: N/A
Order No.: 2503897
Operation No.: 2503897-001
Date of Receipt: 14 July 2025
Date of Calibration: 14 July 2025

Calibrated by Mr.Yothin Charoensuk
Scientist

Approved by

(Mr.Pheraphat Tuanjit)

Manager, Division of Calibration Laboratory

Date of Issue: 17 July 2025

Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95 %.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.



Calibration Report

Certificate No.: 2503897-001-01
Equipment: CHAMBER (Incubator)
Model: ICP 400 Serial No.: K406.0004
Resolution: 0.1 °C ID No.: N/A
Manufacturer: MEMMERT

Date of Calibration: 14 July 2025

Page 2 of 3

Location: Laboratory, SECOT CO., LTD.
Environment Condition: Ambient Temperature (30.8 ± 1) °C
Relative Humidity (60.9 ± 1) %
Line Voltage (222.5 ± 3) Volt

Condition of this results of Calibration:

- This instrument was calibrated by insert 9 standard thermometer into its chamber and calibration according to W-TE-014 Based on TLAS G-20-1/02-08 (E): Guidelines for Calibration and Checks of Temperature Controlled Enclosures.
- The temperature scale used was based on ITS - 90.
- All data show below were final values and the initial data may be obtained upon request.

2. Reference Standard Instrument :

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A	MY57003188	2503175-002	2 June 2026	NATIONAL FOOD INSTITUTE
	RTD	CH#201-209/ RTD#201-209			

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibrated item : Good

UUC Description :

Time of Record 1 Hour 9 Minute At 20.0 °C
Fresh air Damper - Open Position -
X Close Fan 10%
- Not Available

7. Result of Calibration : ☒ Without adjustment ☐ After adjustment




Calibration Report

Certificate No.: 2503897-001-01
Equipment: CHAMBER (Incubator)
Model: ICP 400 **Serial No.:** K406.0004
Resolution: 0.1 °C **ID No.:** N/A
Manufacturer: MEMMERT

Date of Calibration: 14 July 2025

Page 3 of 3

Calibration point: 20.0 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
MIN	29.6	60.3	220.0
MAX	32.3	61.5	225.0

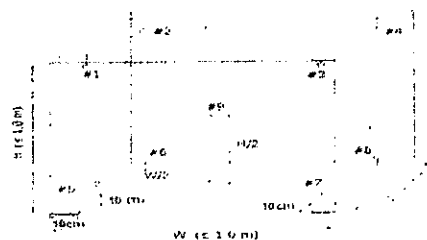


Table1 : Reporting of Temperature

Calibration point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF)									Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	
20.0	20.00	20.16	20.08	20.11	20.28	20.12	20.03	20.05	20.14	0.28

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
20.0	20.0	20.0	20.0	0.14	0.15	0.53

Note The quoted uncertainty include " Stability " and " Loading effect (20% of Temp Uniformity) "

UUC* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.

The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k= 2, providing a level of confidence of approximately 95 %.

----- End -----




Calibration Certificate

Certificate No.: 2503897-002-01
Client name: SECOT CO., LTD.
Address: 239 Rimklongprapa Road,
Bangsue, Bangsue, Bangkok 10800

Page 1 of 3

Equipment: Water Bath
Manufacturer: MEMMERT
Model: WB 29
Serial No.: I698.0051
ID No.: N/A
Order No.: 2503897
Operation No.: 2503897-002
Date of Receipt: 14 July 2025
Date of Calibration: 14 July 2025

Calibrated by Mr.Yothin Charoensuk
Scientist

Approved by

(Mr.Pheraphat Tuanjit)

Manager, Division of Calibration Laboratory

Responsible for the Technical Management Team

Date of Issue: 17 July 2025

The uncertainties are for a confidence probability of approximately 95 %.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.



Calibration Report

Certificate No.: 2503897-002-01
Equipment: Water Bath
 Model: WB 29 Serial No.: I698.0051
 Resolution: 0.1 °C ID No.: N/A
 Manufacturer: MEMMERT
Date of Calibration: 14 July 2025

Page 2 of 3

Location: Laboratory, SECOT CO., LTD.
Environment Condition: Ambient Temperature (31 ± 1) °C
 Relative Humidity (61 ± 1) %
 Line Voltage (228 ± 3) Volt

Condition of this results of Calibration:

- This Instrument was calibrated by insert 5 standard thermometer into its liquid bath and calibration according to W-TE-011 based on ASTM E715-80 (Re-approved-2016): Standard Specification for Gravity-Convection and Forced-Circulation Water Baths.
 - The temperature scale used is ITS - 90.
 - All data show below were final values and the initial data may be obtained upon request.

2. Reference Standard Instrument :

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A	MY57003188	2503175-002	2-Jun-26	NATIONAL FOOD INSTITUTE
	RTD	RTD#301-305 / CH#301-305			

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibrated Item : Good

UUC Description:

Time of Record 1 Hour 9 Minute At 95.0 °C

7. Result of Calibration :
- | | |
|-------------------------------------|--------------------|
| <input checked="" type="checkbox"/> | Without adjustment |
| <input type="checkbox"/> | After adjustment |




Calibration Report

Certificate No.: 2503897-002-01
Equipment: Water Bath
Model: WB 29 Serial No.: I698.0051
Resolution: 0.1 °C ID No.: N/A
Manufacturer: MEMMERT
Date of Calibration: 14 July 2025

Page 3 of 3

Calibration point: 95.0 °C
Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	29.6	62	225.0
Max	32.3	60	230.0

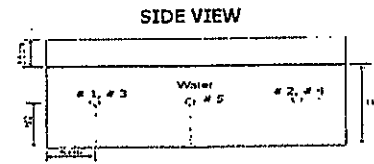
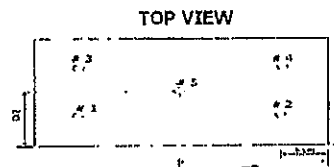


Table1 : Reporting of Temperature

Sensor Installation Location

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.5 is REF)					Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	
95.0	95.15	95.11	95.14	94.96	94.99	0.36

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
95.0	94.9	95.2	95.0	0.21	0.16	0.58

Note The quoted uncertainty include " Stability " and " Loading effect (20% of Temp Uniformity)"

UUC* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.

The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k= 2, providing a level of confidence of approximately 95 %.


----- End -----

Handwritten signature



Atomic Absorption Spectrometry	
PinAAcle900T	
Operational Qualification (OQ)	
Company Name:	SECOT Co.,Ltd.
Address:	239 Rimkhlong Prapa Rd. Khwang Bang Sue, Khet Bang Sue, Bangkok 10800, Thailand
Location, Room:	SECOT INST.1
Serial Number or System Name:	PTDS23051001
Issue Date:	29-Apr-2025
Date Tested: Valid if tested within 1 year of Issue Date	30-Apr-2025
Recertification Period	Recommended at 12 Months
Recertification Due Date:	30-Apr-2026

Release History

Part Number	Release	Publication Date	
09350815	G	August 2023	

Any comments about the documentation for this product should be addressed to:

User Assistance	PerkinElmer Technical Support
PerkinElmer (UK) Ltd	M/S 215
Chalfont Road	710 Bridgeport Avenue
Seer Green	Shelton
Beaconsfield	Connecticut 06484-4794
Bucks HP9 2FX	U.S.A.
United Kingdom	

Service/
Support Quality
PerkinElmer
Validation Program
Engineering

Table of Contents

Table of Contents	2
Introduction	3
Objective	3
Protocol Documentation.....	4
Error Code Abbreviation, Definition, and Making Corrections.....	6
Preliminary Approval Page.....	7
Preliminary Protocol Approval	7
Operational Qualification.....	8
1 System Summary	8
1.1 Instrument Identification	8
1.2 Specifications	8
1.3 Location Requirements	12
1.4 Maintenance and Troubleshooting.....	21
1.5 Hazards and Safety Precautions.....	21
2 Documentation	22
2.1 PerkinElmer Service Engineer Training	22
2.2 Standard Operating Procedures	22
2.3 Operational Qualification Instruction	22
3 Operational Qualification Test Description	23
4 Parameter Testing	26
4.1 Detector Linearity with Barium	26
4.2 Baseline Noise at 1.0 Absorbance with Barium	28
4.3 AA Baseline with Copper	29
4.4 D ₂ Background Compensation with Copper.....	30
4.5 AA-BG Baseline Noise with Copper.....	31
4.6 AA-BG Baseline Noise with Arsenic.....	32
4.7 Flame Safety Checks	33
4.8 Standard Flame Check	34
4.9 Flame Interlock Check	35
4.10 Nitrous Oxide Flame Check (if applicable)	37
4.11 Flame Sensitivity and Precision	39
4.12 Furnace Gas Flows	41
4.13 Chromium Baseline Noise (Furnace).....	43
4.14 Chromium Characteristic Mass and Precision (Furnace)	44
4.15 Copper Characteristic Mass and Zeeman Ratio (Furnace)	46
4.16 Autosampler Linearity (Furnace).....	47
5 Operational Qualification Verification	48
Final Approval Page.....	49
Final Protocol Approval	49
Appendices	51
Appendix A – Deviations	52
Appendix B – Change Control.....	53
Appendix C – Attachments List	54
Appendix D – Document History	55

Introduction

Objective

The objective of this document is to detail the proper operation of the PinAAcle900T. The completed qualification process demonstrates that the equipment meets the vendor-developed standards of operation and safety, and performs the functions specified by the manufacturer.

Scope and Responsibility

PerkinElmer is responsible for providing trained personnel, the OQ elements outlined in this plan and verifying that these elements are fully executed and documented.

SECOT Co.,Ltd. is responsible for accepting the terms of this plan and providing personnel and assistance to PerkinElmer for implementing the OQ outlined in this document.

Warranty Period and Service

Full details of PerkinElmer's instrument warranty have previously been provided with quotations, order acknowledgements and invoices. PerkinElmer's instrument warranty covers all parts and labor, but excludes consumable materials. Exceptions may apply to instruments purchased used.

Contact your PerkinElmer service provider for a service plan which may be purchased to extend coverage beyond warranty. PerkinElmer recommends contracting regular preventive maintenance. Over time, failure to perform the recommended preventive maintenance may reduce the reliability of some systems.

Need to Re-Qualify

The instrument may need to be qualified again following modifications made to the original configuration or if the instrument is serviced or moved

Notices

Except as specifically set forth in its terms and conditions of sale, PerkinElmer makes no warranty of any kind with regard to this document, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

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Protocol Documentation

Documentation protocol may be superseded by customer SOP

Writing Instruments

All writing will be done with a black or blue ink pen.

Signatures

A signature of each party involved with the ownership, management, testing, and quality assurance of each instrument will be required before testing will proceed and for final approval at completion.

On any page where a written entry is made, or data is gathered by a PerkinElmer representative, that page must be signed and dated by the PerkinElmer representative.

Up to three signature entries are provided each for Customer and PerkinElmer on the Preliminary Report Approval Page and Final Approval Page. If any signature lines are unused, draw a single diagonal line filling the Signature area and then write initials and date next to the line.

All signatures will be the signer's full legal name as legibly as can be written and dated.

Initials

At any point when initials are to be used, they will contain at least two of the initials and include a date.

Date

Dates will be given in the format of DD-MMM-YYYY (e.g. 09-Apr-2010). If the day of the month has only one digit, a zero will be employed to maintain the two-digit format for each entry.

Error Codes

When an error is corrected, a single horizontal line through the error will be used. The line will then be initialed and dated along with an error code from the list found in the protocol.

Spaces

For columns where the protocol is asking whether something has been verified, a "Yes" will be written. If not, a "No" will be written and an explanation will be stated in the Comments section. A check mark or "N" is unacceptable. "NA" may be used where the verification was not applicable.

Pass/Fail

For areas where the protocol requires a "Pass/Fail", the words "Pass" or "Fail" will be written in. If the instrument passes, Pass will be entered. If the instrument fails, Fail will be entered.

Visual Inspections

All visual inspections will be filled out with a word that indicates the physical condition being observed. If no damage is observed, use the word "None" if no damage is present. If damage is observed, write a description of the damage observed. This will apply to any visual inspections.

Calibration/Expiration Dates

MMM-YYYY (e.g. Apr-2010) format will be used to denote calibration and reagent expiration dates. The instrument or reagent is valid until the last day of the month noted.

Temperature

All temperatures will be given in the unit of Celsius (°C).

Blank Areas

If there are no comments for a "Comments" section, "None" is written and the rest of the lines are left blank.

If a section is not applicable, such as an alarm function, "NA" is sufficient.

Once an entry has been made (other than "None") any remaining space in the Comments (either single or multiple blank lines) requires a single diagonal line filling the area, along with initials and date next to the line.

EXCEPTION: DO NOT cross out blank lines on the "Error Code Abbreviation, Definition and Making Corrections" page. These pages or sections are either copied for future documentation needs or provide space to maintain records into the future.

Acceptance Criteria

All tests must include values for acceptance criteria and the results of that test must be included.

Precision and Accuracy Measurements

The following areas of precision and accuracy will be noted on a per-test basis.

All instrument precision values (when available) will be noted within the OQ document. All data entered into the OQ document will reflect these values.

For example: If a precision value of four significant digits is supplied for a test by the manufacturer, then all four digits will be entered with the last digit being rounded down if the fifth digit is below 5, rounded up if above 5, and rounded up if fifth digit is 5.

Deviation

Deviations are events that are a departure from the specific protocol procedures as they were approved.

Deviations to the plan are permitted if those deviations are clearly detailed, approved by all parties and entered in Appendix - Deviations

Change Control

Change control procedures are in place to maintain the validation process after modifications are made to the original configuration. Any changes to the hardware, firmware or software of a validated system must be clearly specified and the validation confirmed and recorded.

1. A blank Change Control form is located in Appendix B. Consider making photocopies when blank.
2. If used, insert a completed Change Control Form and its associated data as an Attachment.

Error Code Abbreviation, Definition, and Making Corrections

The error code abbreviation and definition list below is provided for clients and reviewers to make necessary entries and corrections after the document has been approved.

PerkinElmer technical staff and reviewers make all necessary efforts to ensure that this document and related attachments are free of errors and mistakes. However, some typographical, formatting, and inadvertently erroneous entries may exist within the document that can be corrected by client(s). Once an error is found, (1) simply strike the erroneous word or entry with a blue or black pen, (2) enter the correct word or entry above the erroneous word or entry, (3) enter the code (for example; IE for incorrect entry), and (4) then initial and date.

Space is also provided to create new codes or to enter the codes specified by the customer SOP.

CE	Calculation Error	NA	Not Applicable
IE	Incorrect Entry	SE	Spelling Error
IM	Instrument Malfunction	TE	Transcription Error
IO	Inadvertently Omitted	TYP	Typographical Error
IR	Instrument Recalibrated	WD	Wrong Date Entered
LE	Late Entry (of initials or date)	WO	Writeover

Additional Codes

Code	Definition	Initials	Date (DD-MMM-YY/YY)

Preliminary Approval Page

Preliminary Protocol Approval

This is to certify that the Operational Qualifications procedures for the PinAAcle900T Serial number PTDS23051001 have been reviewed and both PerkinElmer and SECOT Co.,Ltd. have agreed to proceed with the procedures described in this document.

SECOT Co.,Ltd.			
Signature	Name	Title	Date (DD-MMM-YYYY)

PerkinElmer			
Signature	Name	Title	Date (DD-MMM-YYYY)

Operational Qualification

1 System Summary

1.1 Instrument Identification

Manufacturer	PerkinElmer
Model	PinAAcle900T
Equipment Serial #	PTDS23051001
Spectrometer Firmware, Kernel, FPGA System Board Version Detector Board Version Lamp Board Version	
Flame Firmware Version	
Furnace & Autosampler Firmware Versions Furnace Board Version	
Instrument Software Version	
Comments:	
PerkinElmer Representative Signature:	Date: (DD-MMM-YYYY)
Customer Representative Signature:	Date: (DD-MMM-YYYY)

1.2 Specifications

Instrument Utilities/Environment

System Power Requirements: 230V (+/-10%), 50/60 Hz (+/- 0.3 Hz) Single phase alternating current.

The PinAAcle 900T will ship standard with an IEC 60309 32 A power connector. *

Power Consumption: 10,100 VA maximum.

Electrical Protection: Insulation class I; pollution degree 2.

Certification: Designed and tested to be in compliance with the legal requirements for laboratory instruments. The instrument is developed and produced in compliance with ISO 9001. The WinLab32 for AA /Syngistix- AA™ Software provides required control parameters for GLP and instrument performance validation.

Temperature & Humidity: The Room Temperature should be between 15 and 35 °C (59-95 °F) with a maximum rate of change of 3 °C (5 °F) per hour. The relative humidity should be between 20 and 80%, non-condensing.

Environment: A relatively dust-free environment is necessary. This is especially important when working with ultra-trace techniques, such as graphite furnace sampling. Other important considerations are to locate the instrument in an area free of corrosive fumes and vibration and in an area that does not receive direct sunlight.

Instrument

System: The AA Flame/THGA system is a fully-integrated bench top design atomic absorption spectrometer, incorporating all spectrometer, flame atomizer and graphite furnace atomizer components in a single instrument.

Optical System

Photometer: Real-time double-beam optical system. The optics are front-surfaced, reflecting, and have a protective coating. The optical system is sealed with a protective cover.

Monochromator: Littrow design with motorized drive for automatic wavelength selection and peaking.

Wavelength Range: 190 – 900 nm.

Diffraction grating: 1800 lines/mm blazed at 236 nm and 597 nm.

Spectral Bandwidths: User selectable automatic slit widths of 0.2, 0.7 and 2.0 nm at their optimized slit height.

Detector: Wide-range segmented solid-state detector, including a built-in low-noise CMOS charge amplifier array.

Automatic Lamp Selection: 8-lamp mount with built-in power supplies for PerkinElmer® cable less Lumina™ hollow cathode and patented electrode less discharge lamps. Computer-controlled lamp selection and alignment via WinLab32 for AA/Syngistix- AA™ Software. Lamp elements and recommended operating currents are automatically recognized and set when using Lumina hollow cathode lamps and PerkinElmer EDL lamps with coding plug.

Background Correction

Deuterium Arc Lamp (flame): Built-in continuum source double-beam background correction using a high-intensity deuterium arc lamp.

Zeeman-Effect Background Correction (furnace): Longitudinal AC Zeeman-effect background correction using a modulated 0.8 Tesla magnetic field oriented longitudinal to the optical path. The magnet is automatically switched on during the atomization step only. Rollover detection is built-in.

Flame Atomizer:

Gas controls: Fully computer-controlled with oxidant and fuel monitoring. There is a keyboard-actuated remote ignition system with air-acetylene. Acetylene flow is automatically adjusted prior to the oxidant change when switching to or from nitrous oxide-acetylene operation.

Safety Functions: Interlocks prevent ignition if the proper burner head, the nebulizer/end cap, or the burner drain system is not correctly installed; the liquid level in the drain vessel is incorrect; or gas pressures are too low. Interlocks also will automatically shut down burner gases if a flame is not detected, or if any of the other interlock functions are activated. Provision is included for safe shutdown from all operating modes in the event of a power failure.

Sample Introduction System: Modular sample introduction system consisting of the quick-change spray chamber, burner head and nebulizer units. Alignment of the flame in the light beam is fully automatic, using a motorized burner mount for vertical and horizontal burner adjustment and automatic software-controlled self-optimization of the burner position. The optimization of the operating flame condition is also fully automatic and software controlled. The introduction system is equipped with a high-strength inert mixing chamber, angled to ensure proper drainage. There is a choice of high sensitivity corrosion-resistant plastic nebulizer or durable stainless steel nebulizer. The standard is all-titanium, 10-cm, single-slot burner head for air-acetylene operation.

Graphite Furnace Atomizer:

THGA: Built-in fully computer-controlled Transversely Heated Graphite Atomizer (THGA™). The graphite tube is transversely heated providing a uniform temperature profile over the entire tube.

Furnace Features: An external protective gas stream around the graphite tube prevents the entrance of outside air to maximize tube life. An internal purge gas goes through the graphite tube to remove the volatilized matrix vapors during drying and thermal pretreatment. The two gas streams are computer-controlled independently. There is pneumatic opening and closing of the furnace for easy tube change.

Furnace Program: Analytical programs with up to 12 steps can be set up. Each step can be programmed with the following parameters:

Temperature: Ambient up to 2600°C in steps of 10 °C

Ramp Time: 0 to 99 s in steps of 1 s.

Hold Time: 0 to 99 s in steps of 1 s.

Internal Gas Flow: 0 mL/min (gas stop), 50 mL/min (mini-flow), 250 mL/min (full flow); can be switched over to another type of gas (Alternate Gas).

Furnace Opening & Closing: Pneumatically-operated by software command.

Furnace Gas: Argon (or Nitrogen). Inlet pressure 350-400 kPa (3.5-4 bar, 51-58 psi). Maximum gas consumption is 700 mL/min. The external flow rate is fixed at 100 mL/min each side.

Cooling System

Description: Self-priming re-circulating system with fan-assisted heat exchanger for constant cooling of the graphite furnace. The water temperature during operation is approximately 38 °C; the water flow is 2.5 L/min.

Power Requirements: 230V (+/-10%), 50/60 Hz (+/-1%); approx. 140 VA maximum power consumption. A means of electrically grounding the instrument and all accessories must be available.

Dimensions: 20 cm wide x 375 cm high x 50 cm deep.

Weight: 18 kg with coolant.

Certification: Designed and tested to be in compliance with the legal requirements for cooling systems.

Furnace Autosampler

Sampler Table: Installed in front of the furnace unit. Removable sample tray with 88 and 146 sampling positions for sample and reference solutions and 1 overflow container for pipette washing. Minimum sample requirement: 0.1 mL.

Dispensable Volume: Sample and Reagent: 1...99 µL, selectable in increments of 1 µL.

Electronics: The auto sampler is powered from the spectrometer and is software-controlled.

Computer & Instrument Software

Computer Requirements: WinLab32 for AA version 7.x and AA/Syngistix- AA version 1.x™ require Microsoft Windows 7 ®. Windows 7 service pack 1 is required for Syngistix installation. A computer with 2 GB RAM and a 60.0 GB or larger hard disk drive is recommended. It is also recommended to use a video display setting greater than 256 colors with a screen resolution at 800 x 600 or higher.

System Environment: Provides complete control of the instrument and its major accessories plus data handling and storage.

Data Handling: Instrument readings linear in absorbance (-0.500 A to +2.000 A), concentration or emission intensity with continuously variable scale expansion from 0.01 to 100 times. Integration times operator-selectable from 0.1 to 60 sec. in increments of 0.1 sec. Reading modes include time-averaged integration, non-averaged integration (peak area), and peak height measurement. Software includes built-in statistics. Up to fifteen (15) standards and a choice of proven calibration equations are included. Re-slope of the analytical curve using a single operator-selected calibration standard is available. There is a built-in Ethernet interface for computer connection and use of optional accessories. There is a data collection time of up to 20 minutes.

1.3 Location Requirements

Dimensions: 95 cm wide x 73 cm high x 68 cm deep

Make sure there is space in the back and sides of the system for air to circulate freely. Do not block the fan located on each side of the instrument. The back of the instrument should not be placed permanently against a wall, as the instrument must be accessible from the back for servicing purposes, and the gas lines cannot be bent. An accessible space of at least 60 cm (24 in.) should be available behind the instrument. If space behind the instrument is not possible, the table or bench on which the instrument is mounted should be on wheels so that it can be easily moved.

Weight: AA - THGA: 141 kg (without controller and cooling system).

Exhaust Vent: A venting system is required to remove the combustion fumes and vapors from the flame or graphite furnace for atomic absorption instruments. Exhaust venting is important for a number of reasons:

- It will protect laboratory personnel from toxic vapors which may be produced by some samples.
- It will tend to remove the effects of room drafts and the laboratory atmosphere on flame stability.
- It will help to protect the instrument from corrosive vapors which may originate from the samples.
- It will remove dissipated heat which is produced by the flame or furnace.

The venting system should provide a flow rate 5600 liters/min (200 cubic feet/min) for an air/acetylene flame or furnace and 7000-8500 liters/min (250-300 cubic feet/min) for a nitrous oxide /acetylene flame. It is strongly recommended that the instrument not be placed in a chemical hood! If a chemical hood must be used, arrangements should be made to keep out corrosive vapors and back drafts from other hoods. The chemical hood would have to be dedicated to the instrument. Sample preparation cannot be carried out in the same hood where the instrument is located.

PerkinElmer offers an accessory Blower and Vent Kit (Part No. **03030448** for 230 V, **03030447** for 115 V) which will fulfill the exhaust requirements for all atomic absorption instruments (see Figure 1). Included in the kit is a rotary blower with capacitor and hardware, a vent to be located above the instrument, and an adapter to permit connection of the blower and vent with suitable metal tubing. The adapter and vent are made of stainless steel sheets.

Notice: Local electrical codes do not permit PerkinElmer Service Engineers to install the blower and vent assembly.

The metal tubing required to connect the vent to the blower and to provide suitable exhaust from the blower is not included in the accessory Blower and Vent Kit. Flexible stainless steel tubing is recommended for this purpose and can be obtained from the companies listed in PerkinElmer's Preparing Your Laboratory brochure and from various other firms. In some instances this type of flexible metal tubing is sold only in minimum lengths of 3 meters (10 feet).

The capacity of the blower depends on the duct length and the number of elbows or bends used to install the system. If an excessively long duct system or a system with many bends is used, a stronger blower may be necessary to provide sufficient exhaust volume. Alternatively, smooth stainless steel tubing may be used instead of flexible stainless steel tubing where flexibility is not required to reduce system friction loss or "drag." A length of smooth stainless steel ducting has 20-30% less friction loss than a comparable length of flexible ducting. When smooth stainless steel tubing is used, elbows must be used to turn corners. These elbows should turn at a center line radius of 45 degrees to reduce friction losses, and the number of elbows should be minimized.

The dimensions for the various parts of the Blower and Vent Kit are shown in Figure 1. The vent i.d. is slightly larger than the tubing o.d. to allow for tubing tolerances. A slight gap between the two units is normal.

When installing such a venting system, all connections should be made with metal screws or rivets. Solder must not be used. The blower should be located at least 4 meters (12 feet) and not more than 6.5 meters (20 feet) from the flame or the graphite furnace and should exhaust to the atmosphere or into a considerably wider exhaust duct. Under these conditions, the following temperatures have been measured during operation of a nitrous oxide-acetylene flame: 310 °C at the vent intake; 160 °C at 2.4 meters (8 feet) from the vent intake; 105 °C at the blower intake; and 50 °C at the blower motor housing near the front bearing.

Instructions for installation (Part No. 09936775) are provided with the Blower and Vent assembly. The blower provided in the PerkinElmer accessory kit requires a line voltage of 115 V or 230 V, depending on which kit is purchased.

Additional recommendations on the venting system include:

- Make sure the duct casing is installed using fireproof construction. Route ducts away from sprinkler heads.
- Locate the discharge outlet as close to the blower as possible. All joints on the discharge side should be airtight, especially if toxic vapors are being carried.
- Equip the outlet end of the system with a back draft damper and take the necessary precautions to keep the exhaust outlet away from open windows or inlet vents and to extend it above the roof of the building for proper dispersal of the exhaust.
- Equip the exhaust end of the system with an exhaust stack to improve the overall efficiency of the system.
- Make sure the length of the duct that enters into the blower is a straight length at least ten times the duct diameter. An elbow entrance into the blower inlet causes a loss in efficiency.
- Design local exhaust ventilation systems individually for each specific atomic absorption instrument. Also, the opening of the exhaust vent should be large enough to cover the graphite furnace or flame area completely.
- Provide make-up air in the same quantity as is exhausted by the system. An "airtight" lab will cause an efficiency loss in the exhaust system.

- Ensure that the system is drawing properly by releasing smoke into the mouth of the collector hood vent. A synthetic "smoke" can be generated by placing open bottles of hydrochloric acid and ammonium hydroxide in proximity under the hood.
- Equip the blower with a pilot light located near the instrument to indicate to the operator when the blower is on.

Atomic Absorption Gases:

Note: Standards for cylinder dimensions, regulator connections, gas fittings, etc. vary from country to country. The information provided here is for the U.S. Contact your PerkinElmer representative for information on the specific requirements of your area.

Compressed Air: For flame operation, the air supply should provide a minimum of 28 liters/min (1 cubic foot/min) at a minimum pressure of 350 kPa (3.5 bar, 50.0 psig). The maximum pressure is 400 kPa (4 bar, 58 psig).

It is desirable to have a water and oil trap or filter between the compressor and the instrument gas control system. The use of an Air Filter Accessory (Part No. **N0775325**) or an Air/Acetylene Filter Accessory (Part No. **N9301398**) is strongly recommended to remove entrained water, oil, water aerosols and solid particles from compressed air lines.

WARNING: The input pressure to the air filter assembly should never exceed 1000 kPa (10 bar, 150 psig). Make sure house air is not above this pressure.

If there is any doubt regarding the usability of a central air supply (insufficient volume or pressure or excessive oil or water contamination), the quality of the supply should be checked prior to the arrival of the instrument.

A small, oil-less air compressor meeting the stated requirements is available from PerkinElmer (Part No. **03030313** or **N0777602** for 115 volts, 60 Hz), (Part No. **03030314** or **N0777603** for 220 volts, 50 Hz); or (Part No. **N0777604** for 220 volts, 60 Hz). These compressors have a relatively high noise level and should be located outside of the laboratory.

An air compressor that is enclosed in a sound insulation box and comes with a built in filter/dryer is part number (**N0777605** for 115 volts, 60 Hz), (**N0777606** for 220 volts, 50 Hz), or (**N0777607** for 220 volts, 60 Hz).

Cylinders of compressed air can also be used but are recommended only as an emergency or short-term solution for the following reasons:

- A standard #1 size air cylinder contains about 6200 liters (220 cubic feet) of air at standard temperature and pressure (STP). A premix burner-nebulizer system uses about 20 liters/min (0.7 cubic feet/min), and, therefore, a cylinder will last only about five hours. Unless an instrument is used only a few hours per day, changing cylinders becomes a nuisance as well as being expensive.

• Occasionally, cylinder air may be obtained from a liquefaction process during which the oxygen-to-nitrogen ratio can change. Therefore, it is not uncommon to find other than 20% oxygen in air cylinders. This can cause erratic burner operation and non-reproducible analytical results and, in extreme cases, may provide a potential safety hazard. In general, if cylinder air is to be used, it is important to specify compressed air rather than breathing air (i.e. medical grade) or an unspecified form.

WARNING: For safe operation, oxygen must NEVER be used with PerkinElmer premix burner systems.

The use of air cylinders requires the use of a suitable dual-stage regulator. A regulator for cylinders with a CGA 590 connection is available from PerkinElmer (Part No. 03030264).

Acetylene. For the overwhelming majority of analyses, acetylene is the preferred fuel gas with atomic absorption spectrometers. Air-acetylene is the preferred flame for the determination of about 35 elements by atomic absorption. The temperature of the air-acetylene flame is approximately 2300 °C. For most air-acetylene flames, the acetylene flow used is about 4 liters/min or 0.14 cubic feet/min. Using a heat combustion value of 1,450 BTU per cubic foot, the heat given off would be approximately 12,300 BTU per hour (3,600 W). An air-acetylene flame can be used with all PerkinElmer burner heads but is most commonly used with the supplied 10-cm (4-inch) burner head (Part No. N3160134).

Suitable acetylene typically has a minimum purity specification of 99.6% with the actual assay being about 99.8%. In general, ordinary welding grade acetylene is adequate for most atomic absorption analyses, though sometimes a particular tank may be contaminated. Special higher purity "atomic absorption" grade acetylene is also available from some vendors, and its use is recommended when the available welding grade acetylene is not sufficiently pure.

A size 1A acetylene cylinder contains about 8,500 liters (300 cubic feet) of acetylene and usually lasts about 30 hours of burning time with an air-acetylene flame. The cylinder requires an acetylene pressure regulator, which can be obtained from the supplier of the acetylene or from PerkinElmer (Part No. 03030106).

CAUTION: Acetylene may react with copper to form a potentially explosive compound. Copper tubing or fittings for acetylene gas must be strictly avoided.

The PerkinElmer Acetylene Regulator Assembly includes an adapter so that the pressure regulator can be connected to cylinders requiring either CGA 300 or CGA 510 fittings and a connector for attaching the fuel hose assembly supplied with the instrument. The fuel hose assembly is constructed of red neoprene, reinforced with high tensile strength rayon cord, and provides a rated working pressure of about 1700 kPa (250 psig). The connectors are permanently mounted at each end of the hose assembly for connection to the pressure regulator and instrument gas controls, and use left-hand threads as per accepted practice for fuel gas connections. (See Section 5 for more details.)

It may be desirable to have an acetylene filter between the acetylene tank and the instrument gas control system to remove particulates and acetone droplets from acetylene, protecting the gas controls and AA burner system from contamination and corrosion. An Acetylene Filter (Part No. **N9301399**) and an Air/Acetylene Filter Accessory (Part No. **N9301398**) are available from PerkinElmer. Some countries also require the use of a flashback arrestor such as PerkinElmer Part No. **N9300068** in the acetylene fuel line.

Acetylene is normally supplied dissolved in acetone, and a small amount of acetone carryover with the acetylene is normal. However, as tank pressure falls, the relative amount of acetone entering the gas stream increases and can give erratic results, particularly for elements such as calcium, tin, chromium, molybdenum and others whose sensitivity is highly dependent on the fuel/oxidant ratio. For this reason, acetylene tanks should be replaced when the cylinder pressure drops to about 600 kPa (85 psig).

WARNING: Failure to change the acetylene cylinder before the cylinder pressure drops below 600 kPa (5.9 bar, 85 psig) may cause damage to valves or tubing within the burner gas control system due to high acetone carryover. Such damage from acetone is not covered by instrument warranties.

Since the acetylene is dissolved in acetone, the pressure drop is not linear with gas removal, and a pressure of 600 kPa (5.9 bar, 85 psig) indicates that the cylinder is nearly empty, assuming the cylinder is at room temperature.

Acetylene tanks should always be stored and operated in a vertical position, rather than horizontally, to prevent liquid acetone from reaching the cylinder valve. New tanks should be positioned vertically for at least 8 hours prior to use. The practice of "cracking the valve" of an acetylene tank (that is, opening the valve slightly for a very short period prior to attaching the regulator) is not recommended. While such an action will clear the valve opening of dust or dirt particles and may remove acetone from the cylinder valve, it is a potentially hazardous practice and one which should never be attempted in the presence of an open flame, sparks or other possible sources of ignition.

CAUTION: Acetylene line pressure from the cylinder to the instrument should never be allowed to exceed 103 kPa (1 bar, 15 psig). At higher pressures, acetylene can spontaneously decompose or explode. PerkinElmer recommends that a maximum acetylene line pressure of 80-95 kPa (12-14 psig) be used to provide a reasonable margin of safety.

Both fuel and oxidant gas lines should be relieved of pressure at the end of the working day, or if the instrument is to be unused for an extended period. Cylinder valves should be closed to avoid the possibility of pressure regulators failing and gas lines being subjected to the full cylinder pressure.

Nitrous Oxide: The nitrous oxide-acetylene flame has a maximum temperature of approximately 2800 °C and is used for the determination of elements that form refractory oxides. It is also used to overcome chemical interferences that may occur in flames of lower temperatures. For the nitrous oxide-acetylene flame, the acetylene flow is about 14 liters/min or 0.5 cubic feet per min. Using a heat of combustion value of 1,450 BTU per cubic foot, the heat given off would be approximately 43,000 BTU per hour (12,500 W).

The use of nitrous oxide requires a number of accessories and precautions. A size 1A cylinder of nitrous oxide contains about 14,800 liters (520 cubic feet) and will typically last for 10 to 12 hours of burning time. Cylinders of nitrous oxide (99.0% minimum purity) are available from local suppliers. A dual-stage regulator is recommended (and is mandatory in some countries.)

Nitrous oxide is supplied in the liquid state, initially at a pressure of about 5000 kPa (52 bar, 750 psig). Since the nitrous oxide is in a liquid form, the pressure

gauge does not give a true indication of how much nitrous oxide remains in the cylinder until the pressure starts to fall rapidly as the residual gas is drawn off.

When nitrous oxide is rapidly removed from the cylinder, the expanding gas causes cooling of the cylinder pressure regulator and the regulator diaphragm sometimes freezes. This can create erratic flame conditions or, in the most extreme case, a flashback. It is therefore advisable to heat the regulator using either a built-in heater or an externally supplied heat source, such as an electrical resistance heating tape.

CAUTION: All lines carrying nitrous oxide should be free of grease, oil or other organic material, as it is possible for spontaneous combustion to occur. Cylinders of nitrous oxide should be considered high-pressure cylinders and should be handled with care at all times.

A dual-stage heated nitrous oxide pressure regulator for use with gas cylinders with a CGA 326 connection is available from PerkinElmer [Part No. **03030204** (115 volts) or **03030349** (230 volts)]. These regulators provide pressure control from 350-520 kPa (3.4-5.2 bar, 50-75 psig) and contain an integral thermostatic heater to prevent freezing of the regulator diaphragm. A color-coded hose with suitable connectors at each end is supplied with the regulators to provide connection to the instrument gas controls.

A nitrous oxide burner head (Part No. **N0400100** for the PinAAcle series of instruments) must be used with nitrous oxide-based flames. The instructions provided with the nitrous oxide burner head should be strictly followed.

Argon: Argon is required for external and internal gas streams through the THGA or HGA graphite furnace to prevent combustion of the graphite tube at temperatures above 500 degrees C. The quality criteria is listed in Table II. Normally, for graphite furnace operation, gaseous argon is used, although either liquid or gaseous argon can be used. The choice of liquid argon or gaseous argon tanks is determined primarily by the availability of each and the usage rate. Liquid argon is usually less expensive per unit volume to purchase, but cannot be stored for extended periods. If liquid argon is used, the tank should be fitted with an over-pressure regulator which will vent the tank as necessary in order to keep the liquid argon cool enough to remain in the liquid state. Gaseous argon tanks do not require venting and consequently can be stored for extended periods without loss.

A dual-stage cylinder regulator that can be used with either gaseous argon or nitrogen is available from PerkinElmer (Part No. **03030284**). The regulator has a CGA 580 fitting, and includes a color-coded hose with 1/4-inch Swagelok® fittings to permit direct connection to the regulator and to the instrument gas controls.

Table II.

Quality Criteria for Argon

Criteria	Specification
Purity	$\geq 99.996\%$
Oxygen	≤ 5 ppm
Nitrogen	≤ 20 ppm
Water	≤ 4 ppm

CAUTION: It is not recommended to use nitrogen as the furnace purge gas. Its use may lead to reduced sensitivity for some elements, and it is also possible for nitrogen to react with the graphite tube at temperatures above 2300 °C to form cyanogen, a toxic gas.

Gas Line Connections: PerkinElmer atomic absorption instruments include the hoses necessary for connection to gas lines (see Table III). It is the responsibility of the user to provide the appropriate gas lines, regulators, connectors and valves to which the hoses are connected.

Note: Regulator, connector and fitting needs vary by country. For information on what is required in your area, consult your local PerkinElmer Service Representative.

N.P.T. = Normal Pipe Thread, L.H.T. = Left-Hand Thread

Handling of Gas Cylinders & Other Safety Practices:

Notice: The permanent installation of gas supplies is the responsibility of the user and should conform to local safety and building codes.

- Flammable gas cylinders (such as acetylene) should not be stored with oxygen, or nitrous oxide cylinders, or adjacent to oxygen charging facilities.
- Fasten all gas cylinders securely to an immovable bulkhead or a permanent wall.
- When gas cylinders are stored in confined areas, such as a room, ventilation should be adequate to prevent toxic or explosive accumulations. Move or store gas cylinders only in a vertical position with the valve cap in place.
- Locate gas cylinders away from heat or ignition sources, including heat lamps. Cylinders have a pressure-relief device that will release the contents of the cylinder if the temperature exceeds 52 °C (125 °F).
- When storing cylinders external to a building, the cylinders should be stored so that they are protected against temperature extremes (including the direct rays of the sun) and should be stored above ground on a suitable floor.
- Mark gas cylinders clearly to identify the contents and status (full, empty, etc.).
- Do not attempt to refill gas cylinders.
- Use only approved regulators and hose connectors. Left-hand thread fittings are used for fuel gas tank connections, whereas right-hand fittings are used for oxidant and support gas connections.

- Use galvanized iron tubing, steel, wrought iron or other tubing that will not react chemically with acetylene. Never use copper tubing with acetylene. Joints may be welded or made up of threaded or flanged fittings, typically stainless steel, aluminum or brass composed of less than 65% copper. Rolled, forged or cast steel or malleable iron fittings may also be used. Cast iron fittings cannot be used safely for acetylene lines.

- Arrange gas hoses where they will not be damaged or stepped on and where things will not be dropped on them.

- Never run acetylene at a pressure higher than 100 kPa (15 psig). At pressures above this level, acetylene may spontaneously explode.

- Perform periodic gas leak tests by applying a soap solution to all joints and seals.

WARNING: Contact between acetylene gas and copper or silver (or high concentrations of silver salts), liquid mercury or gaseous chlorine can produce potentially unstable acetylides. Always clean the burner thoroughly after analyzing solutions with high silver or mercury concentrations, and aspirate solution continuously during the analysis to prevent any residues from drying.

- Periodically check for the presence of acetylene in the laboratory atmosphere, especially near the ceiling.

- When the equipment is turned off (for example, at the end of the working day), close all gas cylinder valves tightly at the tank. Bleed the remainder of the line to the atmosphere before the exhaust fan (vent) is turned off.

- When using premix burners with cyanide solutions, check the pH of the liquid trap and drain vessel. The pH of the liquid should be greater than 10. If the liquid is even slightly acidic, highly toxic hydrogen cyanide gas may be released.

- Take suitable precautions when using volatile organic solvents. A potentially flammable organic vapor "cloud" can form around the opening of the sample vessel. Feeding the capillary tubing through a small hole in a covered sample container is one way of reducing the possibility for ignition.

- Never view the flame, hollow cathode lamps, electrode less discharge lamps or deuterium background corrector lamps directly without protective eyewear. Potentially hazardous ultraviolet radiation may be emitted. Ordinary safety glasses will in general provide sufficient protection, but additional side shields will ensure a further margin of safety. Safety glasses will also provide mechanical protection for the eyes.

- Never leave the flame unattended.

- Zeeman background-corrected AA instruments generate a strong magnetic field. People with cardiac pacemakers are advised not to operate or frequent the vicinity of Zeeman-corrected instruments while they are in operation.

Drain Vessels: A specially-configured drain vessel is supplied with all PerkinElmer atomic spectroscopy instruments with burner systems. That vessel must be used to gather the effluent from the AA burner drain.

The drain vessel should NOT be stored in an enclosed storage area. Rather, the drain vessel should be stored in plain sight of the operator, usually on the floor in front of the instrument or on an open shelf underneath the instrument table.

The drain system should be checked regularly and replaced when necessary. Follow the directions in the instrument manuals regarding the proper placement of the drain tube in the drain vessel and the proper liquid level in the drain vessel.

Atomic Absorption Source Lamps: Atomic absorption spectrometers require different source lamps, depending on the elements to be determined and the instrument to be used. Multi-element lamps are available for some elements, but most lamps are constructed using a single element to avoid potential spectral interferences and reduced performance, especially when using a graphite furnace.

PerkinElmer manufactures all of its hollow cathode and electrode less discharge lamps. The Lumina™ and Atomax™ series of hollow cathode lamps are especially noted for spectral purity, brightness, stability and long life.

Hollow cathode lamps are excellent for most elements; however, there are a number of "difficult" elements for which an improved light source is desirable. PerkinElmer System 2 Electrode less Discharge Lamps (EDLs) provide improved performance in most instances. EDLs are more intense than their corresponding hollow cathode lamps. Most also provide better lamp life and stability and some also provide better sensitivity. EDLs do not require a separate power supply as it is built-in the PinAAcle system.

A lamp mount or turret is supplied with all PerkinElmer AA instruments and will accommodate all PerkinElmer hollow cathode or electrode less discharge lamps. Users who may have lamps with 1.5-inch diameters rather than the standard PerkinElmer 2-inch diameter can adapt those lamps for use in PerkinElmer lamp mounts with the Small Diameter Lamp Adapter Kit, (Part No. 03030870) and the adapter plug (Part No. N3050197).

Furnace Requirements: The furnace power supply is built into the PinAAcle 900T.

Graphite furnaces require electrical power, cooling water and a supply of inert gas, normally argon. A minimum input voltage of 208 volts under load is strongly recommended to enable the furnace to reach maximum potential operating temperatures and required heating rates. The minimum input voltage of 208, under load is also needed for the Zeeman effect background correction, to guarantee proper magnetic field strength. For installations where the line voltage may drop below this level, the use of a "buck boost"-type transformer is strongly recommended to maintain proper analytical operating conditions. Operating the system without the above recommendations, might void the instrument warranty.

An appropriately-rated female electrical connector is required to provide power for the graphite furnace. Please contact your local Service Engineer to determine the appropriate connector for your laboratory.

The THGA furnace and Zeeman magnet of the PinAAcle 900T system operates from a single, dedicated electrical supply of 230 volts ($\pm 10\%$), under full instrument load, 30 amp, 50 or 60 Hz (± 0.3 Hz), single phase, capable of delivering 10.1 KVA. The PinAAcle 900T system is provided with a 30-amp plug. It is recommended that 8-gauge (6 mm²) wire be used for the electrical supply for the PinAAcle 900T system, and that the length of the wiring (circuit breaker to instrument connection) not exceed 20 meters (65 feet). If the length of the wiring exceeds 20 meters, 6 gauge wiring is needed.

For all furnace systems, the electrical supply should contain a "slow blow" circuit breaker capable of handling 300% of the rated current for periods of 3 seconds. Also, the AA spectrometer, graphite furnace, Zeeman magnet, computer and other accessories should all be connected to the same electrical ground. There should be no more than 10 volts peak to peak noise between hot and neutral and no more than 0.5 volts noise between neutral and ground. If noise exceeds either or both values, a line conditioner is needed.

Additional Furnace Requirements:

A water supply is required to cool the furnace quickly to ambient temperature after reaching high atomization temperatures. A suitable recirculating cooling system is included with the PinAAcle 900T.

When operating the HGA Graphite Furnace systems at high temperatures, do not look directly at the tube without suitable eye protection.

1.4 Maintenance and Troubleshooting

Routine maintenance can be performed by a trained analyst using the instructions found in the respective documents for maintenance and troubleshooting. PerkinElmer has trained service representatives, who perform other planned maintenance service annually or as required. Departmental Standard Operating Procedures (SOPs) shall also be consulted to implement and document the necessary repairs.

1.5 Hazards and Safety Precautions

Refer to respective documents for the safety summary outlines and explanation.

2 Documentation

2.1 PerkinElmer Service Engineer Training

Persons authorized by PerkinElmer to perform validations have been properly trained. Training is documented, and a certificate is issued by PerkinElmer to that effect.

See Attachment #1 for PerkinElmer Training Certificate.

2.2 Standard Operating Procedures

It is responsibility of the customer to follow a SOP for use and maintenance of the equipment to ensure consistent operations. The customer SOP may be written after the Qualification and can be added as an attachment after PerkinElmer completes this OQ.

2.3 Operational Qualification Instruction

2.3.1	In the Operational Qualification Test Description: Record Model (or Part Number) and Serial Number of any accessories or components not covered in the OQ.
2.3.2	Record the Serial Number and Calibration Date for each item of Test Equipment used.
2.3.3	Record the Batch/Lot Number and Expiration Date of each Standard, Reagent and Solvent used, including those supplied by the customer.
2.3.4	Label all solutions prepared at customer site in accordance with the customer requirements.
2.3.5	Provide the Standard certificates as Attachments.
2.3.6	Conduct Parameter Testing and record test data, Pass/Fail and Comments.
2.3.7	Verify the completed OQ in Section 5.
2.3.8	Sign, date and number attachments of all recordings or printouts made during the test procedure.
2.3.9	Fill in All Appendices, as required.
2.3.10	Complete and sign off the Final Protocol Approval.
2.3.11	Complete and affix an OQ Certification Sticker to the instrument.

3 Operational Qualification Test Description

Configurations Covered	PinAAcle900T	
Accessories/Components not covered	Model	Serial Number
Estimated Certificate Testing Time		
Pre-test Stabilization	1.0 Hour	
Testing Time	7.0 Hours	
Materials Required		
Documentation	Part Number	
Service Manual	09936989	
Hardware Manual	09936985 or 09931148	
PinAAcle Family Preparing Your Laboratory for PerkinElmer Atomic Absorption Spectrometers	009362_03	
Analytical Methods for AAS Manual	03030152 (FlmCkbn)	
Safety with Organic Solvents	B0190413	
Recommended Single-Element Conditions for THGA Furnaces	09935220	
AS-900 User's Manual	09936997 or 09931157	
Cooling System User's Guide	09935299 (Coolsys-1)	
Automatic Matrix Modification for THGA Graphite Furnace AA	D-6124	
OQ Certification Sticker	09934513	
Comments:		
PerkinElmer Representative Signature:		Date: (DD-MMM-YYYY)
Customer Representative Signature:		Date: (DD-MMM-YYYY)

Test Equipment	Manufacturer	Model	Serial Number	Calibration Date (MMM-YYYY)
0.2A Neutral density filter	PerkinElmer	N1013000		
0.7A Neutral density filter	PerkinElmer	N1013001		
1.0A Neutral density filter	PerkinElmer	N1013002		
2.0A Neutral density filter	PerkinElmer	N1013003		
Nitrous Oxide burner head (if applicable)	PerkinElmer	N0400100	N/A	N/A
Test Jig	PerkinElmer	B0505495	N/A	N/A
Flow Meter		B3100652, or N9307029 or other suitable Flow Meter		
125 mL plastic bottles (optional)	N/A	N/A	N/A	N/A
Standards, Reagents and Solvents	Manufacturer	Part Number	Batch/Lot	Expiration (MMM-YYYY)
PE pure GFAAS-MIXSTD	PerkinElmer	N9300244		
1% Nitric Acid (250 mL) (Optional)	PerkinElmer	N8145050		
0.5% Nitric Acid (250 mL) (Optional)	PerkinElmer	N8125033		
Lamps	Manufacturer	Model / PN	Serial Number	
Lumina HCL Ba - coded	PerkinElmer	N3050109		
Lumina HCL Cr - coded	PerkinElmer	N3050119		
Lumina HCL Cu - coded	PerkinElmer	N3050121		
EDL/2 lamp As – with coding plug	PerkinElmer	N3050605		
Customer Supplied	Manufacturer	Part Number	Batch/Lot	Expiration (MMM-YYYY)
DI Water (if applicable)	N/A	N/A	N/A	N/A
Comments:				
PerkinElmer Representative Signature:			Date: _____ (DD-MMM-YYYY)	
Customer Representative Signature:			Date: _____ (DD-MMM-YYYY)	

<i>All solutions prepared at customer site must be labeled in accordance with the customer requirements</i>	
Tests	
Name of Test	Description
Detector Linearity with Barium	Ensures that the detector is linear in the Visible Range
Baseline Noise at 1.0 Absorbance with Barium	Ensures that a high absorbance will not produce excessive noise.
AA Baseline with Copper	Checking baseline noise.
D ₂ Background Compensation, Copper	Verifies the instruments ability to compensate for Background absorption
AA-BG Baseline Noise with Copper	Ensures that background correction does not produce excessive noise.
AA-BG Baseline Noise with Arsenic	Ensures that background correction does not produce excessive noise at a low wavelength.
Flame safety checks	Checks to ensure that all safety interlocks are closed
Standard flame check	Checks for a moderately blue flame
Flame interlock shutdown	Checks that the flame extinguishes safely
Nitrous Oxide flame check (if applicable)	Checks that the Nitrous Oxide / Acetylene flame ignites and extinguishes correctly
Flame Sensitivity and Precision	Instrument sensitivity and reproducibility checked against Copper standard.
Furnace Gas Flows	Ensures the flow rates are within specification
Chromium Baseline Noise	Signal to noise check
Chromium Characteristic Mass and Precision	Calculate the characteristic mass using characteristic mass tool and precision from the integrated absorbance values
Copper Characteristic Mass and Zeeman Ratio	Calculate the characteristic mass using the characteristic mass tool. Check the Zeeman Ratio
Autosampler Linearity	Checks the Correlation Coefficient
<i>PerkinElmer assumes no responsibility for failure of test results except as covered by instrument warranty or contract.</i>	

4 Parameter Testing

Refer to the information in this section for procedures to perform the tests.

Preparation

- Make sure that the gas supplies are switched on and at the correct pressure.
- Install the Lumina Cu HCL in position 1.
- Install the As EDL, driver and coded plug in position 2.
- Install the Lumina Cr HCL in position 3.
- Install the Lumina Ba HCL in position 4.
- Use the Lamp Setup window to turn on the As EDL, and two of the HCL lamps. It is recommended to warm up the HCL lamps for at least 5 minutes, and the EDL lamp approximately 45 minutes before running a test. The lamps can be turned on after the software initializes.
- Power up the instrument and computer. Launch WinLab32 for AA, or Syngistix for AA software, then *Change Technique* to *Flame* if not already in the flame mode.
- It is recommended to warm-up the system for 30 minutes.

Note: The first eleven tests are performed using the **flame mode**. The remaining tests are performed using the furnace mode. All needed methods are stored in the **Service library**. Results may be stored as a results data set.

1. If Syngistix AA Software is installed, the path is: (C:\Users\Public\PerkinElmer\Syngistix\AA\SystemFiles\Service) if the default directory is used when installing the software.
2. If WinLab for AA Software is installed, the path is:
(C:\Users\Public\PerkinElmer\AA\SystemFiles\Service) if the default directory is used when installing the software.

- **Note:** Absorbance Filters will vary by wavelength, and will never be exactly 0.2, 1.0, or 2.0 absorbance. The filter calibration data sheet provides an absorbance at individual wavelengths.

4.1 Detector Linearity with Barium

4.1.1 Test Conditions

- Install the Barium Lamp.
- If the lamp is not coded, enter the element in the Lamp Setup window.
- Turn on the Barium lamp and select Setup for the Barium lamp.
- Close the Lamp Setup Window.

4.1.2 Test Prerequisites

- Burner Head below the light beam.

4.1.3 Test Steps

- Open the **Det Linearity** (WinLab32), or **PFHT-Detector Lin-Ba** (Syngistix) method in the Service PinAAcle directory. If there is an interlock message concerning the burner head, and/or nitrous oxide, change the oxidant to air in the burner control window.
- Open Continuous Graphics.
- Autozero
- Place the 2.0 A Neutral Density Filter in the Filter holder in the Sample Compartment. Record the Absorbance in the table below. Remove the filter from the filter holder.
- Repeat with the 1.0 A Neutral Density Filter.
- Repeat with the 0.2 A Neutral Density Filter.
- Remove the filter from the filter holder
- Close Continuous Graphics
- Record the test results, and/or print to file.
- If desired, Manual Analysis can be used, so data can be saved, but a blank may need to be added to the service method.

4.1.4 Test Results

Parameter	Specification	Calibrated Filter Absorbance at 553.6	Test Result	Pass/Fail
Absorbance of "2.0 Filter"	± 10% from Calibrated Filter Value			
Absorbance of "1.0 Filter"	± 10% from Calibrated Filter Value			
Absorbance of "0.2 Filter"	± 10% from Calibrated Filter Value			
Comments:				
PerkinElmer Representative Signature:			Date:	
			(DD-MMM-YYYY)	
Customer Representative Signature:			Date:	
			(DD-MMM-YYYY)	

4.2 Baseline Noise at 1.0 Absorbance with Barium

4.2.1 Test Conditions

- Install the Barium Lamp.
- If the lamp is not coded, enter the element in the Lamp Setup window.
- Turn on the Barium lamp and select Setup for the Barium lamp.
- Close the Lamp Setup Window.

4.2.2 Test Prerequisites

- Burner Head below the light beam.

4.2.3 Test Steps

- Open the AA AA BL Noise 1 A (WinLab), and PFHT- AA BL Noise 1A-Ba (Syngistix) method in the Service PinAAcle directory. If there is an interlock message concerning the burner head, and/or nitrous oxide, change the oxidant to air in the burner control window.
- Place the 1.0 A neutral density Filter in the filter holder.
- Open the Analysis window.
- Click the Analyze Sample button and 99 replicates will be measured.
- Remove the filter from the filter holder.
- Record the results in the table below.
- Print the test results if desired.

4.2.4 Test Results

Parameter	Specification	Test Result	Pass/Fail
Standard Deviation	≤ 0.010		
Comments:			
PerkinElmer Representative Signature:		Date: (DD-MMM-YYYY)	
Customer Representative Signature:		Date: (DD-MMM-YYYY)	

4.3 AA Baseline with Copper

4.3.1 Test Conditions

- Install the Copper Lamp.
- If the lamp is not coded, enter the element in the Lamp Setup window.
- Turn on the Copper lamp and select Setup for the Copper lamp.
- Close the Lamp Setup Window.

4.3.2 Test Prerequisites

- Burner Head below the light beam.

4.3.3 Test Steps

- Open the AA BL Noise (WinLab), and PFHT- AA BL Noise- Cu (Syngistix) method in the Service PinAAcle directory.
- In the (Manual) Analysis window, select Analyze Sample for 99 replicates to be measured, using a 0.5 second integration time.
- Record the results in the table below.
- Print the test results if desired.

4.3.4 Test Results

Parameter	Specification	Test Result	Pass/Fail
Standard Deviation	≤ 0.001		
Comments:			
PerkinElmer Representative Signature:		Date: (DD-MMM-YYYY)	
Customer Representative Signature:		Date: (DD-MMM-YYYY)	

4.4 D₂ Background Compensation with Copper

4.4.1 Test Conditions

- Install the Copper Lamp.
- If the lamp is not coded, enter the element in the Lamp Setup window.
- Turn on the Copper lamp and select Setup for the Copper lamp.
- Close the Lamp Setup Window.

4.4.2 Test Prerequisites

- Burner Head below the light beam.

4.4.3 Test Steps

Open the **D2 Compensation** (WinLab), **PFHT-D2 Compensation- Cu** (Syngistix) method in the Service PinAAcle directory.

- Open the Continuous Graphics window.
- Select the Autozero Icon in the Continuous Graphics window.
- Place the 0.7 A neutral density filter in the filter holder.
- Record the Absorbance in the table below.
- Remove the filter from the filter holder.
- Close the Continuous Graphics window.
- If desired, the analysis window can be used instead of Continuous Graphics.
- Print the test results if desired..

4.4.4 Test Results

Parameter	Specification	Test Result	Pass/Fail
Absorbance	≤ 0.010		
Comments:			
PerkinElmer Representative Signature:		Date: <hr/> (DD-MMM-YYYY)	
Customer Representative Signature:		Date: <hr/> (DD-MMM-YYYY)	

4.5 AA-BG Baseline Noise with Copper

4.5.1 Test Conditions

- Install the Copper Lamp.
- If the lamp is not coded, enter the element in the Lamp Setup window.
- Turn on the Copper lamp and select Setup for the Copper lamp.
- Close the Lamp Setup window.

4.5.2 Test Prerequisites

- Burner Head below the light beam.

4.5.3 Test Steps

- Open the AA-BG BL Noise (WinLab), PFHT AA-BG BL Noise Cu (Syngistix) method in the Service PinAAcle directory.
- In the *(Manual) Analysis* window, click on *Analyze Sample*, 99 replicates will be measured, with an integration time of 2.0 seconds.
- Record the results in the table below.
- Print the test results if desired.

4.5.4 Test Results

Parameter	Specification	Test Result	Pass/Fail
Standard Deviation	≤ 0.005		
Comments:			
PerkinElmer Representative Signature:		Date: (DD-MMM-YYYY)	
Customer Representative Signature:		Date: (DD-MMM-YYYY)	

4.6 AA-BG Baseline Noise with Arsenic

4.6.1 Test Conditions

- Install the Arsenic EDL Lamp.
- If there is no coding plug, enter the element in the Lamp Setup window.
- Turn on the Arsenic EDL lamp and select Setup for the Arsenic lamp.
- Close the Lamp Setup Window.

4.6.2 Test Prerequisites

- Burner Head below the light beam.

4.6.3 Test Steps

- Open the AA-BG BL N As (WinLab), PFHT AA-BG BL N As (Syngistix) method.
- In the (Manual) Analysis window, select Analyze Sample, 99 replicates will be measured with an integration time of 2.0 seconds.
- Record the results below.
- Print the test results if desired.

4.6.4 Test Results

Parameter	Specification	Test Result	Pass/Fail
Standard Deviation	≤ 0.005		
Comments:			
PerkinElmer Representative Signature:		Date: (DD-MMM-YYYY)	
Customer Representative Signature:		Date: (DD-MMM-YYYY)	

4.7 Flame Safety Checks

4.7.1 Test Conditions

- Before igniting the flame, make sure the following conditions are satisfied.
- Make sure the vent is on and has the correct flow rate as specified in the Preparing Your Laboratory for AA document.
- Ensure the spray chamber is correctly installed.
- Ensure the end cap is secured by the latches.
- Ensure the burner head is correctly installed.
- Ensure that the correct sample introduction O-rings are installed, they are compatible with the solutions being run, and they are in good condition.
- Make sure the stainless steel nebulizer (if applicable), has an outer O-ring and the end cap retainer is over the nebulizer flange.
- Ensure the fuel and oxidant hoses are correctly fitted to the instrument.
- Ensure the drain system is installed and is operating correctly.
- Make sure the drain system is out in the open (not in a cabinet).
- Ensure the flame atomizer door is in the closed position.
- Ensure all safety interlocks are satisfied.
- Ensure Cyanide solutions, which produce a poisonous gas when mixed with acidic solutions, are not present in the drain bottle.

If the interlocks are not closed, one or more of the following may be the cause:

- The burner head, the nebulizer, or the drain system is not correctly installed.
- The acetylene or oxidant pressure is too low.
- There is not enough liquid in the drain trap/loop.
- The liquid level in the drain vessel is too high.

4.7.2 Test Steps

- Document the above conditions in the check box below.

4.7.3 Test Results

Parameter	Specification	Test Result	Pass/Fail
Flame Safety Check	Items specified above were checked		
Flame Safety Check	Interlocks are correctly closed		
Comments:			
PerkinElmer Representative Signature:		Date: (DD-MMM-YYYY)	
Customer Representative Signature:		Date: (DD-MMM-YYYY)	

4.8 Standard Flame Check

4.8.1 Test Conditions

- Install the Copper Lamp.
- If the lamp is not coded, enter the element in the Lamp Setup window.
- Turn on the Copper lamp and select Setup for the Copper lamp.
- Ensure the standard burner head is installed.
- Ensure that the exhaust vent is turned on.

4.8.2 Test Prerequisites

- Burner Head below the light beam.

4.8.3 Test Steps

- Open the FL Sens&Prec(HS or SS) or PFHT-FI Sen Pred-Cu method located in the PinAAcle directory under the Service directory.
- Open the Flame Control window.
- Light the Flame
- Confirm that the flame is a moderately lean, blue flame.
- Record the results in the box below.

4.8.4 Test Results

Parameter	Specification	Test Result	Pass/Fail
Standard Flame Check	Moderately blue		
Comments:			
PerkinElmer Representative Signature:		Date: (DD-MMM-YYYY)	
Customer Representative Signature:		Date: (DD-MMM-YYYY)	

4.9 Flame Interlock Check

4.9.1 Test Conditions

- Install the Copper Lamp.
- If the lamp is not coded, enter the element in the Lamp Setup window.
- Turn on the Copper lamp and select Setup for the Copper lamp.
- Flame on.

4.9.2 Test Prerequisites

- The flame safety checks passed.

4.9.3 Test Steps

- Cover the flame sensor with a very long screwdriver with a wide blade, or other appropriate tool. Make sure the flame extinguishes safely. You will see a flame interlock error message.
- Re-ignite the flame and unplug the drain sensor cable. Make sure the flame extinguishes safely. **WinLab32:** The Safety Interlock "X" will turn red in the Flame Control Window. A drain not connected pop-up error message will appear. **Syngistix:** You will see a drain not connected error message in the flame control window, and a drain not connected pop-up error message.
- Re-connect the drain sensor cable.
- Re-ignite the flame and carefully rotate the nebulizer side arm counterclockwise. Make sure the flame extinguishes safely. **WinLab32:** The Safety Interlock "X" will turn red in the Flame Control Window. A Nebulizer missing pop-up error message will appear. **Syngistix:** You will see a nebulizer missing error message in the flame control window and a nebulizer missing pop up message.
- Re-position the nebulizer correctly.
- Re-ignite the flame. If accessible, turn off the acetylene valve. Make sure the flame extinguishes in a safe manner. **WinLab32:** The Safety Interlock "X" will turn red in the Flame Control Window. A no fuel pressure pop-up error message will appear. **Syngistix:** You will see a no fuel pressure error message in the flame window and a no fuel pressure pop up message.
- Turn the acetylene back on.
- Re-ignite the flame. If accessible, turn off the air pressure valve. Make sure the flame extinguishes in a safe manner. **WinLab32:** The Safety Interlock "X" will turn red in the Flame Control Window. A no air pressure pop-up error message will appear. **Syngistix:** You will see a no air pressure interlock in the flame control window and a no air pressure pop up message.
- Turn the air back on.

- In the Flame Control window, when the **flame is off**, an **air burner head** is installed, and there is **no nitrous oxide pressure**; check that when Nitrous Oxide is chosen as the oxidant, the flow rates change in the flame control window, and an interlock occurs. **WinLab32**: The Safety Interlock "X" will turn red in the Flame Control Window. When the red box with an X is selected, there should appear the following pop-up message: No N2O pressure. No N2O burner head. **Syngistix**: You will see No N2O pressure, and No N2O burner head in the flame control window.
- Change back to Air in the Burner Control Window. Light the flame.
- In the Flame Control window, when the **flame is on**, an **air burner head is installed**, and there is **no nitrous oxide pressure**; check that when Nitrous Oxide is chosen as the oxidant, the safety interlock stays green, the gas flow rates change, but when apply is selected, the following pop-up message appears: **WinLab32**: No N2O pressure, and No N2O burner head. **Syngistix**: No N2O pressure, and No N2O burner head.
- Check the appropriate Test Result box below after each test.
- Extinguish the flame.

4.9.4 Test Results

Parameter	Specification	Test Result	Pass/Fail
Flame Sensor - Flame Interlock Shutdown Check	Air/Acetylene Flame correctly shuts down		
Drain Sensor - Flame Interlock Shutdown Check	Air/Acetylene Flame correctly shuts down		
Nebulizer Sensor - Flame Interlock Shutdown Check	Air/Acetylene Flame correctly shuts down		
Acetylene pressure Sensor (optional)	Air/Acetylene Flame shuts down in a safe manner		
Air pressure Sensor (optional)	Air/Acetylene Flame shuts down in a safe manner		
Air Burner Head Sensor - Interlock Check	Choosing Nitrous Oxide as the oxidant should trigger an interlock		
Comments:			
PerkinElmer Representative Signature:		Date: (DD-MMM-YYYY)	
Customer Representative Signature:		Date: (DD-MMM-YYYY)	

4.10 Nitrous Oxide Flame Check (if applicable)

4.10.1 Test Conditions

- Install the Copper Lamp.
- If the lamp is not coded, enter the element in the Lamp Setup window.
- Turn on the Copper lamp and select Setup for the Copper lamp.
- Close the Lamp Setup Window.
- Nitrous oxide burner head installed (make sure standard burner head is cool before removing).
- Nitrous gas line is installed between the instrument and a tank that has a pressure above 500 psi (3447 kilopascal or 34.5 bar). The tank is empty if the pressure is below 500 psi (3447 kilopascal or 34.5 bar).
- A heated nitrous oxide regulator is installed on the nitrous oxide tank.
- The nitrous oxide regulator line pressure is set to the correct pressure according to the installation procedure.
- Ensure the vent flow is between 250 and 300 CFM.

4.10.2 Test Prerequisites

- All safety interlocks have been checked.
- A copper method such as the FL Sens&Prec(HS or SS) or PFHT-FI Sen Pred-Cu method is open.

4.10.3 Test Steps

- In the Flame Control window click on the N₂O radio button.
- Switch on the flame by clicking on the Flame On button. A standard flame will be ignited and after a short moment the changeover to Nitrous Oxide will take place.
- Make sure the Nitrous Flame is not too lean (all blue) and not too rich (all white). There should be a pink feather that is 2-5 cm high.
- Select the flame off button. Make sure the Nitrous Oxide Flame extinguishes safely.
- Re-ignite the flame. **If accessible**, turn off the acetylene valve. Make sure the flame extinguishes in a safe manner.
- Re-ignite the flame. **If accessible**, turn off the nitrous oxide valve. Make sure the flame extinguishes in a safe manner.
- Check the appropriate Test Result box for each of the tests.

- Explain to the customer that it is recommended to warm up the burner head for five minutes before switching to the Nitrous Oxide / Acetylene flame to minimize carbon build-up.
- Explain to the customer that the nebulizer is never adjusted while running a Nitrous Oxide / Acetylene flame.
- Explain to the customer that a Nitrous Oxide / Acetylene flame should never be all blue since all blue is too lean, and is prone to a flashback. The flame should also never be all white, as an all-white flame is too rich, and is likely to clog the burner head, producing a flash back as well.

4.10.4 Test Results

Parameter	Specification	Test Result	Pass/Fail
Nitrous Oxide flame lights correctly when the flame on button is selected.	Flame first lights with air/acetylene, then switches to Nitrous Oxide/Acetylene		
Nitrous Oxide flame is slightly rich	Nitrous Oxide flame has the desired red feather		
Acetylene valve is turned off (optional)	Nitrous Oxide/Acetylene flame shuts down in a safe manner		
Nitrous Oxide valve is turned off (optional)	Nitrous Oxide/Acetylene flame shuts down in a safe manner		
Nitrous Oxide flame shuts down correctly	Flame switches back to air/acetylene, then turns off.		
Comments:			
PerkinElmer Representative Signature:		Date: (DD-MMM-YYYY)	
Customer Representative Signature:		Date: (DD-MMM-YYYY)	

4.11 Flame Sensitivity and Precision

4.11.1 Test Conditions

- Install the Copper Lamp.
- If the lamp is not coded, enter the element in the Lamp Setup window.
- Turn on the Copper lamp and select Setup for the Copper lamp.
- Close the Lamp Setup Window.

4.11.2 Test Prerequisites

- For the **Stainless Steel Nebulizer**: Accurately pipette 10 ml of the GFAAS-MIXED STANDARD (part number N930 0244) into an acid-washed 100 ml class A volumetric flask and dilute to volume with deionized water or the 1% Nitric Acid solution. The diluted solution contains **5.0 mg/L copper**. A clean plastic 125 mL bottle can also be used if the standard is made up by weight using a transfer pipet.
- For the **Plastic Nebulizer**: Accurately pipette 4 ml of the GFAAS-MIXED STANDARD (part number N930 0244) into an acid-washed 100 ml class A volumetric flask and dilute to volume with deionized water or the 1% Nitric Acid solution. The diluted solution contains **2.0 mg/L copper**. A clean plastic 125 mL bottle can also be used if the standard is made up by weight using a transfer pipet.
- Ensure the burner head is parallel to the light beam (not tipped).
- Open the Continuous Graphics and flame control windows.
- Ensure the burner head is below the beam from the lamp, and autozero.
- With the flame off, optimize the burner height.
- With the flame on, while aspirating the appropriate standard for the nebulizer being used, align the horizontal and rotational positions.
- Now optimize the nebulizer. Unlock the nebulizer locking nut. Slowly turn the nebulizer adjustment nut counterclockwise until you see bubbles in the copper solution or until the absorbance goes to zero. Turn the nebulizer adjustment nut clockwise until the absorbance goes to its maximum. The minimum absorbance is listed in the table below.
- Optimize gas flows to obtain the highest absorbance.
- Close the Continuous Graphics window.

4.11.3 Test Steps

- Open the **FL Sens&Prec(HS or SS)** or **PFHT-FI Sen Pred-Cu** method. Change the gas flows to the values that gave the highest absorbance during optimization. Define the Blank in the method if needed.
- Open the Manual Analysis and Result windows.

- Aspirate the blank solution. Select Analyze Blank in the Manual Analysis Window. Wait until the 10 replicates are finished.
- Aspirate the copper standard for the nebulizer being used. The Stainless Steel Nebulizer uses the 5 mg/L standard and the Plastic Nebulizer uses the 2 mg/L standard. Select Analyze Sample. Wait until the 10 replicates are finished.
- Record the results in the table below for the selected nebulizer.
- Print the test results if desired.
- Aspirate DI water for 5 minutes, then aspirate air for 30 seconds.
- Turn off the flame.
- The PinAAcle 900 T IQ/OQ test parameters only covers the nebulizers that ship with the PinAAcle 900 T, either the Metal Body Stainless Steel Nebulizer (N3160143), or the Plastic High Sensitivity Nebulizer (N3160144). Other nebulizer assemblies will produce different results.

4.11.4 Test Results

Parameter	Specification	Test Result	Pass/Fail
Flame Sensitivity with SS nebulizer (if applicable)	Mean Absorbance ≥ 0.250 for a 5 mg/L Cu standard		
Flame Sensitivity with plastic nebulizer , without the spacer installed (if applicable)	Mean Absorbance ≥ 0.250 for a 2 mg/L Cu standard		
Flame Precision with the SS nebulizer (if applicable)	RSD $\leq 0.50 \%$		
Flame Precision with the plastic nebulizer (if applicable)	RSD $\leq 0.50 \%$		
Comments:			
PerkinElmer Representative Signature:		Date: (DD-MMM-YYYY)	
Customer Representative Signature:		Date: (DD-MMM-YYYY)	

4.12 Furnace Gas Flows

4.12.1 Test Conditions

- Open the furnace base module.

4.12.2 Test Steps

- Turn on the gas flow, standard flow, not mini flow.
- Open the graphite furnace and remove the graphite tube.
- Insert the test jig (B0505495) into the rear contact cylinder.
- Connect the gas outlet of the jig to a flow meter.
- Measure the flow rate for front and back (internal) and record the values.
- Determine the difference in flow rate between the two sides for the internal flows.
- Remove the test jig and put the graphite tube back into the furnace.
- Check the external flow rates by connecting the flow meter to the external hoses at the QCM connectors and record the values for both sides.
- Determine the difference in flow rate between the two sides for the external flows.
- Adjust the regulator if needed to either increase all flow rates or to decrease all flow rates.
- Check hose connections for any leaks. Make sure the gas lines seal in the connector.
- Close the base module.

4.12.3 Test Results

Parameter	Specification	Test Result	Pass/Fail
Internal Flow Rate, Left Side	250 mL/min \pm 20 mL/min		
Internal Flow Rate, Right Side	250 mL/min \pm 20 mL/min		
Difference between Internal Flow Rates	20 mL/min maximum		
External Flow Rate, Front	100 mL/min \pm 10 mL/min		
External Flow Rate, Back	100 mL/min \pm 10 mL/min		
Difference between External Flow Rates	20 mL/min maximum		
Comments:			
PerkinElmer Representative Signature:		Date: _____ (DD-MMM-YYYY)	
Customer Representative Signature:		Date: _____ (DD-MMM-YYYY)	

4.13 Chromium Baseline Noise (Furnace)

4.13.1 Test Conditions

- Install the Chromium Lamp.
- If the lamp is not coded, enter the element in the Lamp Setup window.
- Turn on the Chromium lamp and select Setup for the Chromium lamp.
- Close the Lamp Setup Window.
- Make sure a **standard THGA tube** is in the furnace. In the *Furnace Control* window click on the **Condition Tube** button to condition and clean the THGA tube.
- Use the 88 position sample tray of the AS-900, check the tray configuration.
- Align the AS-900 carefully, as described in the Hardware Manual.
- Immerse the rinse liquid capillary into a bottle of **Isopropanol**.
- In the *Furnace Control* window click at least 5 times on the **Flush Sampler** button to remove dirt and oils from the pump and capillary system of the AS-900.
- Connect the rinse liquid capillary back into the rinse liquid vessel.
- In the *Furnace Control* window click at least 5 times on the *Flush Sampler* button to remove any Isopropanol from the pump and capillary system of the AS-900. Repeat this step if necessary to remove all air bubbles.

4.13.2 Test Steps

- Open the **THGA Cr Tests** (WinLab), **PZT- BL Char Mass- Cr** (Syngistix) method.
- From the *Tools* (WinLab) or *Analysis & Results* (Syngistix) choices, open the following windows; *Results*, *(Transient) Peaks (Display)* and *(Automated) Analysis (Control)*.
- Before starting the test, run at least one **dry** firing (without any sample) to make sure that there is **no residual signal (less than 0.005 integrated absorbance, which is peak area)** from any previous injections or tube contamination.
- Repeat the dry firing as needed to ensure there is no peak from contamination.
- It is also recommended to inject the blank at least once to make sure all contamination is removed from the sampling capillary and to ensure that the blank solution is clean.
- Change *All Defined* to *Locations* and type in 3 (empty), as the sample location in the *Analysis* window. Click on the *Analyze Samples* button to measure **5 furnace dry firings** (without any sample).
- Record the results in the table below.
- Print the test results if desired.

4.13.3 Test Results

Parameter	Specification	Test Result	Pass/Fail
Standard Deviation	≤ 0.0004		
Comments:			
PerkinElmer Representative Signature:		Date: _____ (DD-MMM-YYYY)	
Customer Representative Signature:		Date: _____ (DD-MMM-YYYY)	

4.14 Chromium Characteristic Mass and Precision (Furnace)

4.14.1 Test Conditions

- Install the Chromium Lamp.
- If the lamp is not coded, enter the element in the Lamp Setup window.
- Turn on the Chromium lamp and select Setup for the Chromium lamp.
- Close the Lamp Setup Window.

4.14.2 Test Prerequisites

- Make sure the dry firing reveals no contamination for Chromium.
- Prepare the test standard according to the following directions.
- Accurately pipette 100 μ l (0.1 ml) of the **GFAAS Mixed Standard (N9300244)** into an acid-washed 200 ml class A volumetric flask and dilute to volume with deionized water or the 0.5% Nitric Acid solution. This diluted solution contains the following concentrations of the test elements and is ready to use. This Standard should be stable for about 1 day. The acid solution can be used to clean the flask. A clean plastic 125 mL bottle can also be used if the standard is made up by weight.

Element	Concentration (μ g/L)
Cu	25.0
Cr	10.0

4.14.3 Test Steps

- Use the same method as the previous test.
- Rinse a clean, dry, sample cup 3 times with the standard solution, fill the cup with the standard solution and place it in position 2 of the sample tray.
- Rinse a clean, dry sample cup 3 times with deionized water, fill the cup with deionized water and place it in position 1 of the sample tray.
- Inject the blank (position 1) using "Select Loc" on the Analyze/Analysis page at least once to make sure all contamination is removed from the sampling capillary and to ensure that the blank solution is clean.
- Change *All Defined* to *Locations* and type in 2 as the sample location in the *Analysis* window, click on the *Analyze Samples* button to measure five 20 uL injections of the Cr standard.
- Calculate the characteristic mass using the *Characteristic Mass* tool from the *Analyses* pull down menu.
- The characteristic mass (m_0) results in picograms, is calculated from the mean integrated absorbance (peak area) values and should not exceed the value listed in the following table.
- **NOTE:** If the characteristic mass is exceptionally low, check for possible contamination of the water, acid, volumetric flask and sample container used for sample preparation. Prepare a new solution if needed.
- The relative standard deviation (%RSD) of the mean sample solution readings, calculated from the integrated absorbance (peak area) values for Cr must not exceed the **maximum value of 2.0%**.
- Record the characteristic mass and precision results in the table below.
- Print the test results if desired.

4.14.4 Test Results

Parameter	Specification	Test Result	Pass/Fail
Chromium Characteristic Mass	≤ 7.0		
Chromium Precision (RSD)	$\leq 2.0 \%$		
Comments:			
PerkinElmer Representative Signature:		Date: (DD-MMM-YYYY)	
Customer Representative Signature:		Date: (DD-MMM-YYYY)	

4.15 Copper Characteristic Mass and Zeeman Ratio (Furnace)

4.15.1 Test Conditions

- Install the Copper Lamp.
- If the lamp is not coded, enter the element in the Lamp Setup window.
- Turn on the Copper lamp and select Setup for the Copper lamp.
- Close the Lamp Setup Window.

4.15.2 Test Prerequisites

- Perform a dry firing after setting up for Copper. Make sure the dry firing reveals no contamination for Copper.
- If a peak is seen, due to contamination, repeat dry firings until no peak is seen.

4.15.3 Test Steps

- Open the THGA Cu Tests (WinLab), PZT- BL Char Mass- Cu (Syngistix) method.
- From the *Tools (WinLab)* or *Analysis (Syngistix)* choices, open the Analysis window.
- Change *All Defined to Locations*, and type in 2 as the sample location in the *Analysis* window, click on the *Analyze Samples* button to measure 5 furnace firings using 20 µL sample injections.
- Calculate the characteristic mass using the *Characteristic Mass* tool from the *Analyses* pull down menu.
- The characteristic mass (m_0) results in picograms, is calculated from the mean integrated absorbance (peak area) values and should be less than or equal to the value listed in the following table.
- **NOTE:** If the characteristic mass is exceedingly low, check for possible contamination of the water, acid, volumetric flask and sample container used for sample preparation. Make sure a standard ZL graphite tube is used, instead of an end-capped tube. Prepare a new solution if needed.
- Record the characteristic mass results in the table below.
- From the mean integrated absorbance (peak area) measurements the Zeeman ratio should be calculated using the following equation:
$$R = \frac{\text{Atomic Signal (Peak Area)}}{[\text{Atomic Signal (Peak Area)} + \text{Background Signal (Peak Area)}]}$$

- The Zeeman Ratio, R, results calculated from the integrated absorbance (peak area) values should lie within the ranges for Cu listed in the table below.
- Record the results for Zeeman ratio in the table below.
- Print the test results if desired.

4.15.4 Test Results

Parameter	Specification	Test Result	Pass/Fail
Copper Characteristic Mass	≤ 17		
Cu Zeeman Ratio	0.52 ± 0.04		
Comments:			
PerkinElmer Representative Signature:		Date: _____ (DD-MMM-YYYY)	
Customer Representative Signature:		Date: _____ (DD-MMM-YYYY)	

4.16 Autosampler Linearity (Furnace)

4.16.1 Test Conditions

- Install the Chromium Lamp.
- If the lamp is not coded, enter the element in the Lamp Setup window.
- Turn on the Chromium lamp and select Setup for the Chromium lamp.
- Close the Lamp Setup Window.

4.16.2 Test Prerequisites

- Perform flushes with isopropanol. Remove the isopropanol by flushing with the normal rinse solution.

4.16.3 Test Steps

- Open the THGA AS-900 Lin (WinLab), PZT – AS900 Linearity- Cr (Syngistix) method.
- From the *Tools* (WinLab) or *Analysis & Results* (Syngistix) choices, open the windows; Results, (Transient) Peaks (Display), Calibration (Display) and (Automated) Analysis.
- Click on the *Analysis* window and then on the *Calibrate* button to start the calibration.

- When the calibration is finished check the **Correlation Coefficient Result** in the *Calibration Display* window.
- The correlation Coefficient Result for Cr must be equal to or exceed the **minimum value of 0.999**.
- Record the results in the table below.
- Print the test results if desired.

4.16.4 Test Results

Parameter	Specification	Test Result	Pass/Fail
Autosampler Linearity with four standards	Minimum Correlation Coefficient of 0.999		
Comments:			
PerkinElmer Representative Signature:		Date: (DD-MMM-YYYY)	
Customer Representative Signature:		Date: (DD-MMM-YYYY)	

5 Operational Qualification Verification

The PinAAcle900T, Serial Number PTDS23051001, operates and performs according to the stated Operational Qualification, and all appropriate forms and documents supporting the system have been filled out and are available.	
PerkinElmer Representative Signature:	Date: (DD-MMM-YYYY)

Final Approval Page

Final Protocol Approval

This is to certify that the Operational Qualifications procedures for the PinAAcle900T Serial number PTDS23051001 have been performed and the configuration installed meets [] does not meet [] the procedures and specifications described in this document.

SECOT Co.,Ltd.			
Signature	Name	Title	Date (DD-MMM-YYYY)

PerkinElmer			
Signature	Name	Title	Date (DD-MMM-YYYY)

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Appendices

Appendix A – Deviations

Upon discovery of a deviation, stop qualification testing and notify SECOT Co.,Ltd. representative. PerkinElmer and SECOT Co.,Ltd. will collaborate to document and resolve the deviation. Duplicate this form for each "Deviation" and attach completed form(s) to this protocol. List all attachments in Appendix C.

Describe in detail the deviation, correction/justification and outcome.

Description: _____

Correction or Justification: _____

Outcome: _____

PerkinElmer			
Signature	Name	Role (Performer or Approver)	Date (DD-MMM-YYYY)

SECOT Co.,Ltd.			
Signature	Name	Role (Performer or Approver)	Date (DD-MMM-YYYY)

Appendix B – Change Control

Note: Create copies of this page, leaving original blank. Read instructions below.

Change Control procedures maintain the validation process after modifications are made to the original configuration (by OEM, SECOT Co.,Ltd., or PerkinElmer).

The Change Control Form is located in Appendix B – Change Control and instructions are located in the Introduction. Insert the completed Change Control Form and its data into this validation document as an Attachment.

Change Control Revision Attachment #: ____

Component / Software Changed

Reasoning and Justification for Change

Verification of New Component / Software

Acceptance Criteria Used

Results of Verification (Attach original data)

Validation Results

Validation	Pass/Fail
Signature	Date (DD-MMM-YYYY)
Performed By:	
Approved By:	

Appendix C – Attachments List

In the table below enter: each attachment; total pages for each attachment; company (OEM, SECOT Co.,Ltd., or PerkinElmer). Sign and date. Additionally, label each page of each Attachment as follows:

- Attachment Number (as per this table)
- Page X of Y (total) Pages of the Attachment
- Reference the page number of the procedure, if the attachment is the result of a test procedure
- Initials of Reviewer
- Date

#	Description	# Pgs	Company	Signature	Date (DD-MMM-YYYY)
1	PerkinElmer Service Engineer Training Certificate		PerkinElmer		
2					
3					
4					
5					
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7					
8					
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10					
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12					
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20					

Appendix D – Document History

Revision	Description of Change	Page(s)	Date
A	First release	-	April 2012
B	Made lamp warm up time recommended. Changed copper to chromium or chromium to copper to correct error.	28	January 2015
	Changed how Nitrous Oxide/Acetylene is checked	39-41	
	Revised documentation list	25	
	Added a choice of using 1% and 0.5% Nitric Acid solutions instead of deionized water	26, 41, 42, 47	
	Added the option of using a plastic bottle and scale to make up the standard solutions	26, 42, 47	
	Changed copper to chromium (to correct error)	50	
	Changed computer specification	13	
	Changed parameter testing preparation	28	
	Added column for calibrated filter absorbance	29	
	Changed filter specification to $\pm 10\%$ to correspond to the specification on previous instruments	29	
	Corrected specification on test # 3	31	
	Added: option of printing results	29-50	
	Added: nebulizer O-ring compatibility statement	35	
	Added: make sure the drain bottle is out in the open	35	

B	Added: make sure the vent is on	35	January 2015
	Split test of nitrous oxide burner head interlock to a flame off test and a flame on test.	40	
	Added: open up a flame method	40	
	Added: option of flame gas pressure testing	38, 40	
	Added: nebulizer clarification for IQ/OQ tests	43	
	Changed the method names to how they appear in the service directory	29-50	
	Added: Autozero. Remove filter from the filter holder. Close continuous graphics. Record the test results and/or print to file. If desired manual analysis can be used so data can be saved, but a blank will need to be added to the method.	29, 30, 32	
	Added: Before igniting the flame, make sure the following conditions are satisfied.	35	
	External Flow measurements changed to Front and Back. Close the base module.	44	
	Removed furnace alignment check. Repeat the dry firing as needed to ensure there is no peak from contamination. It is also recommended to inject the blank at least once to make sure all contamination is removed from the sampling capillary and to ensure that the blank solution is clean.	46	
	Update for Syngistix- AA Software Update for Syngistix- AA Software Service method names are listed for both WinLab32 and Syngistix software. Error messages seen when interlocks are triggered are listed for WinLab32 and Syngistix software.	All	

C	Changed flame nebulizer precision to $\leq 0.5\%$ RSD, since the previous specification was for a new system.	40	July 2015
	Changed the furnace characteristic mass to a maximum value instead of a range.	45- 47	
D	Changed calibration due date to calibration date	24	August 2016
E	Corrected error – characteristic mass should be a maximum value for copper	47	December 2018
F	Addition of the 0.7A Neutral Density Filter to the Material List.	24	December 2021
	Change the Cu D2 Compensation test criteria to use the 0.7A Neutral Density Filter instead of the 1.0A filter.	30	
G	Corrected Test Steps Section 4.12 sequence for Furnace Gas Flows	41	August 2023

ภาคผนวก จ

หนังสืออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
จากกรมโรงงานอุตสาหกรรม



ที่ อก ๐๓๑๐(๑)/ ๑๑ ๐ ๑ ๖

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒๐ กรกฎาคม ๒๕๖๖

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท ซีคอต จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๗ เมษายน ๒๕๖๖

สิ่งที่ส่งมาด้วย ๑. รายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑ แผ่น
๒. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑ แผ่น
๓. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๔ แผ่น

ตามหนังสือที่อ้างถึง บริษัท ซีคอต จำกัด ขอต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๒๓๙ สถานที่ ตั้งเลขที่ ๒๓๙ ถนนริมคลองประปา แขวงบางซื่อ เขตบางซื่อ กรุงเทพมหานคร ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท ซีคอต จำกัด ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐ ราย ตามสิ่งที่ส่งมาด้วย ๑
ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๓๔ ราย ตามสิ่งที่ส่งมาด้วย ๒
ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย น้ำใต้ดิน อากาศเสีย สิ่งปฏิกูล หรือวัสดุที่ไม่ใช้แล้ว และดิน ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะหมดอายุในวันที่ ๒ พฤษภาคม ๒๕๖๙ หากประสงค์จะต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อกรมโรงงานอุตสาหกรรมภายใน ๓๐ วัน ก่อนวันสิ้นสุดอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ซึ่งคำขอต่ออายุดังกล่าวขอรับได้ที่กรมโรงงานอุตสาหกรรม ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายประสม ดำรงพงษ์)

กองวิจัยและเตือนภัยมลพิษโรงงาน ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๕

ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th



"อุตสาหกรรมก้าวหน้า ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



ส่งที่ส่งมาด้วย ๑

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท ซีคอต จำกัด

เลขทะเบียน ว-๒๓๙

ที่ อก ๐๓๑๐(๑)/ ๑๑ ๐ ๑ ๖

ลงวันที่ ๒๐ กรกฎาคม ๒๕๖๖

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐ ราย

๑) นายขรรชัย เกรียงไกรอุดม

ทะเบียนเลขที่ ว-๒๓๙-ก-๐๐๐๒

๒) นางสาวฤดี เกรียงไกรอุดม

ทะเบียนเลขที่ ว-๒๓๙-ก-๐๐๐๓

๓) นางสาวอารยา ทิพรัักษ์

ทะเบียนเลขที่ ว-๒๓๙-ก-๐๐๐๔

๔) นางสาวเขมขุตา อินทร์

ทะเบียนเลขที่ ว-๒๓๙-ก-๐๐๐๕

๕) นางสาวปรีดา สมใจ

ทะเบียนเลขที่ ว-๒๓๙-ก-๐๐๐๖

๖) นางสาวอริยญา มาตา

ทะเบียนเลขที่ ว-๒๓๙-ก-๐๐๐๗

๗) นางสาวลดาวัลย์ วงศ์เจริญ

ทะเบียนเลขที่ ว-๒๓๙-ก-๐๐๐๘

๘) นางสาวณัฏฐวรรณ เกตวันดี

ทะเบียนเลขที่ ว-๒๓๙-ก-๐๐๐๙

๙) นางสาวนริสา ภูวสรเพ็ญ

ทะเบียนเลขที่ ว-๒๓๙-ก-๐๐๑๐

๑๐) นางสาวศิริวรรณ นิมสง่า

ทะเบียนเลขที่ ว-๒๓๙-ก-๐๐๑๑

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท ซีคอฟ จำกัด
ที่ อก ๐๓๓๐(๑)/ ๑๑ ๐ ๑ ๖
เลขทะเบียน ๖-๒๓๙
ลงวันที่ ๒๐ กรกฎาคม ๒๕๖๖

สิ่งที่ส่งมาด้วย ๒

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๓๘ ราย

๑) นางสาวสุดาพร สุนทร.	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๐๑
๒) นางสาวสุภาทิพย์ เทียนเคียว	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๐๓
๓) นางสาวสุนันทา ศิริพัฒนานนท์	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๐๔
๔) นายบวร ศิษย์ยะ	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๐๕
๕) นางสาวเกศรินทร์ วรเดโชวิทยา	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๐๖
๖) นายอนันต์ วัฒนานา	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๐๗
๗) นายชิตพล สมประสงค์	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๐๘
๘) นางสาวศศิธร พรหมประเสริฐ	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๐๙
๙) นายศิวนนท์ กุลวงษ์	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๑๐
๑๐) นางสาวอริสา คณิธรานนท์	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๑๑
๑๑) นางสาวสิริวรรณ แก้วชิงดวง	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๑๒
๑๒) นางสาวปัทมวรรณ สุวรรณวิโรจน์	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๑๓
๑๓) นางสาวกนิษฐา เจริญเชื้อ	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๑๔
๑๔) นายวัชรกานต์ ประมาคเต	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๑๕
๑๕) นายชอง เสงฆ์วัลกุล	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๑๖
๑๖) นางสาวกฤษณา จันทน	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๑๗
๑๗) นางสาวพรนภา บุตรธรรม	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๑๘
๑๘) นางสาวธาริณี อาจปสิว	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๑๙
๑๙) นายอนันต์ ช่างล้อ	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๒๐
๒๐) นางสาวพัชรา สมานอันท์	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๒๑
๒๑) นางสาวจุฑารัตน์ แจ่มเรือน	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๒๒
๒๒) นางสาวจณิสตา กุ้ยอ่อน	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๒๓
๒๓) นายกิตติพงศ์ ตะเกิงสุข	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๒๔
๒๔) นายจิรวัฒน์ โคตรคำหาญ	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๒๕
๒๕) นายชนะพล อัครผล	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๒๖
๒๖) นางสาวทิพย์สุดา วรรณการ	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๒๗
๒๗) นายสิทธิชัย สว่างวงศ์ไชย	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๒๘
๒๘) นายพิษณุ สีนามเพ็ง	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๒๙
๒๙) นายพนชัย ขอบท่ากิจ	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๓๐
๓๐) นายธนาวุฒิ คำนแสง	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๓๑
๓๑) นายณัฐชัย ไชยโคตร	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๓๒
๓๒) นายณัฐดนัย กฤษณะโสม	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๓๓
๓๓) นายศุภชัย สุขใหม่	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๓๔
๓๔) นายรอมฎอน เหลี่ยมหมาก	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๓๕
๓๕) นางสาวสุภาวดี บัวแก้ว	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๓๖
๓๖) นางสาวมาริยาณี ฮาแว	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๓๗
๓๗) นางสาววิระยา ปิจอมบุรณ์	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๓๘
๓๘) นางสาวศลิษา อินริย์	ทะเบียนเลขที่ ๖-๒๓๙-จ-๐๐๓๙

3/11/16

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท ซีคอฟ จำกัด
ที่ อก ๐๓๓๐(๑)/ ๑๑ ๐ ๑ ๖
เลขทะเบียน ๖-๒๓๙
ลงวันที่ ๒๐ กรกฎาคม ๒๕๖๖

สิ่งที่ส่งมาด้วย ๓

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๕๕ รายการ

น้ำเสีย จำนวน 45 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
2	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
3	Barium	1) Digestion, Direct Nitrous Oxide-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
4	α-BHC	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
5	β-BHC	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
6	δ-BHC	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
7	γ-BHC	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

3/11/16

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
8	Biochemical Oxygen Demand	1) 5-Day BOD Test, Azide Modification Method ^[4] 2) 5-Day BOD Test, Membrane Electrode Method ^[4]
9	Cadmium	1) Digestion, Direct Air-Acetylene Flame Method ^[4] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[4] 3) Digestion, Inductively Coupled Plasma Method ^[4]
10	Chemical Oxygen Demand	1) Open Reflux, Titrimetric method ^[4] 2) Closed Reflux, Colorimetric method ^[4] 3) Closed Reflux, Titrimetric Method ^[4]
11	Chlordane	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[4] 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[4]
12	Chromium	1) Digestion, Direct Air-Acetylene Flame Method ^[4] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[4] 3) Digestion, Inductively Coupled Plasma Method ^[4]
13	Color	ADMI Weighted-Ordinate Spectrophotometric Method ^[4]
14	Copper	1) Digestion, Direct Air-Acetylene Flame Method ^[4] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[4] 3) Digestion, Inductively Coupled Plasma Method ^[4]
15	Cyanide	Distillation, Colorimetric method ^[4]
16	4,4'-DDD	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[4] 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[4]

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
17	4,4'-DDE	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[4] 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[4]
18	4,4'-DDT	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[4] 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[4]
19	Dieldrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[4] 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[4]
20	Endosulfan I	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[4] 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[4]
21	Endosulfan II	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[4] 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[4]
22	Endosulfan Sulfate	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[4] 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[4]
23	Endrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[4] 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[4]
24	Endrin Aldehyde	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[4] 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[4]

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
25	Formaldehyde	Distillation, Colorimetric Method ^[4]
26	Free Chlorine	1) Iodometric Method ^[4] 2) DPD Colorimetric Method ^[4]
27	Heptachlor	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[4] 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[4]
28	Heptachlor epoxide	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[4] 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[4]
29	Hexavalent Chromium	1) Colorimetric Method ^[4] 2) Extraction, Air-Acetylene Flame Method ^[4]
30	Lead	1) Digestion, Direct Air-Acetylene Flame Method ^[4] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[4] 3) Digestion, Inductively Coupled Plasma Method ^[4]
31	Manganese	1) Digestion, Direct Air-Acetylene Flame Method ^[4] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[4] 3) Digestion, Inductively Coupled Plasma Method ^[4]
32	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^[4]
33	Methoxychlor	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[4] 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[4]
34	Nickel	1) Digestion, Direct Air-Acetylene Flame Method ^[4] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[4] <i>simple</i>

3) Digestion...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
		3) Digestion, Inductively Coupled Plasma Method ^[4]
35	Oil & Grease	1) Liquid-Liquid, Partition-Gravimetric Method ^[4] 2) Soxhlet Extraction Method ^[4]
36	pH	Electrometric Method ^[4]
37	Phenols	1) Distillation, Chloroform Extraction Method ^[4] 2) Distillation, Direct Photometric Method ^[4]
38	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[4] 2) Digestion, Inductively Coupled Plasma Method ^[4]
39	Sulfide	1) Iodometric method ^[4] 2) Methylene blue method ^[4]
40	Temperature	Laboratory and Field Methods ^[4]
41	Total Dissolved Solids	Dried at 180 °C ^[4]
42	Total Kjeldahl Nitrogen	1) Macro Kjeldahl Method ^[4] 2) Semi-Micro Kjeldahl Method ^[4]
43	Total Suspended Solids	Dried at 103-105 °C ^[4]
44	Trivalent Chromium	1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation ^[4] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method; Colorimetric Method; Calculation ^[4] 3) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ^[4]
45	Zinc	1) Digestion, Direct Air-Acetylene Flame Method ^[4] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[4] 3) Digestion, Inductively Coupled Plasma Method ^[4] <i>simple</i>

น้ำได้ดิบ...

น้ำใต้ดิน จำนวน 125 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
2	Acetone	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
3	Aldrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
4	Anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
5	Antimony	Digestion, Inductively Coupled Plasma Spectrometric Method ⁽⁴⁾
6	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
7	Atrazine	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
8	Barium	1) Digestion, Direct Nitrous Oxide-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Spectrometric Method ⁽⁴⁾
9	Benz(a)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
10	Benzene	Purge and Trap Gas Chromatographic/Mass spectrometric Method ⁽⁴⁾
11	Benzo(b)fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
12	Benzo(k)fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾ 317)

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
13	Benzoic acid	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
14	Benzo(a)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
15	Benzo(g,h,i)perylene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
16	Beryllium	Digestion, Inductively Coupled Plasma Spectrometric Method ⁽⁴⁾
17	Bis(2-chloroethyl)ether	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
18	Bis(2-ethylhexyl)phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
19	Bromodichloromethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
20	Bromoform	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
21	Butanol	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
22	Butyl benzyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
23	Cadmium	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Spectrometric Method ⁽⁴⁾
24	Carbazole	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
25	Carbon disulfide	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
26	Carbon tetrachloride	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ 317)

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
27	Chlordane	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
28	p-Chloroaniline	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
29	Chlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
30	Chlorodibromomethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
31	Chloroform	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
32	2-Chlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
33	Chromium	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Spectrometric Method ⁽⁴⁾
34	Chromium (III)	1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method; Colorimetric Method; Calculation ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Spectrometric Method; Colorimetric Method; Calculation ⁽⁴⁾
35	Chromium (VI)	1) Colorimetric Method ⁽⁴⁾ 2) Extraction, Air-Acetylene Flame Method ⁽⁴⁾
36	Chrysene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ <i>SMD</i>

37 Cyanide...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
37	Cyanide	1) Distillation, Titrimetric Method ⁽⁴⁾ 2) Distillation, Colorimetric Method ⁽⁴⁾
38	2,4-D	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
39	DDD	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
40	DDE	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
41	DDT	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
42	Dibenz(a,h)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
43	Di-n-butyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
44	1,2-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
45	1,3-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
46	1,4-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
47	3,3'-Dichlorobenzidine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
48	1,1-Dichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
49	1,2-Dichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ <i>SMD</i>

50 1,1-Dichloroethylene...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
50	1,1-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(๑)
51	cis-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(๑)
52	trans-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(๑)
53	2,4-Dichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(๑)
54	1,2-Dichloropropane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(๑)
55	1,3-Dichloropropane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(๑)
56	1,3-Dichloropropene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(๑)
57	Dieldrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(๑) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(๑)
58	Diethyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(๑)
59	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(๑)
60	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(๑)
61	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(๑)
62	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(๑)
63	Di-n-Octyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(๑)
64	Endosulfan	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(๑) 2) Liquid-Liquid...

2) Liquid-Liquid...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
65	Endrin	2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(๑) 1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(๑) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(๑)
66	Ethylbenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(๑)
67	Fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(๑)
68	Fluorene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(๑)
69	Heptachlor	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(๑) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(๑)
70	Heptachlor epoxide	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(๑) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(๑)
71	Hexachlorobenzene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(๑)
72	Hexachloro-1,3-butadiene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(๑)
73	n-Hexane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(๑)
74	α-HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(๑) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(๑)
75	β-HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(๑) 2) Liquid-Liquid...

2) Liquid-Liquid...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
76	γ-HCH	2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[4]
77	Hexachlorocyclopentadiene	1) Liquid-Liquid Extraction, Gas Chromatographic/ Method ^[4] 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[4]
78	Hexachloroethane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[4]
79	Indeno(1,2,3-cd)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[4]
80	Isophorone	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[4]
81	Lead	1) Digestion, Direct Air-Acetylene Flame Method ^[4] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[4] 3) Digestion, Inductively Coupled Plasma Spectrometric Method ^[4]
82	Manganese	1) Digestion, Direct Air-Acetylene Flame Method ^[4] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[4] 3) Digestion, Inductively Coupled Plasma Spectrometric Method ^[4]
83	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^[4]
84	Methanol	Purge and Trap Gas Chromatographic/ Mass spectrometric Method ^[4]
85	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic Method ^[4]
86	Methyl bromide	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^[4]

87 Methylene chloride...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
87	Methylene chloride	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^[4]
88	2-Methylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[4]
89	2-Methylnaphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[4]
90	Methyl tert-butyl ether	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^[4]
91	Naphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[4]
92	Nickel	1) Digestion, Direct Air-Acetylene Flame Method ^[4] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[4] 3) Digestion, Inductively Coupled Plasma Spectrometric Method ^[4]
93	Nitrobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[4]
94	N-Nitrosodiphenylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[4]
95	N-Nitrosodi-n-propylamine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[4]
96	Polychlorinated Biphenyls - PCB-1016 - PCB-1221 - PCB-1232 - PCB-1242 - PCB-1248 - PCB-1254 - PCB-1260	Liquid-Liquid Extraction, Gas Chromatographic Method ^[4]
97	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic Method ^[4]
98	pH	Electrometric method ^[4]

99 Phenanthrene...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
99	Phenanthrene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[4]
100	Phenol	1) Distillation, Chloroform Extraction Method ^[4] 2) Distillation, Direct Photometric Method ^[4] 3) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[4]
101	Pyrene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[4]
102	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[4] 2) Digestion, Inductively Coupled Plasma Method ^[4]
103	Silver	1) Digestion, Direct Air-Acetylene Flame Method ^[4] 2) Digestion, Inductively Coupled Plasma Method ^[4]
104	Styrene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^[4]
105	1,1,2,2-Tetrachloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^[4]
106	Tetrachloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^[4]
107	Toluene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^[4]
108	TPH (C ₉ -C ₉)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25]
109	TPH (C ₈ -C ₁₆)	1) Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^[9,21] 2) Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass spectrometric Method ^[9,25]
110	TPH (C ₁₀ -C ₃₅)	1) Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^[9,21] <i>simy</i>

2) Separatory...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
		2) Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass spectrometric Method ^[9,25]
111	1,2,4-Trichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^[4]
112	1,1,1-Trichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^[4]
113	1,1,2-Trichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^[4]
114	Trichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^[4]
115	2,4,5-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[4]
116	2,4,6-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[4]
117	1,3,5-Trimethylbenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^[4]
118	Vanadium	Digestion, Inductively Coupled Plasma Spectrometric Method ^[4]
119	Vinyl acetate	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^[4]
120	Vinyl chloride	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^[4]
121	m-Xylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^[4]
122	o-Xylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^[4]
123	p-Xylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^[4]
124	Xylene (Total)	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^[4] <i>simy</i>

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
125	Zinc	1) Digestion, Direct Air-Acetylene Flame Method ^[4] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[4] 3) Digestion, Inductively Coupled Plasma Spectrometric Method ^[4]

อากาศเสีย (ปล่อยระบาย) จำนวน 27 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ^[5] 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5]
2	Arsenic	1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[5] 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5]
3	Beryllium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5]
4	Cadmium	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ^[5] 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5]
5	Carbon monoxide	Instrumental Analyzer Method ^[5]
6	Chlorine	1) Absorption Sampling, Ion Chromatographic Method ^[5] 2) Isokinetic Sampling, Ion Chromatographic Method ^[5]
7	Chromium	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ^[5] 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5] <i>3m/</i>

8 Cobalt..

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
8	Cobalt	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5]
9	Copper	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ^[5] 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5]
10	Cresol	Adsorption Sampling, Gas Chromatographic Method ^[5]
11	Dioxin/Furans	Isokinetic Sampling ^[5]
12	Hydrogen chloride	1) Absorption Sampling, Ion Chromatographic Method ^[5] 2) Isokinetic Sampling, Ion Chromatographic Method ^[5]
13	Hydrogen Fluoride	1) Absorption Sampling, Ion Chromatographic Method ^[5] 2) Isokinetic Sampling, Ion Chromatographic Method ^[5]
14	Hydrogen Sulfide	Absorption Sampling, Iodometric Method ^[5]
15	Lead	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ^[5] 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5]
16	Manganese	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ^[5] 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5]
17	Mercury	Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^[5]
18	Nickel	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ^[5] 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5] <i>3m/</i>

19 Opacity...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
19	Opacity	Ringelmann's Method ^[2]
20	Oxides of Nitrogen	1) Absorption Sampling, Phenoldisulfonic acid Method ^[5] 2) Absorption Sampling, Ion Chromatographic Method ^[5] 3) Instrumental Analyzer Method ^[5]
21	Selenium	1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[5] 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5]
22	Sulfur dioxide	1) Isokinetic Sampling, Barium-Thorin Titrimetric Method ^[5] 2) Absorption Sampling, Barium-Thorin Titrimetric Method ^[5] 3) Instrumental Analyzer Method ^[5]
23	Sulfuric acid	Isokinetic Sampling, Barium-Thorin Titrimetric Method ^[5]
24	Tin	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5]
25	Total Suspended Particulate	1) Isokinetic Sampling, Gravimetric Method ^[5] 2) Paired Train, Isokinetic Sampling, Gravimetric Method ^[5]
26	Vanadium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5]
27	Xylene	1) Adsorption Sampling, Gas Chromatographic Method ^[5] 2) Adsorption Sampling, Gas Chromatographic/Mass Spectrometric Method ^[5]

สิ่งปฏิกูล...

สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 34 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^[1,6,9,22] 2) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[1,6,9,22] 3) Soxhlet Extraction, Gas Chromatographic Method ^[10,22] 4) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,22]
2	Antimony	1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[1,6,16] 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[1,6,16] 3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[7,16] 4) Digestion, Inductively Coupled Plasma Method ^[7,16]
3	Arsenic	1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[1,6,16] 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[1,6,16] 3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[7,16] 4) Digestion, Inductively Coupled Plasma Method ^[7,16]
4	Barium	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^[1,6,15]

2) Waste Extraction...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
5	Beryllium	2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,14) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 4) Digestion, Inductively Coupled Plasma Method ^(7,14)
6	Cadmium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,14)
7	Chlordane	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1,6,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,14) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 4) Digestion, Inductively Coupled Plasma Method ^(7,14)
8	Chromium	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,9,22) 2) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,27) 3) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 4) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27) 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1,6,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,14) <i>3) Digestion...</i>

3) Digestion...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
9	Chromium (III)	3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 4) Digestion, Inductively Coupled Plasma Method ^(7,14) 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation ^(1,6,15,17) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation ^(1,6,14,17)
10	Chromium (VI)	3) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,15,17) 4) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,14,17)
11	Cobalt	1) Waste Extraction, Colorimetric Method ^(1,17) 2) Alkaline Digestion, Colorimetric Method ^(8,17)
12	Copper	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,14) 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1,6,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,14) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 4) Digestion, Inductively Coupled Plasma Method ^(7,14) <i>3) Digestion...</i>

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
13	2,4-D	1) Waste Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,25) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁵⁾
14	DDD	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,9,22) 2) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,27) 3) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 4) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
15	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,9,22) 2) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,27) 3) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 4) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
16	DDT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,9,22) 2) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,27) 3) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 4) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27) <i>เพิ่ม</i>

17 Dieldrin...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
17	Dieldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,9,22) 2) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,27) 3) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 4) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,9,22) 2) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,27) 3) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 4) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,9,22) 2) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,27) 3) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 4) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
20	Lead	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1,6,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,14) <i>เพิ่ม</i>

3) Digestion...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
21	Lindane	3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 4) Digestion, Inductively Coupled Plasma Method ^(7,14) 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,9,22) 2) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(1,9,27) 3) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 4) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,27)
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(1,18) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,14) 3) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹⁹⁾ 4) Digestion, Inductively Coupled Plasma Method ^(7,14)
23	Methoxychlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,9,22) 2) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(1,9,27) 3) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 4) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,27)

24 Molybdenum...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
24	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,14)
25	Nickel	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1,6,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,14) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 4) Digestion, Inductively Coupled Plasma Method ^(7,14)
26	Polychlorinated Biphenyls - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,9,23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,23)
27	Pentachlorophenol	1) Waste Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(1,25) 2) Ultrasonic Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽²⁵⁾
28	pH	Electrometric Method ^(3,1,32)
29	Selenium	1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(1,6,20) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,14) 3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,20)

4) Digestion...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
30	Silver	4) Digestion, Inductively Coupled Plasma Method ^(7,14) 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,14)
31	Thallium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,14)
32	Trichloroethylene	1) Waste Extraction, Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(1,12,26) 2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,26)
33	Vanadium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,14)
34	Zinc	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1,6,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,14) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 4) Digestion, Inductively Coupled Plasma Method ^(7,14)

ดิน จำนวน 124 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27) <i>สมพงษ์</i>

2 Acetone...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
2	Acetone	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
3	Aldrin	1) Ultrasonic Extraction, Gas Chromatographic Method ^(11,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
4	Anthracene	Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
5	Antimony	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,16) 2) Digestion, Inductively Coupled Plasma Method ^(7,14)
6	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,16) 2) Digestion, Inductively Coupled Plasma Method ^(7,14)
7	Atrazine	Ultrasonic Extraction, Gas Chromatographic Method ^(11,29)
8	Barium	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 2) Digestion, Inductively Coupled Plasma Method ^(7,14)
9	Benz(a)anthracene	Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
10	Benzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
11	Benzo(b)fluoranthene	Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
12	Benzo(k)fluoranthene	Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
13	Benzoic acid	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,27) <i>สมพงษ์</i>

14 Benzo(a)pyrene...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
14	Benzo(a)pyrene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,27)
15	Benzo(g,h,i)perylene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,27)
16	Beryllium	Digestion, Inductively Coupled Plasma Method ^(7,14)
17	Bis(2-chloroethyl)ether	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,27)
18	Bis(2-ethylhexyl)phthalate	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,27)
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
20	Bromoform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
21	Butanol	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
22	Butyl benzyl phthalate	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,27)
23	Cadmium	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 2) Digestion, Inductively Coupled Plasma Method ^(7,14)
24	Carbazole	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,27)
25	Carbon disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
27	Chlordane	1) Ultrasonic Extraction, Gas Chromatographic Method ^(11,22) 2) Ultrasonic Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
28	p-Chloroaniline	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,27)
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
31	Chloroform	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
32	2-Chlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
33	Chromium	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 2) Digestion, Inductively Coupled Plasma Method ^(7,14)
34	Chromium (III)	1) Digestion, Flame Atomic Absorption Spectrometric Method; Colorimetric Method; Calculation ^(7,8,15,17) 2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ^(7,8,14,17)
35	Chromium (VI)	Alkaline Digestion, Colorimetric Method ^(8,17)
36	Chrysene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,27)
37	Cyanide	1) Extraction, Distillation, Titrimetric Method ^(28,29,30) 2) Extraction, Distillation, Colorimetric Method ^(28,29,30)
38	2,4-D	Ultrasonic Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽²⁴⁾
39	DDD	1) Ultrasonic Extraction, Gas Chromatographic Method ^(11,22) 2) Ultrasonic Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
40	DDE	1) Ultrasonic Extraction, Gas Chromatographic Method ^(11,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
41	DDT	1) Ultrasonic Extraction, Gas Chromatographic Method ^(11,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
42	Dibenz(a,h)anthracene	Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
43	Di-n-butyl phthalate	Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
47	3,3'-Dichlorobenzidine	Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
53	2,4-Dichlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,27)

54 1,2-Dichloropropane...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
57	Dieldrin	1) Ultrasonic Extraction, Gas Chromatographic Method ^(11,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
58	Diethyl phthalate	Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
59	2,4-Dimethylphenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
60	2,4-Dinitrophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
61	2,4-Dinitrotoluene	Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
62	2,6-Dinitrotoluene	Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
63	Di-n-Octyl phthalate	Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
64	Endosulfan	1) Ultrasonic Extraction, Gas Chromatographic Method ^(11,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
65	Endrin	1) Ultrasonic Extraction, Gas Chromatographic Method ^(11,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)

67 Fluoranthene...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
67	Fluoranthene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,27)
68	Fluorene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,27)
69	Heptachlor	1) Ultrasonic Extraction, Gas Chromatographic Method ^(11,22) 2) Ultrasonic Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
70	Heptachlor epoxide	1) Ultrasonic Extraction, Gas Chromatographic Method ^(11,22) 2) Ultrasonic Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
71	Hexachlorobenzene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
73	n-Hexane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
74	α-HCH	1) Ultrasonic Extraction, Gas Chromatographic Method ^(11,22) 2) Ultrasonic Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
75	β-HCH	1) Ultrasonic Extraction, Gas Chromatographic Method ^(11,22) 2) Ultrasonic Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
76	γ-HCH	1) Ultrasonic Extraction, Gas Chromatographic Method ^(11,22) 2) Ultrasonic Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
77	Hexachlorocyclopentadiene	Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)

78 Hexachloroethane...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
78	Hexachloroethane	Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
79	Indeno(1,2,3-cd)pyrene	Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
80	Isophorone	Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
81	Lead	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 2) Digestion, Inductively Coupled Plasma Method ^(7,14)
82	Manganese	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 2) Digestion, Inductively Coupled Plasma Method ^(7,14)
83	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹⁹⁾ 2) Digestion, Inductively Coupled Plasma Method ^(7,14)
84	Methanol	Ultrasonic Extraction, Direct Aqueous Injection, Gas Chromatographic Method ^(11,21)
85	Methoxychlor	1) Ultrasonic Extraction, Gas Chromatographic Method ^(11,22) 2) Ultrasonic Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
86	Methyl bromide	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
87	Methylene chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
88	2-Methylphenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
89	2-Methylnaphthalene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,27)

90 Methyl tert-butyl ether...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
90	Methyl tert-butyl ether	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
91	Naphthalene	Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
92	Nickel	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,14)
93	Nitrobenzene	Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
94	N-Nitrosodiphenylamine	Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
95	N-Nitrosodi-n-propylamine	Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
96	Polychlorinated Biphenyls - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260	Soxhlet Extraction, Gas Chromatographic Method ^(10,23)
97	Pentachlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁴⁾
98	Phenanthrene	Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
99	Phenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
100	Pyrene	Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,27)
101	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,20)

2) Digestion...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
102	Silver	2) Digestion, Inductively Coupled Plasma Method ^(7,14) 1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,14)
103	Styrene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
106	Toluene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
107	TPH (C ₅ -C ₈)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
108	TPH (C ₈ -C ₁₆)	1) Soxhlet Extraction, Gas Chromatographic Method ^(10,21) 2) Soxhlet Extraction, Gas Chromatographic/Mass spectrometric Method ^(10,26)
109	TPH (C ₁₅ -C ₃₅)	1) Soxhlet Extraction, Gas Chromatographic Method ^(10,21) 2) Soxhlet Extraction, Gas Chromatographic/Mass spectrometric Method ^(10,26)
110	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
111	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
112	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
113	Trichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)

114 2,4,5-Trichlorophenol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
114	2,4,5-Trichlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
115	2,4,6-Trichlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
116	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
117	Vanadium	Digestion, Inductively Coupled Plasma Method ^(7,14)
118	Vinyl acetate	Purge and Trap, Gas Chromatographic/Mass spectrometric Method ^(13,26)
119	Vinyl chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
120	m-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
121	o-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
122	p-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
123	Xylene (Total)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,26)
124	Zinc	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 2) Digestion, Inductively Coupled Plasma Method ^(7,14) <i>สิงห์</i>

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ที่ อก ๐๓๑๐(๑)/ ๕๐ ๕๕



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๒๗ พฤษภาคม ๒๕๖๗

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ซีคอฟ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๒๑ พฤษภาคม ๒๕๖๗

ตามคำขอที่อ้างถึง บริษัท ซีคอฟ จำกัด ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๒๓๔
สถานที่ตั้งเลขที่ ๒๓๔ ถนนริมคลองประปา แขวงบางซื่อ เขตบางซื่อ กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากร
ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์
จำนวน ๒ ราย ได้แก่

๑) นายวัชรภรณ์ ประมาคะเด

ทะเบียนเลขที่ ว-๒๓๔-จ-๐๐๑๕

๒) นายรัตนชัย ขอบทำกิจ

ทะเบียนเลขที่ ว-๒๓๔-จ-๐๐๓๐

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ


(นายพรพศ กิตติกรจง)
รองอธิบดี ปฏิบัติราชการแทน
อธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและเคียนมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๕๙

ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



ที่ อก ๐๓๑๐(๑)/ ๑๑ ๕๕ ๗



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๒๑ พฤศจิกายน ๒๕๖๗

เรื่อง ยกเลิกบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ซีคอฟ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๕ พฤศจิกายน ๒๕๖๗

ตามคำขอที่อ้างถึง บริษัท ซีคอฟ จำกัด ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๒๓๔
สถานที่ตั้งเลขที่ ๒๓๔ ถนนริมคลองประปา แขวงบางซื่อ เขตบางซื่อ กรุงเทพมหานคร ขอยกเลิกบุคลากร
ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์
จำนวน ๓ ราย ได้แก่

๑) นางสาวพัชรา สมานอินท์

ทะเบียนเลขที่ ว-๒๓๔-จ-๐๐๒๑

๒) นางสาวสุภาวดี บัวแก้ว

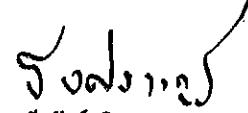
ทะเบียนเลขที่ ว-๒๓๔-จ-๐๐๓๖

๓) นางสาวมาลียาณี ฮาแว

ทะเบียนเลขที่ ว-๒๓๔-จ-๐๐๓๗

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ


(นายธีรทัศน์ อิศรางกูร ณ อยุธยา)
รองอธิบดี ปฏิบัติราชการแทน
อธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและเคียนมลพิษโรงงาน

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ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



ภาคผนวก ก

ใบรับรองความสามารถห้องปฏิบัติการและขอบข่ายการรับรอง
ห้องปฏิบัติการทดสอบ ตามมาตรฐาน ISO/IEC 17025
จากสำนักงานมาตรฐานอุตสาหกรรม (สมอ.)



แบบ กษ/กม.๖
Form NSC/TISI 2

ใบรับรองเลขที่ 24-L80026
(Certificate No.)

ใบรับรองระบบงาน (Certificate of Accreditation)

อาศัยอำนาจตามความในพระราชบัญญัติการมาตรฐานแห่งชาติ พ.ศ. ๒๕๕๑
(By Virtue of National Standardization Act B.E. 2551 (2008))

เลขาธิการสำนักงานมาตรฐานผลิตภัณฑ์อุตสาหกรรม
(Secretary-General, Thai Industrial Standards Institute)

ออกใบรับรองฉบับนี้ให้
(Issues this certificate to)

บริษัท ซีคอต จำกัด ฝ่ายห้องปฏิบัติการทดสอบด้านสิ่งแวดล้อม
(Secot Company Limited, Environmental Laboratory Division)

ตั้งอยู่เลขที่
(Address)

๒๓๙ ถนนริมคลองประปา แขวงบางซื่อ เขตบางซื่อ กรุงเทพมหานคร
(239 Rimklongprapa Road, Bangsue, Bangkok)

ได้รับการรับรองความสามารถ
(Certificate of competence)

ตามมาตรฐานเลขที่ มอก. ๑๗๐๒๕ - ๒๕๖๑
(Standard No. TIS 17025-2561 (2018) (ISO/IEC 17025: 2017))

ข้อกำหนดทั่วไปว่าด้วยความสามารถของ ห้องปฏิบัติการทดสอบและห้องปฏิบัติการสอบเทียบ
(General requirements for the competence of testing and calibration laboratories)

หมายเลขการรับรองที่ ทดสอบ ๐๓๙๔
(Accreditation No. Testing 0394)

โดยมีรายละเอียดสาขาและขอบข่ายที่ได้ใบรับรอง แสดงไว้ใน QR CODE และ www.tisi.go.th
(Details of the scheme and scope of the certificate are shown in QR CODE and www.tisi.go.th)

ออกให้ ณ วันที่ ๖ ธันวาคม พ.ศ. ๒๕๖๖
(Issue date : 6 December B.E. 2566 (2023))

(นายวีระศักดิ์ เพ็งหล่ง)

ผู้อำนวยการสำนักงานคณะกรรมการการมาตรฐานแห่งชาติ
ปฏิบัติราชการแทน
เลขาธิการสำนักงานมาตรฐานผลิตภัณฑ์อุตสาหกรรม



กระทรวงอุตสาหกรรม สำนักงานมาตรฐานผลิตภัณฑ์อุตสาหกรรม
(Ministry of Industry Thailand, Thai Industrial Standards Institute)



รายละเอียดสาขาและขอบข่ายใบรับรองห้องปฏิบัติการ
(Scope of Accreditation for Testing)
ใบรับรองเลขที่ 24-L80026
(Certification No. 24-L80026)



ชื่อห้องปฏิบัติการ
(Laboratory Name)

หมายเลขการรับรองที่
(Accreditation No.)

ฉบับที่ 03
(Issue No. 03)

สถานภาพห้องปฏิบัติการ
(Laboratory status)

บริษัท ซีคอต จำกัด ฝ่ายห้องปฏิบัติการทดสอบด้านสิ่งแวดล้อม
(Secot Company Limited, Environmental Laboratory Division)

ทดสอบ 0394
(Testing 0394)

ออกให้ตั้งแต่วันที่ 15 กันยายน พ.ศ. 2568
(Valid from 15 September B.E.2568 (2025))

☒ ถาวร (Permanent) ☐ นอกสถานที่ (Site) ☐ชั่วคราว (Temporary)

ถึงวันที่ 8 กันยายน พ.ศ. 2571
(Until 8 September B.E.2571 (2028))

☐ เคลื่อนที่ (Mobile) ☐ หลายสถานที่ (Multisite)

สาขาการทดสอบ (Field of Testing)	รายการทดสอบ (Parameter)	วิธีทดสอบ (Test Method)
สาขาสิ่งแวดล้อม (Environmental field) 1. น้ำและน้ำเสีย (Water and wastewater)	- Heavy metals • Arsenic (As) 0.000 5 mg/L to 0.090 0 mg/L • Arsenic (As) 0.05 mg/L to 4.50 mg/L • Barium (Ba) 0.02 mg/L to 4.50 mg/L • Cadmium (Cd) 0.01 mg/L to 4.50 mg/L • Chromium (Cr) 0.01 mg/L to 4.50 mg/L	- Standard Methods for the Examination of Water and Wastewater, APHA, AWWA, WEF, 24 th edition, 2023, Part 3030 F and Part 3114 C - Standard Methods for the Examination of Water and Wastewater, APHA, AWWA, WEF, 24 th edition, 2023, Part 3030 E and Part 3120 B

กระทรวงอุตสาหกรรมสำนักงานมาตรฐานผลิตภัณฑ์อุตสาหกรรม
(Ministry of Industry, Thai Industrial Standards Institute)

รายละเอียดสาขาและขอบข่ายใบรับรองห้องปฏิบัติการ
(Scope of Accreditation for Testing)
ใบรับรองเลขที่ 24-LB0026
(Certification No. 24-LB0026)



ฉบับที่ 03
(Issue No. 03)

ออกให้ตั้งแต่วันที่ 15 กันยายน พ.ศ. 2568
(Valid from 15 September B.E.2568 (2025))

ถึงวันที่ 8 กันยายน พ.ศ. 2571
(Until 8 September B.E.2571 (2028))

สถานภาพห้องปฏิบัติการ
(Laboratory status)

☒ถาวร
(Permanent)

☐นอกสถานที่
(Site)

☐ชั่วคราว
(Temporary)

☐เคลื่อนที่
(Mobile)

☐หลายสถานที่
(Multisite)

สาขาการทดสอบ (Field of Testing)	รายการทดสอบ (Parameter)	วิธีทดสอบ (Test Method)
<p>สาขาส่งแวดล้อม (Environmental field)</p> <p>1. น้ำและน้ำเสีย (ต่อ) (Water and wastewater) (cont.)</p>	<p>- Heavy metals</p> <ul style="list-style-type: none"> Copper (Cu) 0.02 mg/L to 4.50 mg/L Iron (Fe) 0.05 mg/L to 9.00 mg/L Lead (Pb) 0.03 mg/L to 4.50 mg/L Manganese (Mn) 0.01 mg/L to 9.00 mg/L Nickel (Ni) 0.01 mg/L to 4.50 mg/L Zinc (Zn) 0.02 mg/L to 9.00 mg/L <p>- Chemical oxygen demand (COD) 10.00 mg/L to 9 000 mg/L</p>	<p>- Standard Methods for the Examination of Water and Wastewater, APHA, AWWA, WEF, 24th edition, 2023, Part 3030 E and Part 3120 B</p> <p>- Standard Methods for the Examination of Water and Wastewater, APHA, AWWA, WEF, 24th edition, 2023, Part 5220 D</p>

รายละเอียดสาขาและขอบข่ายใบรับรองห้องปฏิบัติการ
(Scope of Accreditation for Testing)
ใบรับรองเลขที่ 24-LB0026
(Certification No. 24-LB0026)



ฉบับที่ 03
(Issue No. 03)

ออกให้ตั้งแต่วันที่ 15 กันยายน พ.ศ. 2568
(Valid from 15 September B.E.2568 (2025))

ถึงวันที่ 8 กันยายน พ.ศ. 2571
(Until 8 September B.E.2571 (2028))

สถานภาพห้องปฏิบัติการ
(Laboratory status)

☒ถาวร
(Permanent)

☐นอกสถานที่
(Site)

☐ชั่วคราว
(Temporary)

☐เคลื่อนที่
(Mobile)

☐หลายสถานที่
(Multisite)

สาขาการทดสอบ (Field of Testing)	รายการทดสอบ (Parameter)	วิธีทดสอบ (Test Method)
<p>สาขาส่งแวดล้อม (Environmental field)</p> <p>2. บริเวณทำงาน (Workplace)</p>	<p>- Total dust 0.10 mg/filter to 2.00 mg/filter</p> <p>- Respirable dust 0.10 mg/filter to 2.00 mg/filter</p> <p>- Benzene 0.70 µg/tube to 420 µg/tube</p> <p>- Toluene 0.70 µg/tube to 420 µg/tube</p> <p>- Total xylenes 1.40 µg/tube to 840 µg/tube</p> <p>- m, p-Xylene 0.70 µg/tube to 420 µg/tube</p>	<p>- NIOSH Manual of Analytical Methods (NMAM), Method 0500, 4th edition, 15th August 1994 (Exclude Sampling)</p> <p>- NIOSH Manual of Analytical Methods (NMAM), Method 0600, 4th edition, 15th January 1998 (Exclude Sampling)</p> <p>- NIOSH Manual of Analytical Methods (NMAM), Method 1501, 4th edition, 15th March 2003 (Exclude Sampling)</p>

รายละเอียดสาขาและขอบข่ายใบรับรองห้องปฏิบัติการ

(Scope of Accreditation for Testing)

ใบรับรองเลขที่ 24-LB0026

(Certification No. 24-LB0026)



ฉบับที่ 03
(Issue No. 03)

ออกให้ตั้งแต่วันที่ 15 กันยายน พ.ศ. 2568
(Valid from 15 September B.E.2568 (2025))

ถึงวันที่ 8 กันยายน พ.ศ. 2571
(Until 8 September B.E.2571 (2028))

สถานภาพห้องปฏิบัติการ
(Laboratory status)

☒ถาวร

(Permanent)

☐นอกสถานที่

(Site)

☐ชั่วคราว

(Temporary)

☐เคลื่อนที่

(Mobile)

☐หลายสถานที่

(Multisite)

สาขาการทดสอบ (Field of Testing)	รายการทดสอบ (Parameter)	วิธีทดสอบ (Test Method)
<p>สาขาส่งแวดล้อม (Environmental field)</p> <p>2. บริเวณทำงาน (ต่อ) (Workplace) (Cont.)</p> <p>3. ปล่องระบายอากาศ (Stack)</p>	<p>- o-Xylene 0.70 µg/tube to 420 µg/tube</p> <p>- Sulfur dioxide 1.00 mg/L to 16 000 mg/L</p> <p>- Hydrogen fluoride 5 µg/sample to 400 µg/sample</p> <p>- Hydrogen chloride 5 µg/sample to 400 µg/sample</p>	<p>- NIOSH Manual of Analytical Methods (NMAM), Method 1501, 4th edition, 15th March 2003 (Exclude Sampling)</p> <p>- US.EPA, Code of Federal Regulations, 40 CFR 60 appendix A, Method 6, July 2024 (Exclude Sampling)</p> <p>- WI-7.2-1-22 based on US.EPA, Code of Federal Regulations, 40 CFR 60 appendix A, Method 26, 26A, 2024</p>

รายละเอียดสาขาและขอบข่ายใบรับรองห้องปฏิบัติการ

(Scope of Accreditation for Testing)

ใบรับรองเลขที่ 24-LB0026

(Certification No. 24-LB0026)



ฉบับที่ 03
(Issue No. 03)

ออกให้ตั้งแต่วันที่ 15 กันยายน พ.ศ. 2568
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ถึงวันที่ 8 กันยายน พ.ศ. 2571
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สถานภาพห้องปฏิบัติการ
(Laboratory status)

☒ถาวร

(Permanent)

☒นอกสถานที่

(Site)

☐ชั่วคราว

(Temporary)

☐เคลื่อนที่

(Mobile)

☐หลายสถานที่

(Multisite)

สาขาการทดสอบ (Field of Testing)	รายการทดสอบ (Parameter)	วิธีทดสอบ (Test Method)
<p>สาขาส่งแวดล้อม (Environmental field)</p> <p>4. บรรยากาศทั่วไป (Ambient air)</p>	<p>- Volatile organic compounds (VOCs)</p> <ul style="list-style-type: none"> Chloroethene 0.05 µg/m³ to 51.00 µg/m³ (0.02 ppbv to 20.00 ppbv) 1,3-butadiene 0.04 µg/m³ to 44.00 µg/m³ (0.02 ppbv to 20.00 ppbv) Bromomethane 0.08 µg/m³ to 77.00 µg/m³ (0.02 ppbv to 20.00 ppbv) Acrolein 0.05 µg/m³ to 45.00 µg/m³ (0.02 ppbv to 20.00 ppbv) Acrylonitrile 0.04 µg/m³ to 43.00 µg/m³ (0.02 ppbv to 20.00 ppbv) Dichloromethane 0.14 µg/m³ to 69.00 µg/m³ (0.04 ppbv to 20.00 ppbv) 	<p>- WI-7.2-1-24 based on US EPA, Compendium Method TO-15, EPA/625/R-96/010b, Second edition, January 1999</p>

รายละเอียดสาขาและขอบข่ายใบรับรองห้องปฏิบัติการ
(Scope of Accreditation for Testing)
ใบรับรองเลขที่ 24-LB0026
(Certification No. 24-LB0026)



ฉบับที่ 03
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ออกให้ตั้งแต่วันที่ 15 กันยายน พ.ศ. 2568
(Valid from 15 September B.E.2568 (2025))

ถึงวันที่ 8 กันยายน พ.ศ. 2571
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สถานภาพห้องปฏิบัติการ
(Laboratory status)

☒ ถาวร
(Permanent)

☒ นอกสถานที่
(Site)

☐ชั่วคราว
(Temporary)

☐ เคลื่อนที่
(Mobile)

☐ หลายสถานที่
(Multisite)

สาขาการทดสอบ (Field of Testing)	รายการทดสอบ (Parameter)	วิธีทดสอบ (Test Method)
<p>สาขาส่งแวดล้อม (Environmental field)</p> <p>4. บรรยากาศทั่วไป (ต่อ) (Ambient air) (cont.)</p>	<p>- Volatile organic compounds (VOCs)</p> <ul style="list-style-type: none"> Carbon disulfide 0.06 $\mu\text{g}/\text{m}^3$ to 62.00 $\mu\text{g}/\text{m}^3$ (0.02 ppbv to 20.00 ppbv) Trichloromethane 0.20 $\mu\text{g}/\text{m}^3$ to 97.00 $\mu\text{g}/\text{m}^3$ (0.04 ppbv to 20.00 ppbv) 1,2-dichloroethane 0.08 $\mu\text{g}/\text{m}^3$ to 80.00 $\mu\text{g}/\text{m}^3$ (0.02 ppbv to 20.00 ppbv) Benzene 0.06 $\mu\text{g}/\text{m}^3$ to 63.00 $\mu\text{g}/\text{m}^3$ (0.02 ppbv to 20.00 ppbv) Carbon tetrachloride 0.25 $\mu\text{g}/\text{m}^3$ to 125 $\mu\text{g}/\text{m}^3$ (0.04 ppbv to 20.00 ppbv) Trichloroethylene 0.21 $\mu\text{g}/\text{m}^3$ to 107 $\mu\text{g}/\text{m}^3$ (0.04 ppbv to 20.00 ppbv) 	<p>- WI-7.2-1-24 based on US EPA, Compendium Method TO-15, EPA/625/R-96/010b, Second edition, January 1999</p>

รายละเอียดสาขาและขอบข่ายใบรับรองห้องปฏิบัติการ
(Scope of Accreditation for Testing)
ใบรับรองเลขที่ 24-LB0026
(Certification No. 24-LB0026)



ฉบับที่ 03
(Issue No. 03)

ออกให้ตั้งแต่วันที่ 15 กันยายน พ.ศ. 2568
(Valid from 15 September B.E.2568 (2025))

ถึงวันที่ 8 กันยายน พ.ศ. 2571
(Until 8 September B.E.2571 (2028))

สถานภาพห้องปฏิบัติการ
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☒ ถาวร
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(Multisite)

สาขาการทดสอบ (Field of Testing)	รายการทดสอบ (Parameter)	วิธีทดสอบ (Test Method)
<p>สาขาส่งแวดล้อม (environmental field)</p> <p>4. บรรยากาศทั่วไป (ต่อ) (Ambient air) (Cont.)</p>	<p>- Volatile organic compounds (VOCs)</p> <ul style="list-style-type: none"> 1,2-dichloropropane 0.18 $\mu\text{g}/\text{m}^3$ to 92.00 $\mu\text{g}/\text{m}^3$ (0.04 ppbv to 20.00 ppbv) Tetrachloroethylene 0.27 $\mu\text{g}/\text{m}^3$ to 135 $\mu\text{g}/\text{m}^3$ (0.04 ppbv to 20.00 ppbv) 1,2-dibromoethane 0.31 $\mu\text{g}/\text{m}^3$ to 153 $\mu\text{g}/\text{m}^3$ (0.04 ppbv to 20.00 ppbv) 1,1,2,2-tetrachloroethane 0.69 $\mu\text{g}/\text{m}^3$ to 137 $\mu\text{g}/\text{m}^3$ (0.10 ppbv to 20.00 ppbv) Benzyl chloride 0.52 $\mu\text{g}/\text{m}^3$ to 103 $\mu\text{g}/\text{m}^3$ (0.10 ppbv to 20.00 ppbv) 1,4-dichlorobenzene 0.24 $\mu\text{g}/\text{m}^3$ to 120 $\mu\text{g}/\text{m}^3$ (0.04 ppbv to 20.00 ppbv) 	<p>- WI-7.2-1-24 based on US EPA, Compendium Method TO-15, EPA/625/R-96/010b, Second edition, January 1999</p>