# เอกสารแนบ 14

## เอกสารอนุญาตห้องปฏิบัติการ

MM-NE07

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท ตรวจวัดสิ่งแวดล้อม จำกัด เลขทะเบียน ว-๓๐๑
ที่ อก ๐๓๑๐(๑)/ ๒๖๔๓ ลงวันที่ ๓๑ มกราคม ๒๕๖๖

ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๔ รายการ

น้ำเสีย จำนวน 4 รายการ

| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 1 | Biochemical Oxygen Demand | 5-Day BOD Test, Membrane Electrode Method |
| 2 | pH | Electrometric Method |
| 3 | Total Dissolved Solids | Dried at 180 °C |
| 4 | Total Suspended Solids | Dried at 103-105 °C |

เอกสารอ้างอิง

APHA, AWWA, WEF. Standard Methods for the Examination of Water and Wastewater. 23rd ed. Washington, DC: APHA, 2017.



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ที่ อก ๐๓๑๐(๑)/ ๒๖๔๓

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๓๑ มกราคม ๒๕๖๖

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท ตรวจวัดสิ่งแวดล้อม จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๘ ธันวาคม ๒๕๖๕

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน บริษัท ตรวจวัดสิ่งแวดล้อม จำกัด จำนวน ๑ แผ่น

ตามหนังสือที่อ้างถึง บริษัท ตรวจวัดสิ่งแวดล้อม จำกัด ขอต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๓๐๑ สถานที่ตั้งเลขที่ ๕/๔๕ หมู่บ้าน บ้านกลางกรุง บิซทาวน์ ซอยศรีนครินทร์ ๔๖/๑ (ปราโมทย์) แขวงหนองบอน เขตประเวศ กรุงเทพมหานคร ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท ตรวจวัดสิ่งแวดล้อม จำกัด ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์
นางส[redacted]

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์
๑) น[redacted]
๒) น[redacted]
๓) น[redacted]
๔) น[redacted]

ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย ตามสิ่งที่ส่งมาด้วย

หนังสือฉบับนี้จะหมดอายุในวันที่ ๓ มกราคม ๒๕๖๙ หากประสงค์จะต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อกรมโรงงานอุตสาหกรรม ภายใน ๓๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

[redacted]

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเตือนภัยมลพิษโรงงาน
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ
โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕
โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๙
ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th

CALIBRATION LABORATORY CO., LTD.
2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax. 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com

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ANAB ANSI National Accreditation Board ACCREDITED ISO/IEC 17025 CALIBRATION AND DIMENSIONAL MEASUREMENT ACDM-2814

MM-NE07

# REPORT OF CALIBRATION

## FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | DIGITAL THERMOMETER WITH PROBE |
| MANUFACTURER | : | LUTRON |
| MODEL / TYPE | : | MTM-380SD |
| SERIAL NO. | : | I.570147/N/A[LA-0013/LA-0013/A] |
| DATE OF CALIBRATION | : | 09 April 2024 |

**ENVIRONMENT CONDITIONS :**

Temperature : (23 ± 2) °C Relative Humidity : (55 ± 10) % RH

**PROCEDURE USED :**

This instrument was calibrated under procedure No. **CLC-CPTH-06** based on **ASTM E 220-86** as calibration guidelines. The calibration was performed by using Calibration Bath, Precision Thermometer and IPRT which maintained by the Calibration Laboratory Co., Ltd.

**REFERENCE STANDARD USED :**

1. Calibration Bath, Kambic Model OB-22/2 ULT, OB-22/2 S/N. 17115653, 17115654.
2. Precision Thermometer, ASL Model F200-A-8 S/N. 014433/03.
3. IPRT, ASL Model T100-250-1D, T100-450-1D S/N. L0193A-1-1, L1123A-1-5.

**TRACEABILITY :**

1. The measurements are traceable to International System of Units (SI) , through Calibration Laboratory Co., Ltd. Certificate No. Q23136342, Q23126517. Due Date 20 December 2024, 20 November 2024.
2. The measurements are traceable to International System of Units (SI) , through Thailand Institute of Scientific and Technological Research (TISTR). Certificate No. PSL-T 0203/67, Due Date 07 December 2024.
3. The measurements are traceable to International System of Units (SI) , through National Institute of Metrology (Thailand). Certificate No.TT-0136-23, TT-0132-23. Due Date 12 December 2024, 22 November 2024.

**UNCERTAINTY :**

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2{,}00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %. It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"



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# CERTIFICATE OF CALIBRATION

## FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | DIGITAL THERMOMETER WITH PROBE |
| MANUFACTURER | : | LUTRON |
| MODEL / TYPE | : | MTM-380SD |
| SERIAL NO. | : | I.570147/N/A[LA-0013/LA-0013/A] |
| CLID. NO. | : | 232204019 |
| JOB CONTROL NO. | : | 240408038373 |
| CALIBRATION SERVICE | : | ☑ IN-LABORATORY ☐ ON-SITE |

CUSTOMER : ENVIRONMENTAL MEASUREMENTS CO., LTD.
5/45 BAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1 (PRAMOTE),
NONG BON SUB-DISTRICT, PRAWET DISTRICT, BANGKOK 10250

DATE OF RECEIVED : 08 April 2024 DATE OF ISSUED : 10 April 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Pimsiri Hemtanon
Calibration Engineer

Approved By :

Authorized Signatory
10 April 2024

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units ( SI )



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MM-NE07

# CERTIFICATE OF CALIBRATION

## FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | DO METER |
| MANUFACTURER | : | YSI |
| MODEL / TYPE | : | 5000-230V/5010 |
| SERIAL NO. | : | 16D101626/19D100367[DOM-01] |
| CLID. NO. | : | 272100329 |
| JOB CONTROL NO. | : | 240408038371 |
| CALIBRATION SERVICE | : | ☑ IN-LABORATORY ☐ ON-SITE |

CUSTOMER : ENVIRONMENTAL MEASUREMENTS CO., LTD.
5/45 BAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1 (PRAMOTE),
NONG BON SUB-DISTRICT, PRAWET DISTRICT, BANGKOK 10250

DATE OF RECEIVED : 08 April 2024 DATE OF ISSUED : 10 April 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Sukgasem Seehanart
Calibration Engineer

Approved By :
Authorized Signatory
10 April 2024

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units ( SI )



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CALIBRATION LABORATORY CO., LTD.
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ANAB ANSI National Accreditation Board ACCREDITED MANUFACTURER CALIBRATION AND DIMENSIONAL MEASUREMENT ACDM-2814

CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment

The DUC Reading were recorded and the means value were reported of five times measurement in the table below.

## CALIBRATION DATA

CORRECTION OF TEMPERATURE : T1 [ THERMOCOUPLE TYPE K ]

| Immersion depth (mm) | Actual Temperature ( °C ) | DUC Reading ( °C ) | Correction ( °C ) | Uncertainty ± ( °C ) |
|---|---|---|---|---|
| 200 | 4.00 | 4.2 | -0.20 | 0.52 |
| | 20.01 | 20.3 | -0.29 | |
| | 95.04 | 95.6 | -0.56 | |
| | 104.02 | 104.9 | -0.88 | |
| | 180.03 | 181.4 | -1.37 | |

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 56 of 67

This report is valid for the above stated instrument/s only.

### End of Certificate ###

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MM-NE07

**CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION**

**MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment**

The table in the following gives the calibration results and associated measurement uncertainties of Do Meter.

**CALIBRATION DATA**

**CORRECTION OF DO METER @ 20°C**

| Nominal Value ( mg/L ) | DUC Reading ( mg/L ) | Correction ( mg/L ) | Uncertainty ( mg/L ) |
|---|---|---|---|
| 7.78 | 7.80 | -0.02 | ± 0.38 |

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 5 of 67

**This report is valid for the above stated instrument/s only.**

**### End of Certificate ###**



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# REPORT OF CALIBRATION

## FOR

| | | |
|---|---|---|
| **NOMENCLATURE** | : | **DO METER** |
| **MANUFACTURER** | : | **YSI** |
| **MODEL / TYPE** | : | **5000-230V/5010** |
| **SERIAL NO.** | : | **16D101626/19D100367[DOM-01]** |
| **DATE OF CALIBRATION** | : | **09 April 2024** |

**ENVIRONMENT CONDITIONS :**

**Temperature :** **(25 ± 2.5) °C** **Relative Humidity :** **(50 ± 15) %RH**

**PROCEDURE USED :**

This instrument was calibrated under procedure No. **CLC-CPCH-06.** The calibration was performed by direct measurement with Certified Reference Material (CRM).

**REFERENCE STANDARD USED :**

Dissolved Oxygen, Sigma-Alorich Product ID QC3077-500ML .

**TRACEABILITY :**

The measurements are traceable to International System of Units (SI) , through Merck Co., Ltd.
Lot LRAD3840 , Due Date October 2024.

**UNCERTAINTY :**

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2{,}00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"



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# REPORT OF CALIBRATION

## FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | DIGITAL THERMOHYGRO METER |
| MANUFACTURER | : | DIGICON |
| MODEL / TYPE | : | TH-02A |
| SERIAL NO. | : | 1919E0284980[DTH-02] |
| DATE OF CALIBRATION | : | 10 April 2024 |

**ENVIRONMENT CONDITIONS :**

**Temperature :** (23 ± 2) °C **Relative Humidity :** (55 ± 10) %RH

**PROCEDURE USED :**

This instrument was calibrated under procedure No. **CLC-CPTH-11.** The calibration was performed by using Chilled Mirror Hygrometer which maintained by the Calibration Laboratory Co., Ltd.

**REFERENCE STANDARD USED :**

Chilled Mirror Hygrometer, Edgetech Model Dew Master S/N. 44602.

Temperature & Humidity Chamber, PGC Model 9141-5116 S/N. 1304261.

**TRACEABILITY :**

The measurements are traceable to International System of Units (SI) , through Thunder Scientific Corporation.

Certificate No. 21594, Due Date 06 July 2024.

**UNCERTAINTY :**

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2{,}00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

**Certificate No. Q24038370**

**F3-011-05/12-23**



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# CERTIFICATE OF CALIBRATION

## FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | DIGITAL THERMOHYGRO METER |
| MANUFACTURER | : | DIGICON |
| MODEL / TYPE | : | TH-02A |
| SERIAL NO. | : | 1919E0284980[DTH-02] |
| CLID. NO. | : | 232100201 |
| JOB CONTROL NO. | : | 240408038370 |
| CALIBRATION SERVICE | : | ☑ IN-LABORATORY ☐ ON-SITE |

CUSTOMER : ENVIRONMENTAL MEASUREMENTS CO., LTD.
5/45 BAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1 (PRAMOTE),
NONG BON SUB-DISTRICT, PRAWET DISTRICT, BANGKOK 10250

DATE OF RECEIVED : 08 April 2024 DATE OF ISSUED : 17 April 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

**Calibrated By :** Tanawan Seenam-Ngoen

Calibration Engineer

**Approved By :**

Authorized Signatory

17 April 2024

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units ( SI )

**Certificate No. Q24038370**

**F3-011-05/12-23**



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MM-NE07

# CERTIFICATE OF CALIBRATION

## FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | DIGITAL THERMOHYGRO METER |
| MANUFACTURER | : | DIGICON |
| MODEL / TYPE | : | TH-02A |
| SERIAL NO. | : | 1919E0284991[DTH-01] |
| CLID. NO. | : | 232100200 |
| JOB CONTROL NO. | : | 240408038369 |
| CALIBRATION SERVICE | : | ☑ IN-LABORATORY ☐ ON-SITE |

CUSTOMER : ENVIRONMENTAL MEASUREMENTS CO., LTD.
5/45 BAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1 (PRAMOTE),
NONG BON SUB-DISTRICT, PRAWET DISTRICT, BANGKOK 10250

DATE OF RECEIVED : 08 April 2024 DATE OF ISSUED : 17 April 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Tanawan Seenam-Ngoen
Calibration Engineer

Approved By :
Authorized Signatory
17 April 2024

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ANAB ANSI National Accreditation Board ACCREDITED CALIBRATION AND DIMENSIONAL MEASUREMENT ACDM-2814

**CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION**

**MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment**

The table in the following gives the calibration results and associated measurement uncertainties of the measuring digital thermohygro meter.

## CALIBRATION DATA

### 1. CORRECTION OF TEMPERATURE

| Test point (°C) | Actual Temperature (°C) | DUC Reading (°C) | Correction (°C) | Uncertainty ±(°C) |
|---|---|---|---|---|
| 20.0 | 20.00 | 19.7 | +0.30 | 0.27 |
| 25.0 | 25.00 | 24.7 | +0.30 | |
| 30.0 | 30.00 | 29.6 | +0.40 | |

### 2. CORRECTION OF HUMIDITY

| STD Temperature (°C) | STD Reading (%RH) | DUC Reading (%RH) | Correction (%RH) | Uncertainty ± (%RH) |
|---|---|---|---|---|
| 25 | 40.0 | 33 | +7.0 | 0.8 |
| 25 | 60.0 | 53 | +7.0 | 0.9 |

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 59 of 67

This report is valid for the above stated instrument/s only.

### End of Certificate ###



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**CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION**

**MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment**

The table in the following gives the calibration results and associated measurement uncertainties of the measuring digital thermohygro meter.

**CALIBRATION DATA**

**1. CORRECTION OF TEMPERATURE**

| Test point (°C) | Actual Temperature (°C) | DUC Reading (°C) | Correction (°C) | Uncertainty ±(°C) |
|---|---|---|---|---|
| 20.0 | 20.00 | 19.6 | +0.40 | 0.27 |
| 25.0 | 25.00 | 24.6 | +0.40 | |
| 30.0 | 30.00 | 29.5 | +0.50 | |

**2. CORRECTION OF HUMIDITY**

| STD Temperature (°C) | STD Reading (%RH) | DUC Reading (%RH) | Correction (%RH) | Uncertainty ± (%RH) |
|---|---|---|---|---|
| 25 | 40.0 | 32 | +8.0 | 0.8 |
| 25 | 60.0 | 52 | +8.0 | 0.9 |

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 59 of 67

**This report is valid for the above stated instrument/s only.**

**### End of Certificate ###**



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CALIBRATION LABORATORY CO., LTD.
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ANAB ANSI National Accreditation Board ACCREDITED LABORATORY CALIBRATION AND DIMENSIONAL MEASUREMENT ACDM-2814

# REPORT OF CALIBRATION

## FOR

| | | |
|---|---|---|
| **NOMENCLATURE** | : | **DIGITAL THERMOHYGRO METER** |
| **MANUFACTURER** | : | **DIGICON** |
| **MODEL / TYPE** | : | **TH-02A** |
| **SERIAL NO.** | : | **1919E0284991[DTH-01]** |
| **DATE OF CALIBRATION** | : | **10 April 2024** |

**ENVIRONMENT CONDITIONS :**

**Temperature :** **(23 ± 2) °C** **Relative Humidity :** **(55 ± 10) %RH**

**PROCEDURE USED :**

This instrument was calibrated under procedure No. **CLC-CPTH-11.** The calibration was performed by using Chilled Mirror Hygrometer which maintained by the Calibration Laboratory Co., Ltd.

**REFERENCE STANDARD USED :**

Chilled Mirror Hygrometer, Edgetech Model Dew Master S/N. 44602.

Temperature & Humidity Chamber, PGC Model 9141-5116 S/N. 1304261.

**TRACEABILITY :**

The measurements are traceable to International System of Units (SI) , through Thunder Scientific Corporation. Certificate No. 21594, Due Date 06 July 2024.

**UNCERTAINTY :**

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2{,}00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %. It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

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NSC-TISI-TIS 17025 CALIBRATION 0059 CLC

# REPORT OF CALIBRATION

## FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | WATER BATH |
| MANUFACTURER | : | M-LAB |
| MODEL / TYPE | : | WBN 15 |
| SERIAL NO. | : | 0335[LA-007] |
| LOCATION SITE | : | LABORATORY-HOT ZONE |
| DATE OF CALIBRATION | : | 04 April 2024 |

**ENVIRONMENT CONDITIONS :**

**Temperature : 24 °C to 25 °C** **Relative Humidity : 50% to 52%**

**PROCEDURE USED :**

This instrument was calibrated under procedure No. **WI-305-135** based on **ASTM E 715-80:2016** as calibration guidelines.

The calibration was performed by using Hydra Series II which maintained by the Calibration Laboratory Co., Ltd.

**REFERENCE STANDARD USED :**

Hydra Series II, Fluke Model 2635A S/N. 7107303.

**TRACEABILITY :**

The measurements are traceable to International System of Units (SI) , through Calibration Laboratory Co., Ltd.

Certificate No. Q24026699, Due Date 13 September 2024.

**UNCERTAINTY :**

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2{,}00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

**Certificate No. Q24024795**

**F3-011-05/12-23**



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# CERTIFICATE OF CALIBRATION

## FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | WATER BATH |
| MANUFACTURER | : | M-LAB |
| MODEL / TYPE | : | WBN 15 |
| SERIAL NO. | : | 0335[LA-007] |
| CLID. NO. | : | 332300657 |
| JOB CONTROL NO. | : | 240307024795 |
| CALIBRATION SERVICE | : | ☐ IN-LABORATORY ☑ ON-SITE |

CUSTOMER : ENVIRONMENTAL MEASUREMENTS CO., LTD.
5/45 BAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1 (PRAMOTE),
NONG BON SUB-DISTRICT, PRAWET DISTRICT, BANGKOK 10250

DATE OF RECEIVED : 07 March 2024 DATE OF ISSUED : 06 April 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Wenick Inchaisri
Calibration Engineer

Approved By :

Authorized Signatory
06 April 2024

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units ( SI )

**Certificate No. Q24024795**

**F3-011-05/12-23**



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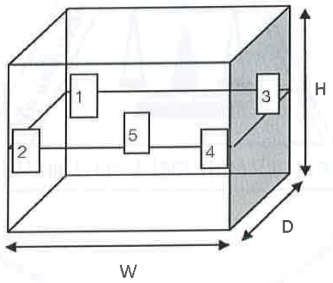
## CALIBRATION DATA

### 2. TEMPERATURE DISTRIBUTION

| Test Point (°C) | DUC Reading (°C) | STD Reading (°C) | | | | | Uncertainty ±(°C) |
|---|---|---|---|---|---|---|---|
| | | Probe No. 1 | Probe No. 2 | Probe No. 3 | Probe No. 4 | Probe No. 5 | |
| 85.0 | 85.0 | 84.37 | 84.87 | 84.67 | 84.86 | 84.71 | 0.60 |

Technical Note : W = 35 cm, D = 30 cm, H = 15 cm.

The Scope of Accredited TISI Certificate No. 23-LB0092 Issue 02 Page 128 of 138




**This report is valid for the above stated instrument/s only.**

**### End of Certificate ###**



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**CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION**

**MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment**

The table in the following gives the calibration results and associated measurement uncertainties of the measuring water bath.

## CALIBRATION DATA

### 1. WATER BATH PERFORMANCE

| Test Point (°C) | DUC Reading (°C) | Uniformity (°C) | Stability (°C) |
|---|---|---|---|
| 85.0 | 85.0 | 0.48 | 0.17 |

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# REPORT OF CALIBRATION

## FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | WATER BATH |
| MANUFACTURER | : | MEMMERT |
| MODEL / TYPE | : | WNB14 |
| SERIAL NO. | : | L418.0758[LA-004] |
| LOCATION SITE | : | LABORATORY-HOT ZONE |
| DATE OF CALIBRATION | : | 04 April 2024 |

**ENVIRONMENT CONDITIONS :**

**Temperature : 24 °C to 25 °C** **Relative Humidity : 50% to 52%**

**PROCEDURE USED :**

This instrument was calibrated under procedure No. **WI-305-135** based on **ASTM E 715-80:2016** as calibration guidelines.

The calibration was performed by using Hydra Series II which maintained by the Calibration Laboratory Co., Ltd.

**REFERENCE STANDARD USED :**

Hydra Series II, Fluke Model 2635A S/N. 7107303.

**TRACEABILITY :**

The measurements are traceable to International System of Units (SI) , through Calibration Laboratory Co., Ltd.

Certificate No. Q24026699, Due Date 13 September 2024.

**UNCERTAINTY :**

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2{,}00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"



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# CERTIFICATE OF CALIBRATION

## FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | WATER BATH |
| MANUFACTURER | : | MEMMERT |
| MODEL / TYPE | : | WNB14 |
| SERIAL NO. | : | L418.0758[LA-004] |
| CLID. NO. | : | 332100157 |
| JOB CONTROL NO. | : | 240307024794 |
| CALIBRATION SERVICE | : | ☐ IN-LABORATORY ☑ ON-SITE |

CUSTOMER : ENVIRONMENTAL MEASUREMENTS CO., LTD.
5/45 BAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1 (PRAMOTE),
NONG BON SUB-DISTRICT, PRAWET DISTRICT, BANGKOK 10250

DATE OF RECEIVED : 07 March 2024 DATE OF ISSUED : 06 April 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Wenick Inchaisri
Calibration Engineer

Approved By :

Authorized Signatory
06 April 2024

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units ( SI )



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## CALIBRATION DATA

### 2. TEMPERATURE DISTRIBUTION

| Test Point (°C) | DUC Reading (°C) | STD Reading (°C) | | | | | Uncertainty ±(°C) |
|---|---|---|---|---|---|---|---|
| | | Probe No. 1 | Probe No. 2 | Probe No. 3 | Probe No. 4 | Probe No. 5 | |
| 95.0 | 95.0 | 96.62 | 96.74 | 96.93 | 96.68 | 96.66 | 0.65 |

Technical Note : W = 35 cm, D = 29 cm, H = 14 cm.

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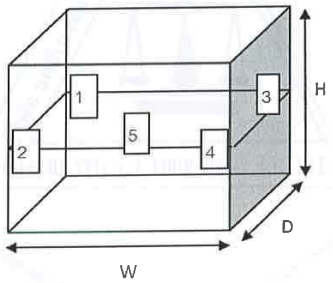


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**### End of Certificate ###**



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**CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION**

**MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment**

The table in the following gives the calibration results and associated measurement uncertainties of the measuring water bath.

## CALIBRATION DATA

### 1. WATER BATH PERFORMANCE

| Test Point (°C) | DUC Reading (°C) | Uniformity (°C) | Stability (°C) |
|---|---|---|---|
| 95.0 | 95.0 | 0.50 | 0.21 |

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# REPORT OF CALIBRATION

## FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | REFRIGERATOR |
| MANUFACTURER | : | MEDICOOL |
| MODEL / TYPE | : | BB-117 |
| SERIAL NO. | : | BB117-190725001[LA-003] |
| LOCATION SITE | : | LABORATORY |
| DATE OF CALIBRATION | : | 04 April 2024 |

**ENVIRONMENT CONDITIONS :**

Temperature : 24 °C to 25 °C Relative Humidity : 50 % to 52 %

**PROCEDURE USED :**

This instrument was calibrated under procedure No. **WI-305-165** based on **TLAS G-20-1/02-08** as calibration guidelines.

The calibration was performed by using Hydra Data Logger which maintained by the Calibration Laboratory Co., Ltd.

**REFERENCE STANDARD USED :**

Hydra Data Logger, Fluke Model 2620 S/N. 5592550.

**TRACEABILITY :**

The measurements are traceable to International System of Units (SI) , through Calibration Laboratory Co., Ltd.

Certificate No. Q23065868, Due Date 22 June 2024.

**UNCERTAINTY :**

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"



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# CERTIFICATE OF CALIBRATION

## FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | REFRIGERATOR |
| MANUFACTURER | : | MEDICOOL |
| MODEL / TYPE | : | BB-117 |
| SERIAL NO. | : | BB117-190725001[LA-003] |
| CLID. NO. | : | 332100156 |
| JOB CONTROL NO. | : | 240307024793 |
| CALIBRATION SERVICE | : | ☐ IN-LABORATORY ☑ ON-SITE |

CUSTOMER : ENVIRONMENTAL MEASUREMENTS CO., LTD.
5/45 BAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1 (PRAMOTE),
NONG BON SUB-DISTRICT, PRAWET DISTRICT, BANGKOK 10250

DATE OF RECEIVED : 07 March 2024 DATE OF ISSUED : 06 April 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Wenick Inchaisri
Calibration Engineer

Approved By :

Authorized Signatory
06 April 2024

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units ( SI )

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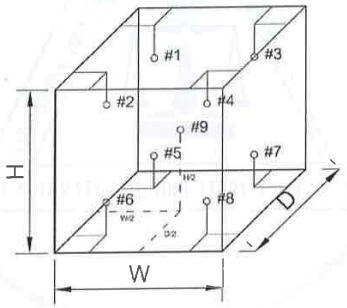
## CALIBRATION DATA

### 2. TEMPERATURE DISTRIBUTION

| DUC | | Measured Temperature ( °C )@Probe No.9 is Ref. | | | | | | | | | Uncertainty ±( °C ) | Coverage factor *k* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Setting ( °C ) | Indicating ( °C ) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | |
| 4.0 | 4.0 | 3.22 | 3.93 | 3.21 | 3.93 | 3.52 | 3.29 | 3.02 | 3.18 | 3.31 | 1.40 | 2,00 |

Technical Note : W = 50 cm, D = 50 cm, H = 120 cm.

The Scope of Accredited TISI Certificate No. 23-LB0092 Issue 02 Page 129 of 138

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**### End of Certificate ###**



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**CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION**

**MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment**

The table in the following gives the calibration results and associated measurement uncertainties of the measuring refrigerator.

## CALIBRATION DATA

### 1. REFRIGERATOR PERFORMANCE

| DUC | | Measured Uniformity ( °C ) | Measured Stability ( °C ) | Measured Overall Variation ( °C ) |
|---|---|---|---|---|
| Setting ( °C ) | Indicating ( °C ) | | | |
| 4.0 | 4.0 | 0.82 | 1.14 | 2.49 |

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NSC-TISI-TIS 17025 CALIBRATION 0059 CLC

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# REPORT OF CALIBRATION

## FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | INCUBATOR |
| MANUFACTURER | : | ACCUPLUS |
| MODEL / TYPE | : | SMART i250 |
| SERIAL NO. | : | 2059-0718-0010[LA-002] |
| LOCATION SITE | : | LABORATORY |
| DATE OF CALIBRATION | : | 04 April 2024 |

**ENVIRONMENT CONDITIONS :**

Temperature : 24 °C to 25 °C Relative Humidity : 50 % to 52 %

**PROCEDURE USED :**

This instrument was calibrated under procedure No. **WI-305-165** based on **TLAS G-20-1/02-08** as calibration guidelines.

The calibration was performed by using Hydra Data Logger which maintained by the Calibration Laboratory Co., Ltd.

**REFERENCE STANDARD USED :**

Hydra Data Logger, Fluke Model 2620 S/N. 5592550.

**TRACEABILITY :**

The measurements are traceable to International System of Units (SI) , through Calibration Laboratory Co., Ltd.

Certificate No. Q23065868, Due Date 22 June 2024.

**UNCERTAINTY :**

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"



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# CERTIFICATE OF CALIBRATION

## FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | INCUBATOR |
| MANUFACTURER | : | ACCUPLUS |
| MODEL / TYPE | : | SMART i250 |
| SERIAL NO. | : | 2059-0718-0010[LA-002] |
| CLID. NO. | : | 332100155 |
| JOB CONTROL NO. | : | 240307024792 |
| CALIBRATION SERVICE | : | ☐ IN-LABORATORY ☑ ON-SITE |

CUSTOMER : ENVIRONMENTAL MEASUREMENTS CO., LTD.
5/45 BAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1 (PRAMOTE),
NONG BON SUB-DISTRICT, PRAWET DISTRICT, BANGKOK 10250

DATE OF RECEIVED : 07 March 2024 DATE OF ISSUED : 06 April 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Wenick Inchaisri
Calibration Engineer

Approved By :

Authorized Signatory
06 April 2024

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units ( SI )



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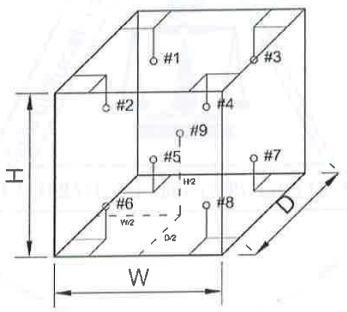
## CALIBRATION DATA

### 2. TEMPERATURE DISTRIBUTION

| DUC | | Measured Temperature ( °C )@Probe No.9 is Ref. | | | | | | | | | Uncertainty ±( °C ) | Coverage factor *k* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Setting ( ° C ) | Indicating ( ° C ) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | |
| 20.0 | 20.0 | 20.58 | 20.70 | 20.70 | 20.46 | 20.54 | 20.53 | 20.53 | 20.36 | 20.39 | 0.68 | 2,00 |

Technical Note : W = 50 cm, D = 48 cm, H = 110 cm.

The Scope of Accredited TISI Certificate No. 23-LB0092 Issue 02 Page 129 of 138




**This report is valid for the above stated instrument/s only.**

**### End of Certificate ###**





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**CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION**

**MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment**

The table in the following gives the calibration results and associated measurement uncertainties of the measuring incubator.

## CALIBRATION DATA

### 1. INCUBATOR PERFORMANCE

| DUC | | Measured Uniformity ( °C ) | Measured Stability ( °C ) | Measured Overall Variation ( °C ) |
|---|---|---|---|---|
| Setting ( °C ) | Indicating ( °C ) | | | |
| 20.0 | 20.0 | 0.52 | 0.46 | 1.06 |

CALIBRATION LABORATORY CO., LTD.
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MM-NE07

# REPORT OF CALIBRATION

## FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | HOT AIR OVEN |
| MANUFACTURER | : | MEMMERT |
| MODEL / TYPE | : | UF110 |
| SERIAL NO. | : | B422.0026[LA-0012] |
| LOCATION SITE | : | LABORATORY-HOT ZONE |
| DATE OF CALIBRATION | : | 04 April 2024 |

**ENVIRONMENT CONDITIONS :**

Temperature : 24 °C to 25 °C Relative Humidity : 50% to 52 %

**PROCEDURE USED :**

This instrument was calibrated under procedure No. **CLC-CPTH-07** based on **TLAS G-20** as calibration guidelines.

The calibration was performed by using Hydra Data Logger which maintained by the Calibration Laboratory Co., Ltd.

**REFERENCE STANDARD USED :**

Hydra Data Logger, Fluke Model 2620 S/N. 5592550.

**TRACEABILITY :**

The measurements are traceable to International System of Units (SI) , through Calibration Laboratory Co., Ltd.

Certificate No. Q23065868, Due Date 22 June 2024.

**UNCERTAINTY :**

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"



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# CERTIFICATE OF CALIBRATION

## FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | HOT AIR OVEN |
| MANUFACTURER | : | MEMMERT |
| MODEL / TYPE | : | UF110 |
| SERIAL NO. | : | B422.0026[LA-0012] |
| CLID. NO. | : | 332202464 |
| JOB CONTROL NO. | : | 240307024791 |
| CALIBRATION SERVICE | : | ☐ IN-LABORATORY ☑ ON-SITE |

CUSTOMER : ENVIRONMENTAL MEASUREMENTS CO., LTD.
5/45 BAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1 (PRAMOTE),
NONG BON SUB-DISTRICT, PRAWET DISTRICT, BANGKOK 10250

DATE OF RECEIVED : 07 March 2024 DATE OF ISSUED : 06 April 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Wenick Inchaisri
Calibration Engineer

Approved By :

Authorized Signatory
06 April 2024

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units ( SI )

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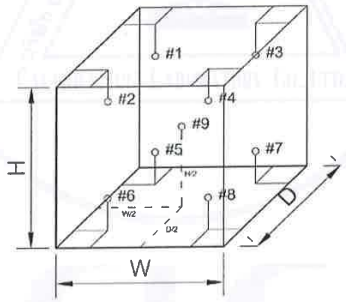
## CALIBRATION DATA

### 2. TEMPERATURE DISTRIBUTION

| DUC | | Measured Temperature ( °C )@Probe No.9 is Ref. | | | | | | | | | Uncertainty ±( °C ) | Coverage factor *k* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Setting ( ° C ) | Indicating ( ° C ) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | |
| 104.0 | 104.0 | 103.11 | 104.12 | 103.56 | 103.79 | 103.72 | 103.88 | 103.57 | 104.18 | 103.88 | 0.45 | 2,00 |
| 180.0 | 180.0 | 178.33 | 180.32 | 178.77 | 179.54 | 179.26 | 179.74 | 179.19 | 180.15 | 179.58 | 0.55 | 2,00 |

Technical Note : W = 56 cm, D = 40 cm, H = 48 cm.

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 58 of 67




**This report is valid for the above stated instrument/s only.**

**### End of Certificate ###**





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ANAB ANSI National Accreditation Board ACCREDITED CALIBRATION AND DIMENSIONAL MEASUREMENT ACDM-2814

**CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION**

**MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment**

The table in the following gives the calibration results and associated measurement uncertainties of the measuring hot air oven.

## CALIBRATION DATA

### 1. HOT AIR OVEN PERFORMANCE

| DUC | | Measured Uniformity ( °C ) | Measured Stability ( °C ) | Measured Overall Variation ( °C ) |
|---|---|---|---|---|
| Setting ( °C ) | Indicating ( °C ) | | | |
| 104.0 | 104.0 | 0.81 | 0.07 | 1.20 |
| 180.0 | 180.0 | 1.35 | 0.19 | 2.17 |

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CLC Accredited ISO/IEC 17025

NSC-TISI-TIS 17025 CALIBRATION 0059 CLC

MM-NE07

# REPORT OF CALIBRATION

## FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | BALANCE |
| MANUFACTURER | : | METTLER TOLEDO |
| MODEL / TYPE | : | MS204TS/00 |
| SERIAL NO. | : | B935191252[LA-002] |
| LOCATION SITE | : | LABORATORY - BALANCE ROOM |
| DATE OF CALIBRATION | : | 04 April 2024 |

**ENVIRONMENT CONDITIONS :**

Temperature : 24 °C to 25 °C Relative Humidity : 50 % to 51 %

**PROCEDURE USED :**

This instrument was calibrated under procedure No. **WI-305-46** based on **EURAMET cg-18 Version 4.0 (11/2015).**

The calibration was performed by Comparison with Weight Set which maintained by the Calibration Laboratory Co., Ltd.

**REFERENCE STANDARD USED :**

1. Weight Set, Phoenix Class E2 S/N. WBS-SET-E2-01.
2. Weight, Sartorius Class E2 S/N. 44329129, 43529037, 44329167, 43529293.

**TRACEABILITY :**

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand). Certificate No. MM-0123-22, Due Date 22 August 2024.
2. The measurements are traceable to International System of Units (SI) , through Sartorius Lab Instruments GmbH & Co. KG. Certificate No. M141607, M141608, M141609, M141611. Due Date 15 September 2025.

**UNCERTAINTY :**

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95%. It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q24024790

F3-011-05/12-23



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CLC Accredited ISO/IEC 17025

NSC-TISI-TIS 17025 CALIBRATION 0059 CLC

# CERTIFICATE OF CALIBRATION

## FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | BALANCE |
| MANUFACTURER | : | METTLER TOLEDO |
| MODEL / TYPE | : | MS204TS/00 |
| SERIAL NO. | : | B935191252[LA-002] |
| CLID. NO. | : | 362200356 |
| JOB CONTROL NO. | : | 240307024790 |
| CALIBRATION SERVICE | : | ☐ IN-LABORATORY ☑ ON-SITE |

CUSTOMER : ENVIRONMENTAL MEASUREMENTS CO., LTD.
5/45 BAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1 (PRAMOTE),
NONG BON SUB-DISTRICT, PRAWET DISTRICT, BANGKOK 10250

DATE OF RECEIVED : 07 March 2024 DATE OF ISSUED : 08 April 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Chonvit Thongnat
Calibration Engineer

Approved By :

Authorized Signatory
08 April 2024

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units ( SI )

Certificate No. Q24024790

F3-011-05/12-23



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# CERTIFICATE OF CALIBRATION

## FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | BALANCE |
| MANUFACTURER | : | SHIMADZU |
| MODEL / TYPE | : | AP225WD |
| SERIAL NO. | : | D316300692[LA-001] |
| CLID. NO. | : | 362100172 |
| JOB CONTROL NO. | : | 240307024789 |
| CALIBRATION SERVICE | : | ☐ IN-LABORATORY ☑ ON-SITE |

CUSTOMER : ENVIRONMENTAL MEASUREMENTS CO., LTD.
5/45 BAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1 (PRAMOTE),
NONG BON SUB-DISTRICT, PRAWET DISTRICT, BANGKOK 10250

DATE OF RECEIVED : 07 March 2024 DATE OF ISSUED : 05 April 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Chonvit Thongnat
Calibration Engineer

Approved By :
Authorized Signatory
05 April 2024

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units ( SI )

Certificate No. Q24024789
F3-011-05/12-23



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NSC-TISI-TIS 17025 CALIBRATION 0059 CLC

CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment

## CALIBRATION DATA

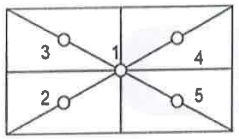
### 1. Error of indications

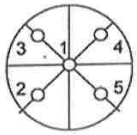
| Nominal Test Value ( g ) | Conventional mass ( g ) | Display Value ( g ) | Error of Balance ( g ) | Uncertainty ± ( mg ) | Coverage factor *k* |
|---|---|---|---|---|---|
| Unload | 0.0000 | 0.0000 | 0.0000 | 0.07 | 2,00 |
| 0.1000 | 0.1000 | 0.0999 | -0.0001 | 0.11 | 2,00 |
| 0.5000 | 0.5000 | 0.5000 | 0.0000 | 0.11 | 2,00 |
| 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.11 | 2,00 |
| 2.0000 | 2.0000 | 2.0000 | 0.0000 | 0.11 | 2,00 |
| 5.0000 | 5.0000 | 4.9999 | -0.0001 | 0.11 | 2,00 |
| 10.0000 | 10.0000 | 9.9999 | -0.0001 | 0.11 | 2,00 |

### 2. Repeatability of indications

| Nominal Test Value ( g ) | Standard Deviation of Reading ( g ) |
|---|---|
| 200.0000 | 0.00005 |

### 3. Effect of eccentric application of a load on the indication

☐ 


☑ 


| Nominal Test Value ( g ) | Display Value ( g ) | | | | | Maximum Difference of Center Value ( g ) |
|---|---|---|---|---|---|---|
| | Position 1 | Position 2 | Position 3 | Position 4 | Position 5 | |
| 100.0000 | 100.0000 | 100.0001 | 100.0001 | 99.9999 | 100.0001 | 0.0001 |

Note. The Scope of Accredited TISI Certificate No. 23-LB0092 Issue 02 Page 116 of 138

This report is valid for the above stated instrument/s only.

### End of Certificate ###

Certificate No. Q24024790
F3-011-05/12-23



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MM-NE07

**CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION**

**MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment**

**CALIBRATION DATA**

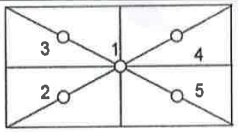
**1. Error of indications**

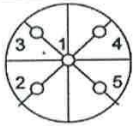
| Nominal Test Value ( g ) | Conventional mass ( g ) | Display Value ( g ) | Error of Balance ( g ) | Uncertainty ± ( mg ) | Coverage factor *k* |
|---|---|---|---|---|---|
| Unload | 0.0000 | 0.0000 | 0.0000 | 0.07 | 2,00 |
| 5.0000 | 5.0000 | 5.0000 | 0.0000 | 0.11 | 2,00 |
| 10.0000 | 10.0000 | 10.0001 | +0.0001 | 0.11 | 2,00 |
| 20.0000 | 20.0000 | 20.0001 | +0.0001 | 0.11 | 2,00 |
| 40.0000 | 40.0000 | 40.0001 | +0.0001 | 0.13 | 2,00 |
| 60.0000 | 60.0000 | 60.0001 | +0.0001 | 0.17 | 2,00 |
| 80.0000 | 80.0000 | 80.0002 | +0.0002 | 0.17 | 2,00 |
| 100.0000 | 100.0000 | 100.0001 | +0.0001 | 0.17 | 2,00 |
| 120.0000 | 120.0000 | 120.0001 | +0.0001 | 0.29 | 2,00 |
| 140.0000 | 140.0000 | 140.0002 | +0.0002 | 0.29 | 2,00 |
| 160.0000 | 160.0000 | 160.0002 | +0.0002 | 0.29 | 2,00 |
| 180.0000 | 180.0000 | 180.0001 | +0.0001 | 0.29 | 2,00 |
| 200.0000 | 200.0001 | 200.0001 | 0.0000 | 0.29 | 2,00 |

**2. Repeatability of indications**

| Nominal Test Value ( g ) | Standard Deviation of Reading ( g ) |
|---|---|
| 200.0000 | 0.00005 |

**3. Effect of eccentric application of a load on the indication**

☐ 


☑ 


| Nominal Test Value ( g ) | Display Value ( g ) | | | | | Maximum Difference of Center Value ( g ) |
|---|---|---|---|---|---|---|
| | Position 1 | Position 2 | Position 3 | Position 4 | Position 5 | |
| 100.0000 | 100.0001 | 100.0001 | 100.0002 | 100.0002 | 100.0002 | 0.0001 |

Note. The Scope of Accredited TISI Certificate No. 23-LB0092 Issue 02 Page 116 of 138

**This report is valid for the above stated instrument/s only.**

**### End of Certificate ###**



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# REPORT OF CALIBRATION

## FOR

| | | |
|---|---|---|
| **NOMENCLATURE** | : | **BALANCE** |
| **MANUFACTURER** | : | **SHIMADZU** |
| **MODEL / TYPE** | : | **AP225WD** |
| **SERIAL NO.** | : | **D316300692[LA-001]** |
| **LOCATION SITE** | : | **LABORATORY-BALANCE ROOM** |
| **DATE OF CALIBRATION** | : | **04 April 2024** |

**ENVIRONMENT CONDITIONS :**

**Temperature : 23 °C to 24 °C** **Relative Humidity : 49 % to 50 %**

**PROCEDURE USED :**

This instrument was calibrated under procedure No. **WI-305-46** based on **EURAMET/cg-18/Version 4.0 (11/2015).**

The calibration was performed by Comparison with Weight Set which maintained by the Calibration Laboratory Co., Ltd.

**REFERENCE STANDARD USED :**

1. Weight Set, Phoenix Class E2 S/N. WBS-SET-E2-01.
2. Weight, Sartorius Class E2 S/N. 44329129, 43529037, 44329167, 43529293.

**TRACEABILITY :**

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand). Certificate No. MM-0123-22, Due Date 22 August 2024.
2. The measurements are traceable to International System of Units (SI) , through Sartorius Lab Instruments GmbH & Co. KG. Certificate No. M141607, M141608, M141609, M141611. Due Date 15 September 2025.

**UNCERTAINTY :**

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95%. It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

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# REPORT OF CALIBRATION

## FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | PRIMARY FLOW CALIBRATOR |
| MANUFACTURER | : | MESALABS |
| MODEL / TYPE | : | DEFENDER 510-M |
| SERIAL NO. | : | 172525 |
| DATE OF CALIBRATION | : | 11 October 2024 |

**ENVIRONMENT CONDITIONS :**

Temperature : (23 ± 2 ) °C Relative Humidity : (55 ± 10) % RH

**PROCEDURE USED :**

This instrument was calibrated under procedure No. **CLC-CPPF-03.** The calibration was performed by comparison with Gas Flow Meter which refers to the standard condition of 101.325 kPa and 0 °C.

**REFERENCE STANDARD USED :**

Gas Flow Meter, Alicat Scientific Model M-5SLPM-D-DB15 S/N. 261330.

**TRACEABILITY :**

The measurements are traceable to International System of Units (SI), through Chell Intrument Ltd.

Certificate No. N037064, Due Date 26 February 2025.

**UNCERTAINTY :**

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"



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# CERTIFICATE OF CALIBRATION

## FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | PRIMARY FLOW CALIBRATOR |
| MANUFACTURER | : | MESALABS |
| MODEL / TYPE | : | DEFENDER 510-M |
| SERIAL NO. | : | 172525 |
| CLID. NO. | : | 212401789 |
| JOB CONTROL NO. | : | 241010108770 |
| CALIBRATION SERVICE | : | ☑ IN-LABORATORY ☐ ON-SITE |

CUSTOMER : ENVIRONMENTAL MEASUREMENTS CO., LTD.
5/45 BAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1 (PRAMOTE),
NONG BON SUB-DISTRICT, PRAWET DISTRICT, BANGKOK 10250

DATE OF RECEIVED : 10 October 2024 DATE OF ISSUED : 15 October 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Supphakit Sakuntaharn
Calibration Engineer

Approved By :

Authorized Signatory
15 October 2024

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units ( SI )

MM-NE07

JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd
63/14-15, 67/35-36
Petchkasem 7,7/1, Rd. Watthapra, Bangkokyai,
Bangkok 10600 (Thailand)
Tel: +6608680812
Mobile: +66863999453
E-mail: jnac-calibration@jiranatee.com
Web site: www.jiranatee.com

*Accredited calibration laboratory*
*ISO/IEC 17025:2017*
*NSC-TISI-TIS 17025*
*CALIBRATION 0367*

*Flow measurement laboratory*
*Calibration services department.*

NSC – TISI – TIS 17025
CALIBRATION 0367

# CERTIFICATE OF CALIBRATION

**Certificate No.** : **COF-042-67**



**MEASUREMENT ITEM** : Top Load Orifice
**MANUFACTURER** : Thermo Scientific
**MODEL/TYPE** : G25A
**SERIAL NUMBER** : 3375
**ID NUMBER** : -
**CONDITION AS-RECEIVED** : Used item
**CUSTOMER** : Environmental Measurements Co., Ltd.
5/45 Baan Klang Krung Biz Town, Soi Srinagarindra 46/1 (Pramote), Nong Bon Sub-District Prawet District, Bangkok 10250

**RECEIVED DATE** : 27 Sep 2024
**MEASUREMENT DATE** : 08 Oct 2024
**ISSUE DATE** : 08 Oct 2024

**ENVIRONMENTAL CONDITIONS:**
Ambient condition in the laboratory are as follow:

| | | |
|---|---|---|
| Temperature | : 23.0 ± 3.0 | ˚C |
| Relative Humidity | : 55.0 ± 15.0 | %RH |
| Atmospheric Pressure | : 1010 ± 10 | hPa |

**CALIBRATION CONDITION:**
Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are 23.7 ˚C and 52.7 %RH.

***NOTED:*** *The certificate is valid only to the item calibrated on date and place of calibration.*

**TABULATION OF RESULTS:**
The table on next page give the measured values.

***Calibration procedure:***
*The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/IMC/W2-dp. The WI-CL-004 was used as a calibration guideline.*

***Traceability:***
*This certificate provides a traceability of the measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0063-23.*

***Uncertainty of Measurement:***
*The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor k=2, Which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM 'Evaluation of measurement data - Guide to the expression of uncertainty in measurement'*

**Calibrated by:**
☐ Mr. Sorawit Thachalad
☑ Miss Jittraporn Lertsomphol

**Approved signatory:** .....

Calibration Department Manager

THIS CERTIFICATE REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY

Jiranatee Associates Co., Ltd.

v.1.14/22

CALIBRATION LABORATORY CO., LTD.
2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com

CLC Accredited ISO/IEC 17025

ANAB ANSI National Accreditation Board ACCREDITED CALIBRATION AND DIMENSIONAL MEASUREMENT ACDM-2814

**CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION**

**MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment**

The table in the following gives the calibration results and associated measurement uncertainties of the measuring primary flow calibrator.

**CALIBRATION DATA**

| DUC Setting ( L / min ) | STD Reading ( L / min ) | Correction ( L / min ) | Uncertainty ± ( L/min ) |
|---|---|---|---|
| 0.500 | 0.51828 | +0.01828 | 0.57735 |
| 1.000 | 1.0326 | +0.0326 | 0.5774 |
| 2.000 | 2.0561 | +0.0561 | 0.5774 |
| 5.000 | 5.1183 | +0.1183 | 0.5781 |

Technical Note. Media of Gas : Air

Setting Temperature 23 ° C ; Pressure 101.3 kPa

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 48 of 67

**This report is valid for the above stated instrument/s only.**

**### End of Certificate ###**

**Certificate No. Q24108770**

**F3-011-05/12-23**



@clccalibration

MM-NE07

# THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

## Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 3 October, 2023 Certification No. 344/23



Object : Wind speed and wind direction

Manufacturer : Sensor : NRG

Basic Datalogger : Symphonie

Type : Sensor : 40C Basic Datalogger : LR20

Serial No. : Sensor : 1795-00135858 Basic Datalogger : 309013229

Customer : Environmental Measurements Co.,Ltd.
5/45 Baan Klang Krung Biz Town, Soi Srinagarindra 46/1 (Pramote),
Nong Bon Sub-District, Prawet District, Bangkok 10250.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1011.3 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0800.0000 serial 9023

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

Calibrated by : Signed :

Mr. Watcharapol Subwat Mr. P

Mechanical Engineer

(Authorised Signatory)
for the Chief
Sub-Standard Instrument

กรมอุตุนิยมวิทยา
METEOROLOGICAL DEPARTMENT

JIRANATEE ASSOCIATES CO.,LTD.

Continuation of Certificate of Calibration Number COF-042-67



**MEASUREMENT RESULTS:**

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots Meter). The Humid air was used as a medium in the system. The standard conditions are 25°C (298.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

**Table 1:** The results of $Q$ Standard calibration data

| Plate | Flow rate m³/min | Pressure [Pa] mmHg | Temperature [Ta] °C | Temperature [Tm] °C | Δp_meter mmHg | Δp_Orifice inH₂O | $Y$ | Standard Flow [$Q_S$] m³/min |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.702 | 757.395 | 23.63 | 22.54 | 57.122 | 1.729 | 1.316 | 0.653 |
| 2 | 1.000 | 757.471 | 23.83 | 22.84 | 61.580 | 3.472 | 1.864 | 0.923 |
| 3 | 1.119 | 757.263 | 23.92 | 22.82 | 43.090 | 4.596 | 2.144 | 1.059 |
| 4 | 1.165 | 757.228 | 23.85 | 22.65 | 30.341 | 5.160 | 2.272 | 1.123 |
| 5 | 1.409 | 757.252 | 23.68 | 22.47 | 30.293 | 7.615 | 2.761 | 1.359 |

Slope ($m$): **2.04447**

Intercept ($b$): **-0.02098**

Correlation coefficient ($r$): **0.99989**

**Uncertainty ($k$=2):** **0.015** **m³/min**

**Table 2:** The results of $Q$ actual calibration data

| Plate | Flow rate m³/min | Pressure [Pa] mmHg | Temperature [Ta] °C | Temperature [Tm] °C | Δp_meter mmHg | Δp_Orifice inH₂O | $Y$ | Standard Flow [$Q_a$] m³/min |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.702 | 757.395 | 23.63 | 22.54 | 57.122 | 1.729 | 0.823 | 0.652 |
| 2 | 1.000 | 757.471 | 23.83 | 22.84 | 61.580 | 3.472 | 1.167 | 0.922 |
| 3 | 1.119 | 757.263 | 23.92 | 22.82 | 43.090 | 4.596 | 1.343 | 1.059 |
| 4 | 1.165 | 757.228 | 23.85 | 22.65 | 30.341 | 5.160 | 1.423 | 1.123 |
| 5 | 1.409 | 757.252 | 23.68 | 22.47 | 30.293 | 7.615 | 1.728 | 1.358 |

Slope ($m$): **1.28051**

Intercept ($b$): **-0.01311**

Correlation coefficient ($r$): **0.99989**

**Uncertainty ($k$ = 2):** **0.015** **m³/min**

***End of Certificate of Calibration***

JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co., Ltd.

น.14/23

MM-NE07

CALIBRATION LABORATORY CO., LTD.
2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
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CLC Accredited ISO/IEC 17025

ilac-MRA

NSC-TISI-TIS 17025 CALIBRATION 0059 CLC

# CERTIFICATE OF CALIBRATION

## FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | VIBRATION METER |
| MANUFACTURER | : | VIBROCK |
| MODEL / TYPE | : | V9000 |
| SERIAL NO. | : | 2351 |
| CLID. NO. | : | 252101273 |
| JOB CONTROL NO. | : | 240912097767 |
| CALIBRATION SERVICE | : | ☑ IN-LABORATORY ☐ ON-SITE |

CUSTOMER : ENVIRONMENTAL MEASUREMENTS CO., LTD.
5/45 BAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1 (PRAMOTE),
NONG BON SUB-DISTRICT, PRAWET DISTRICT, BANGKOK 10250

DATE OF RECEIVED : 12 September 2024 DATE OF ISSUED : 16 September 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Suwit Phuanbusabong
Calibration Engineer

Approved By :
Authorized Signatory
16 September 2024

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units ( SI )

Certificate No. Q24097767
F3-011-05/12-23



@clccalibration

น.14/24

THAI METEOROLOGICAL DEPARTMENT
4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

# The Result of Calibration

Certification No. 344/23

3 October, 2023



| Standard | HOOK GAGE NO. 1425 | | | TESTED ANEMOMETER | |
|---|---|---|---|---|---|
| Ultrasonic Anemometer | Pressure | Vacumm | Velocity | Velocity | Correction |
| m/sec | inches H2O | inches H2O | m/sec | m/sec | m/sec |
| 1.00 | - | - | - | 0.95 | 0.05 |
| 3.02 | - | - | - | 2.85 | 0.17 |
| 5.00 | - | - | - | 4.95 | 0.05 |
| 7.00 | - | - | - | 6.85 | 0.15 |
| 9.02 | - | - | - | 8.95 | 0.07 |
| 11.01 | - | - | - | 10.85 | 0.16 |
| 13.01 | - | - | - | 12.99 | 0.02 |
| 15.01 | - | - | - | 15.10 | -0.09 |
| 17.02 | - | - | - | 16.98 | 0.04 |
| 20.02 | - | - | - | 20.13 | -0.11 |

| Wind Aloft Plotting Board. US.DEPARTMENT OF COMMERCE WEATHER BUREAU | |
|---|---|
| WIND DIRETION | TESTED WIND DIRECTION |
| 0 | 0 |
| 90 | 90 |
| 180 | 180 |
| 270 | 270 |

Calibrated by :

Mr.

Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

CALIBRATION LABORATORY CO., LTD.
2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
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NSC-TISI-TIS 17025 CALIBRATION 0059 CLC

CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment

**CALIBRATION DATA**

VELOCITY RESULT

| Test point | | Mode | STD Reading | DUC Reading | Correction | Uncertainty |
|---|---|---|---|---|---|---|
| ( mm/s ) | ( frequency ) | | ( mm/s ) | ( mm/s ) | ( mm/s ) | ±( % of rdg. ) |
| 10 | 160 Hz | peak | 10.00 | 9.82 | +0.18 | 1.1 |
| 20 | 160 Hz | | 20.00 | 19.44 | +0.56 | 1.0 |
| 40 | 160 Hz | | 40.00 | 39.23 | +0.77 | 1.0 |
| 60 | 160 Hz | | 60.00 | 58.94 | +1.06 | 1.0 |
| 80 | 160 Hz | | 80.00 | 78.55 | +1.45 | 1.0 |
| 100 | 160 Hz | | 100.00 | 97.49 | +2.51 | 1.0 |

Note. The Scope of Accredited TISI Certificate No. 23-LB0092 Issue 02 Page 60 of 138

**This report is valid for the above stated instrument/s only.**

**### End of Certificate ###**





CALIBRATION LABORATORY CO., LTD.
2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com
CLC Accredited ISO/IEC 17025
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NSC-TISI-TIS 17025 CALIBRATION 0059 CLC

# REPORT OF CALIBRATION

# FOR

| | | |
|---|---|---|
| NOMENCLATURE | : | VIBRATION METER |
| MANUFACTURER | : | VIBROCK |
| MODEL / TYPE | : | V9000 |
| SERIAL NO. | : | 2351 |
| DATE OF CALIBRATION | : | 13 September 2024 |

**ENVIRONMENT CONDITIONS :**

**Temperature :** (23 ± 2) °C **Relative Humidity :** (55 ± 15) %RH

**PROCEDURE USED :**

This instrument was calibrated under procedure No. **WI-305-127** based on **ISO 16063-21** as calibration guideline.

The calibration was performed by using Digital Multimeter, Programmable Timer/Counter, Accelerometer and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

**REFERENCE STANDARD USED :**

1. Digital Multimeter, Hewlett Packard Model 34401A S/N. 3146A75935.
2. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.
3. Accelerometer with Measuring Amplifier, Bruel & Kjaer Model 8305, 2626 S/N. 705491, 1741406.

**TRACEABILITY :**

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0130-23, Due Date 29 November 2024.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0050/24 , Due Date 13 May 2025 .
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0053-23, Due Date 12 October 2024.

**UNCERTAINTY :**

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k$ = 2,00 which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

ALT Acoustic Laboratory Thailand

*Certificate No.: C2409-0836*

| | | | |
|---|---|---|---|
| Environmental conditions: | Pressure: | Temperature: | Relative humidity: |
| Reference conditions: | 101.325 kPa | 23.0 °C | 50 %RH |
| Measurement conditions: | 100.90 ± 0.01 kPa | 23.2 ± 1.1 °C | 58.2 ± 2.3 %RH |

**1. Sound pressure level**

| Specified sound pressure level (dB) | Measured sound pressure level (dB) | Deviated value (dB) | Tolerance limit IEC60942:2017 Class 1 (dB) |
|---|---|---|---|
| Reference microphone 40AU S/N 309231 | | | |
| 94.00 | 93.93 | 0.07 | ±0.25 |
| 114.00 | 114.01 | 0.01 | ±0.25 |

**2. Frequency**

| Specified Frequency (Hz) | Measured Frequency (Hz) | Deviated value (%) | Tolerance limit IEC60942:2017 Class 1 (%) |
|---|---|---|---|
| Reference microphone 40AU S/N 309231 | | | |
| 1000.00 | 1000.30 | 0.03 | ±0.7 |
| 1000.00 | 1000.18 | 0.02 | ±0.7 |

**3. Total distortion + Noise**

| Specified sound pressure level (dB) | Measured Distortion (%) | Tolerance limit IEC60942:2017 Class 1 (%) |
|---|---|---|
| Reference Sound Analyser Nor140 S/N 1405248 | | |
| 94.00 | 0.50 | ±2.5 |
| 114.00 | 1.10 | ±2.5 |

**Uncertainty of measurement**

| Parameters | Uncertainty |
|---|---|
| Sound pressure level | 0.10 dB |
| Frequency | 0.020 % |
| Total distortion + Noise | 0.10 % |

**Date of calibration:** 2024-09-30
**Date of issue :** 2024-10-02





ALT Acoustic Laboratory Thailand

**Acoustic Laboratory (Thailand) Co., Ltd.**
6/57 Soi Phoem Sin 42, Sai Mai, Sai Mai, Bangkok 10220
Tel: (+66) 02-1296780 Email: info@altbkk.com

ilac-MRA NSC-TISI-TIS 17025 CALIBRATION 0468

# *Certificate of Calibration*

*Certificate No.: C2409-0836*

**Customer:** ENVIRONMENTAL MEASUREMENTS CO., LTD.
5/45 Baan Klang Krung Biz Town, Soi Srinagarindra
46/1 (Pramote), NONG BON Sub-district,
PRAWET District, BANGKOK 10250

**Date of calibration:** 2024-09-30
**Date of issue:** 2024-10-02
**Instrument Calibrated:** Sound Calibrator
**Manufacturer:** BSWA
**Type:** CA111
**Serial no:** 550482

**Calibration and verification performed:**
The performed tests refer to IEC 60942 (2017): Electro-acoustics - Sound Calibrators. The calibrator has been tested as described in Annex B of the same standard.

**Preconditioning:**
The equipment was preconditioned for more than 16 hours at the specified calibration temperature and humidity

**Instruments and Program:**
A complete list of instruments, hardware, and software, that has been used for this calibration is separately available from the calibration laboratory.

**Equipment standards used:**
-Sound Measuring Equipment Calibration Unit 483B S/N31083
-Digital Multimeter Keysight S/N HP34401A
-Ultra-low Distortion Function Generator Stanford SRS DS360 S/N123625
-Acoustic Sound Calibrator Class 0 Nor1253 S/N32941
-Reference Microphone Condenser G.R.A.S. 40AU-1 S/N309231
-Sound Analyser Nor140 S/N1405248
-Combined Pressure, Humidity and Temperature Transmitter PTU300 S/NM2520568

**Traceability**
The measured values are traceable to following the ISO/IEC 17025 laboratories:
Sound Pressure Level: NCL, Norway
Reference microphone: NCL, Norway
Voltage: TPA, Thailand
Frequency: TPA, Thailand
Reference Pressure, Humidity and Temperature: TPA, Thailand
Distortion Meter: EEI,Thailand

This certificate of calibration is issued by Acoustic Laboratory Thailand (ALT). It also states that the laboratory has a satisfactory quality assurance system and traceability to accredited or national calibration laboratories. This certificate may not be reproduced other than in full.

MM-NE07

Request No. : 22-68 / 0059

MTC No. : PSL-P 0019 / 68

# CERTIFICATE OF CALIBRATION

Nomenclature : Digital Lux Meter

Serial No. : A.067438

Maker : EXTECH Instruments

Model : 407026

Customer : **ENVIRONMENTAL MEASUREMENTS CO., LTD.**

Address : 5/45 Baan Klang Krung Biz Town, Soi Srinagarindra 46/1 (Pramote), Nong Bon Sub-District Prawet District, Bangkok 10250

Date of receipt : 28 October 2024

Date of calibration : 4 November 2024

Place of calibration : Photometry and Temperature Standards Laboratory, MTC. (Bangpoo)

Basis of calibration : calibration at 0 ~ 5000 lux.

Condition of calibration : - Ambient temperature : (25 ± 2) °C

- Relative humidity : (60 ± 20) %

Reference Standard : Working Standard Luminous Intensity Lamp, Serial No.: FEL003 and 3501, can be traceable to international system of units (SI), through calibration certificate MTC No. PSL-P 0151/67 and PSL-P 0152/67, date of calibration 10 May 2024.

Traceability : This certificate is traceable to SI units through the National Institute of Metrology (Thailand) calibration certificate No. TP-1010-23, TP-1011-23 and TP-1012-23

Support Equipment : 1. Photometric bench , 3.0 meter long

2. DC power supply, Serial No.: BC - 341006035007/2

3. Digital Multimeter , Model : R 6551 , S/N : 92041186 and 92041192

Calibration Procedure : The measurement was done in accordance with WI.CP.10.

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k$ = 2 , providing a level of confidence of approximately 95 %.



R.P.

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FM.BL.MTC.002 Rev.5

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Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827

2024/11/27

ALT
Acoustic Laboratory Thailand

*Certificate No.: C2409-0836*

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%

Calibrated By: ..... (Mr.

Approved By: ..... (M

**Date of calibration:** 2024-09-30
**Date of issue :** 2024-10-02

-------- **End of Calibration Certificate** -------

ALT
Acoustic Laboratory Thailand

Registration number 0105564086235
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Tel (+66) 02-1296780 Email: info@altbkk.com
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MM-NE07

**Acoustic Laboratory (Thailand) Co., Ltd.**
6/57 Soi Phoem Sin 42, Sai Mai, Sai Mai, Bangkok 10220
Tel: (+66) 02-1296780 Email: info@altbkk.com

# *Certificate of Calibration*

*Certificate No.: S2409-0833*

**Customer:** ENVIRONMENTAL MEASUREMENTS CO., LTD.
5/45 Baan Klang Krung Biz Town, Soi Srinagarindra
46/1 (Pramote), NONG BON Sub-district,
PRAWET District, BANGKOK 10250

**Date of calibration:** 2024-10-01
**Date of issue:** 2024-10-02
**Instrument Calibrated:** Noise Dosimeter
**Manufacturer:** SOUNDTEK
**Model:** ST-130
**Serial no:** 170800130

**Calibration and verification performed:**
Acoustical levels are stated relative to 20μPa. Other dB levels are relative values.
The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which with the reported effective degree of freedom corresponds to coverage probability of approximately 95%.
The sound level meter instrument submitted for periodic testing following the periodic tests of IEC 61672-3 : 2013.

**Preconditioning:**
The equipment was preconditioned for more than 16 hours at the specified calibration temperature and humidity.

**Instruments and Program:**
A complete list of instruments, hardware, and software, that has been used for this calibration is separately available from the calibration laboratory.

**Equipment standards used:**
- Sound measuring equipment calibration unit Nor140 S/N1405248
- Acoustic sound calibrator class 1 Nor1256 S/N125626542
- Combined Pressure, Humidity and Temperature Transmitter PTU300 S/NM2520568

**Traceability**
The measured values are traceable to following the ISO/IEC 17025 laboratories:
Sound Pressure Level: EEI, Thailand
Reference Pressure, Humidity and Temperature: TPA, Thailand

This certificate of calibration is issued by Acoustic Laboratory Thailand (ALT). It also states that the laboratory has a satisfactory quality assurance system and traceability to accredited or national calibration laboratories. This certificate may not be reproduced other than in full.



น.14/28

Request No. : 22-68 / 0059
MTC No. : PSL-P 0019 / 68
Serial No. : A.067438

**Results :**

| UUC Range (lux) | Standard (lux) | *UUC Reading Before Adj.(lux) | UUC Reading After Adj.(lux) | Uncertainty of Measurement ± (lux) |
|---|---|---|---|---|
| 2000 | 100 | 103 | 104 | 2.0 |
| | 500 | 502 | 505 | 10 |
| | 1000 | 992 | 1000 | 20 |
| | 1500 | 1486 | 1497 | 30 |
| | 2000 | 1972 | 1994 | 40 |
| 20000 (×10) | 2000 | 197 | 200 | 40 |
| | 3000 | 296 | 300 | 60 |
| | 4000 | 391 | 397 | 80 |
| | 5000 | 490 | 497 | 100 |

Note : *UUC = Unit Under Calibration.

**...end of certificate...**

**Calibrated by :**

(Ms. [redacted])

**Approved by :**

(M[redacted]

**Director**

**Photometry and Temperature Standards Laboratory**

Ref. : 2012267102803899001
Issued date : 4 November 2024



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FM.BL.MTC.002 Rev.5

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Tel. (66) 0 2323 1672-80 ext. 115, 116
(66) 08 3219 9440
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office
196 Phahonyothin Road, Ladyao, Chatuchak, Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827

ALT
Acoustic Laboratory Thailand

*Certificate No.: S2409-0833*

**C-Weighting acoustic frequency response meter free-field acoustic response at a level of 80.0 dB**

| Frequency Weighting (Hz) | Deviation from various frequency weighting response curve | | |
|---|---|---|---|
| | C-Weighting (dB) | Uncertainty (dB) | Acceptance limit (dB) |
| 125 | 0.4 | 0.20 | ±1.5 |
| 1000 | 0.0 | 0.20 | ±1.0 |
| 8000 | 1.3 | 0.20 | ±5.0 |

**Note: Acoustical signal test of frequency weightings are not accredited**

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%

Calibrated By: ... Approved By: .....
(Mr ) (Mr )

**Date of calibration :** 2024-10-01
**Date of issue :** 2024-10-02

-------- End of Calibration Certificate -------





ALT
Acoustic Laboratory Thailand

*Certificate No.: S2409-0833*

| | Pressure: | Temperature: | Relative humidity: |
|---|---|---|---|
| Environmental conditions: | | | |
| Reference conditions: | 101.325 kPa | 23.0 °C | 50 %RH |
| Measurement conditions: | 100.78 ± 0.10 kPa | 22.9 ± 0.5 °C | 52.5 ± 5.0 %RH |

**1. Indication at the calibration check frequency**

| Reference Acoustic Signal (dB) | Measured value (dB) | | Deviated value (dB) | Uncertainty (dB) | Acceptant limit (dB) |
|---|---|---|---|---|---|
| | Before adjust | After adjust | | | |
| 93.9 | 94.1 | 93.9 | 0.0 | 0.12 | ±1.0 |

Note: Indication at the checked calibration frequency was adjusted to 93.9 dB by the sound calibrator BSWA model:CA111 S/N:550482

**2. Frequency Weighting at 1 kHz**

| Frequency Weighting | Measured value (dB) | Deviated value (dB) | Uncertainty (dB) | Acceptance limit (dB) |
|---|---|---|---|---|
| A-Weighting | 94.0 | 0.0 | 0.20 | ±0.3 |
| C-Weighting | 94.0 | 0.0 | 0.20 | ±0.3 |

**Note: Frequency weighting at 1 kHz are not accredited**

**3. Time Weighting at 1 kHz**

| Time Weighting | Measured value (dB) | Deviated value (dB) | Uncertainty (dB) | Acceptance limit (dB) |
|---|---|---|---|---|
| Fast | 94.0 | 0.0 | 0.20 | ±0.3 |
| Slow | 94.0 | 0.0 | 0.20 | ±0.3 |

**Note: Time Weighting at 1 kHz are not accredited**

**4. Acoustical signal test of frequency weightings**

**A-Weighting acoustic frequency response meter free-field acoustic response at a level of 80.0 dB**

| Frequency Weighting (Hz) | Deviation from various frequency weighting response curve | | |
|---|---|---|---|
| | A-Weighting (dB) | Uncertainty (dB) | Acceptance limit (dB) |
| 125 | 0.2 | 0.20 | ±1.5 |
| 1000 | 0.0 | 0.20 | ±1.0 |
| 8000 | 0.6 | 0.20 | ±5.0 |

**Note: Acoustical signal test of frequency weightings are not accredited**

**Date of calibration :** 2024-10-01
**Date of Issue :** 2024-10-02

Registration number 0105564086235
6/57 Poemsin Soi 42, Sai Mai, 10220 Bangkok Thailand
Tel (+66) 02-1296780 Email: info@altbkk.com
www.altbkk.com

*Certificate No.: S2409-0834*

| Environmental conditions: | Pressure: | Temperature: | Relative humidity: |
|---|---|---|---|
| Reference conditions: | 101.325 kPa | 23.0 °C | 50 %RH |
| Measurement conditions: | 100.38 ± 0.50 kPa | 23.0 ± 0.5 °C | 53.4 ± 5.0 %RH |

**1. Indication at the calibration check frequency**

| Reference Acoustic Signal (dB) | Measured value (dB) | | Deviated value (dB) | Uncertainty (dB) | Acceptant limit (dB) |
|---|---|---|---|---|---|
| | Before adjust | After adjust | | | |
| 93.9 | 94.1 | 93.9 | 0.0 | 0.12 | ±1.0 |

Note: Indication at the checked calibration frequency was adjusted to 93.9 dB by the sound calibrator BSWA model:CA111 S/N:550482

**2. Frequency Weighting at 1 kHz**

| Frequency Weighting | Measured value (dB) | Deviated value (dB) | Uncertainty (dB) | Acceptance limit (dB) |
|---|---|---|---|---|
| A-Weighting | 94.0 | 0.0 | 0.20 | ±0.3 |
| C-Weighting | 93.9 | 0.0 | 0.20 | ±0.3 |

**Note: Frequency weighting at 1 kHz are not accredited**

**3. Time Weighting at 1 kHz**

| Time Weighting | Measured value (dB) | Deviated value (dB) | Uncertainty (dB) | Acceptance limit (dB) |
|---|---|---|---|---|
| Fast | 94.0 | 0.0 | 0.20 | ±0.3 |
| Slow | 94.0 | 0.0 | 0.20 | ±0.3 |

**Note: Time Weighting at 1 kHz are not accredited**

**4. Acoustical signal test of frequency weightings**

**A-Weighting acoustic frequency response meter free-field acoustic response at a level of 80.0 dB**

| Frequency Weighting (Hz) | Deviation from various frequency weighting response curve | | |
|---|---|---|---|
| | A-Weighting (dB) | Uncertainty (dB) | Acceptance limit (dB) |
| 125 | 0.1 | 0.20 | ±1.5 |
| 1000 | 0.0 | 0.20 | ±1.0 |
| 8000 | 1.9 | 0.20 | ±5.0 |

**Note: Acoustical signal test of frequency weightings are not accredited**

**Date of calibration :** 2024-10-01
**Date of Issue :** 2024-10-02



**Acoustic Laboratory (Thailand) Co., Ltd.**
6/57 Soi Phoem Sin 42, Sai Mai, Sai Mai, Bangkok 10220
Tel: (+66) 02-1296780 Email: info@altbkk.com

# *Certificate of Calibration*

*Certificate No.: S2409-0834*

**Customer:** ENVIRONMENTAL MEASUREMENTS CO., LTD.
5/45 Baan Klang Krung Biz Town, Soi Srinagarindra
46/1 (Pramote), NONG BON Sub-district,
PRAWET District, BANGKOK 10250

**Date of calibration:** 2024-10-01
**Date of issue:** 2024-10-02
**Instrument Calibrated:** Noise Dosimeter
**Manufacturer:** SOUNDTEK
**Model:** ST-130
**Serial no:** 170800167

**Calibration and verification performed:**
Acoustical levels are stated relative to 20μPa. Other dB levels are relative values.
The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which with the reported effective degree of freedom corresponds to coverage probability of approximately 95%.
The sound level meter instrument submitted for periodic testing following the periodic tests of IEC 61672-3 : 2013.

**Preconditioning:**
The equipment was preconditioned for more than 16 hours at the specified calibration temperature and humidity.

**Instruments and Program:**
A complete list of instruments, hardware, and software, that has been used for this calibration is separately available from the calibration laboratory.

**Equipment standards used:**
- Sound measuring equipment calibration unit Nor140 S/N1405248
- Acoustic sound calibrator class 1 Nor1256 S/N125626542
- Combined Pressure, Humidity and Temperature Transmitter PTU300 S/NM2520568

**Traceability**
The measured values are traceable to following the ISO/IEC 17025 laboratories:
Sound Pressure Level: EEI, Thailand
Reference Pressure, Humidity and Temperature: TPA, Thailand

This certificate of calibration is issued by Acoustic Laboratory Thailand (ALT). It also states that the laboratory has a satisfactory quality assurance system and traceability to accredited or national calibration laboratories. This certificate may not be reproduced other than in full.

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**Acoustic Laboratory (Thailand) Co., Ltd.**
6/57 Soi Phoem Sin 42, Sai Mai, Sai Mai, Bangkok 10220
Tel: (+66) 02-1296780 Email: info@altbkk.com

# *Certificate of Calibration*

*Certificate No.: S2409-0835*

**Customer:** ENVIRONMENTAL MEASUREMENTS CO., LTD.
5/45 Baan Klang Krung Biz Town, Soi Srinagarindra
46/1 (Pramote), NONG BON Sub-district,
PRAWET District, BANGKOK 10250

**Date of calibration:** 2024-10-01
**Date of issue:** 2024-10-02
**Instrument Calibrated:** Noise Dosimeter
**Manufacturer:** SOUNDTEK
**Model:** ST-130
**Serial no:** 170800266

**Calibration and verification performed:**
Acoustical levels are stated relative to 20μPa. Other dB levels are relative values.
The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which with the reported effective degree of freedom corresponds to coverage probability of approximately 95%.
The sound level meter instrument submitted for periodic testing following the periodic tests of IEC 61672-3 : 2013.

**Preconditioning:**
The equipment was preconditioned for more than 16 hours at the specified calibration temperature and humidity.

**Instruments and Program:**
A complete list of instruments, hardware, and software, that has been used for this calibration is separately available from the calibration laboratory.

**Equipment standards used:**
- Sound measuring equipment calibration unit Nor140 S/N1405248
- Acoustic sound calibrator class 1 Nor1256 S/N125626542
- Combined Pressure, Humidity and Temperature Transmitter PTU300 S/NM2520568

**Traceability**
The measured values are traceable to following the ISO/IEC 17025 laboratories:
Sound Pressure Level: EEI, Thailand
Reference Pressure, Humidity and Temperature: TPA, Thailand

This certificate of calibration is issued by Acoustic Laboratory Thailand (ALT). It also states that the laboratory has a satisfactory quality assurance system and traceability to accredited or national calibration laboratories. This certificate may not be reproduced other than in full.



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*Certificate No.: S2409-0834*

**C-Weighting acoustic frequency response meter free-field acoustic response at a level of 80.0 dB**

| Frequency Weighting (Hz) | Deviation from various frequency weighting response curve | | |
|---|---|---|---|
| | C-Weighting (dB) | Uncertainty (dB) | Acceptance limit (dB) |
| 125 | 1.0 | 0.20 | ±1.5 |
| 1000 | -0.1 | 0.20 | ±1.0 |
| 8000 | 2.5 | 0.20 | ±5.0 |

**Note: Acoustical signal test of frequency weightings are not accredited**

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%

Calibrated By: ..... Approved By: ..... .....
(Mr (Mr

**Date of calibration :** 2024-10-01
**Date of issue :** 2024-10-02

**------- End of Calibration Certificate -------**

Registration number 0105564086235
6/57 Poemsin Soi 42, Sai Mai, 10220 Bangkok Thailand
Tel (+66) 02-1296780 Email: info@altbkk.com
www.altbkk.com

ALT Acoustic Laboratory Thailand

*Certificate No.: S2409-0835*

| Environmental conditions: | Pressure: | Temperature: | Relative humidity: |
|---|---|---|---|
| Reference conditions: | 101.325 kPa | 23.0 °C | 50 %RH |
| Measurement conditions: | 100.38 ± 0.50 kPa | 23.0 ± 0.5 °C | 53.4 ± 5.0 %RH |

**1. Indication at the calibration check frequency**

| Reference Acoustic Signal (dB) | Measured value (dB) | | Deviated value (dB) | Uncertainty (dB) | Acceptant limit (dB) |
|---|---|---|---|---|---|
| | Before adjust | After adjust | | | |
| 93.9 | 94.1 | 93.9 | 0.0 | 0.12 | ±1.0 |

Note: Indication at the checked calibration frequency was adjusted to 93.9 dB by the sound calibrator BSWA model:CA111 S/N:550482

**2. Frequency Weighting at 1 kHz**

| Frequency Weighting | Measured value (dB) | Deviated value (dB) | Uncertainty (dB) | Acceptance limit (dB) |
|---|---|---|---|---|
| A-Weighting | 94.0 | 0.0 | 0.20 | ±0.3 |
| C-Weighting | 94.1 | 0.0 | 0.20 | ±0.3 |

**Note: Frequency weighting at 1 kHz are not accredited**

**3. Time Weighting at 1 kHz**

| Time Weighting | Measured value (dB) | Deviated value (dB) | Uncertainty (dB) | Acceptance limit (dB) |
|---|---|---|---|---|
| Fast | 94.0 | 0.0 | 0.20 | ±0.3 |
| Slow | 94.0 | 0.0 | 0.20 | ±0.3 |

**Note: Time Weighting at 1 kHz are not accredited**

**4. Acoustical signal test of frequency weightings**

**A-Weighting acoustic frequency response meter free-field acoustic response at a level of 80.0 dB**

| Frequency Weighting (Hz) | Deviation from various frequency weighting response curve | | |
|---|---|---|---|
| | A-Weighting (dB) | Uncertainty (dB) | Acceptance limit (dB) |
| 125 | 0.9 | 0.20 | ±1.5 |
| 1000 | 0.2 | 0.20 | ±1.0 |
| 8000 | 3.3 | 0.20 | ±5.0 |

**Note: Acoustical signal test of frequency weightings are not accredited**

**Date of calibration :** 2024-10-01
**Date of issue :** 2024-10-02



ALT Acoustic Laboratory Thailand

*Certificate No.: S2409-0835*

**C-Weighting acoustic frequency response meter free-field acoustic response at a level of 80.0 dB**

| Frequency Weighting (Hz) | Deviation from various frequency weighting response curve | | |
|---|---|---|---|
| | C-Weighting (dB) | Uncertainty (dB) | Acceptance limit (dB) |
| 125 | 0.5 | 0.20 | ±1.5 |
| 1000 | 0.3 | 0.20 | ±1.0 |
| 8000 | 4.5 | 0.20 | ±5.0 |

**Note: Acoustical signal test of frequency weightings are not accredited**

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%

Calibrated By: ... ..... Approved By: ..... .....
(Mr.A ) (Mr. ))

**Date of calibration :** 2024-10-01
**Date of issue :** 2024-10-02

**-------- End of Calibration Certificate -------**

*Certificate No.: S2409-0831*

| Environmental conditions: | Pressure: | Temperature: | Relative humidity: |
|---|---|---|---|
| Reference conditions: | 101.325 kPa | 23.0 °C | 50 %RH |
| Measurement conditions: | 100.38 ± 0.50 kPa | 23.0 ± 0.5 °C | 53.4 ± 5.0 %RH |

**1. Indication at the calibration check frequency**

| Reference Acoustic Signal (dB) | Measured value (dB) | | Deviated value (dB) | Uncertainty (dB) | Acceptant limit (dB) |
|---|---|---|---|---|---|
| | Before adjust | After adjust | | | |
| 93.9 | 93.8 | 93.9 | 0.0 | 0.12 | ±1.0 |

Note: Indication at the checked calibration frequency was adjusted to 93.9 dB by the sound calibrator BSWA model:CA111 S/N:550482

**2. Frequency Weighting at 1 kHz**

| Frequency Weighting | Measured value (dB) | Deviated value (dB) | Uncertainty (dB) | Acceptance limit (dB) |
|---|---|---|---|---|
| A-Weighting | 94.0 | 0.0 | 0.20 | ±0.3 |
| C-Weighting | 94.0 | 0.0 | 0.20 | ±0.3 |

**Note: Frequency weighting at 1 kHz are not accredited**

**3. Time Weighting at 1 kHz**

| Time Weighting | Measured value (dB) | Deviated value (dB) | Uncertainty (dB) | Acceptance limit (dB) |
|---|---|---|---|---|
| Fast | 94.0 | 0.0 | 0.20 | ±0.3 |
| Slow | 94.0 | 0.0 | 0.20 | ±0.3 |

**Note: Time Weighting at 1 kHz are not accredited**

**4. Acoustical signal test of frequency weightings**

**A-Weighting acoustic frequency response meter free-field acoustic response at a level of 80.0 dB**

| Frequency Weighting (Hz) | Deviation from various frequency weighting response curve | | |
|---|---|---|---|
| | A-Weighting (dB) | Uncertainty (dB) | Acceptance limit (dB) |
| 125 | -0.7 | 0.20 | ±1.5 |
| 1000 | 0.0 | 0.20 | ±1.0 |
| 8000 | -0.4 | 0.20 | ±5.0 |

**Note: Acoustical signal test of frequency weightings are not accredited**

**Date of calibration :** 2024-10-02
**Date of issue :** 2024-10-03



**Acoustic Laboratory (Thailand) Co., Ltd.**
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Tel: (+66) 02-1296780 Email: info@altbkk.com

# *Certificate of Calibration*

*Certificate No.: S2409-0831*

**Customer:** ENVIRONMENTAL MEASUREMENTS CO., LTD.
5/45 Baan Klang Krung Biz Town, Soi Srinagarindra
46/1 (Pramote), NONG BON Sub-district,
PRAWET District, BANGKOK 10250

**Date of calibration:** 2024-10-02
**Date of issue:** 2024-10-03
**Instrument Calibrated:** Noise Dosimeter
**Manufacturer:** SOUNDTEK
**Model:** ST-130
**Serial no:** 170800271

**Calibration and verification performed:**
Acoustical levels are stated relative to 20μPa. Other dB levels are relative values.
The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which with the reported effective degree of freedom corresponds to coverage probability of approximately 95%.
The sound level meter instrument submitted for periodic testing following the periodic tests of IEC 61672-3 : 2013.

**Preconditioning:**
The equipment was preconditioned for more than 16 hours at the specified calibration temperature and humidity.

**Instruments and Program:**
A complete list of instruments, hardware, and software, that has been used for this calibration is separately available from the calibration laboratory.

**Equipment standards used:**
- Sound measuring equipment calibration unit Nor140 S/N1405248
- Acoustic sound calibrator class 1 Nor1256 S/N125626542
- Combined Pressure, Humidity and Temperature Transmitter PTU300 S/NM2520568

**Traceability**
The measured values are traceable to following the ISO/IEC 17025 laboratories:
Sound Pressure Level: EEI, Thailand
Reference Pressure, Humidity and Temperature: TPA, Thailand

This certificate of calibration is issued by Acoustic Laboratory Thailand (ALT). It also states that the laboratory has a satisfactory quality assurance system and traceability to accredited or national calibration laboratories. This certificate may not be reproduced other than in full.

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6/57 Soi Phoem Sin 42, Sai Mai, Sai Mai, Bangkok 10220
Tel: (+66) 02-1296780 Email: info@altbkk.com

# *Certificate of Calibration*

*Certificate No.: S2409-0832*

**Customer:** ENVIRONMENTAL MEASUREMENTS CO., LTD.
5/45 Baan Klang Krung Biz Town, Soi Srinagarindra
46/1 (Pramote), NONG BON Sub-district,
PRAWET District, BANGKOK 10250

**Date of calibration:** 2024-10-01
**Date of issue:** 2024-10-02
**Instrument Calibrated:** Noise Dosimeter
**Manufacturer:** SOUNDTEK
**Model:** ST-130
**Serial no:** 170800288

**Calibration and verification performed:**
Acoustical levels are stated relative to 20μPa. Other dB levels are relative values.
The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which with the reported effective degree of freedom corresponds to coverage probability of approximately 95%.
The sound level meter instrument submitted for periodic testing following the periodic tests of IEC 61672-3 : 2013.

**Preconditioning:**
The equipment was preconditioned for more than 16 hours at the specified calibration temperature and humidity.

**Instruments and Program:**
A complete list of instruments, hardware, and software, that has been used for this calibration is separately available from the calibration laboratory.

**Equipment standards used:**
- Sound measuring equipment calibration unit Nor140 S/N1405248
- Acoustic sound calibrator class 1 Nor1256 S/N125626542
- Combined Pressure, Humidity and Temperature Transmitter PTU300 S/NM2520568

**Traceability**
The measured values are traceable to following the ISO/IEC 17025 laboratories:
Sound Pressure Level: EEI, Thailand
Reference Pressure, Humidity and Temperature: TPA, Thailand

This certificate of calibration is issued by Acoustic Laboratory Thailand (ALT). It also states that the laboratory has a satisfactory quality assurance system and traceability to accredited or national calibration laboratories. This certificate may not be reproduced other than in full.





*Certificate No.: S2409-0831*

**C-Weighting acoustic frequency response meter free-field acoustic response at a level of 80.0 dB**

| Frequency Weighting (Hz) | Deviation from various frequency weighting response curve | | |
|---|---|---|---|
| | C-Weighting (dB) | Uncertainty (dB) | Acceptance limit (dB) |
| 125 | -0.1 | 0.20 | ±1.5 |
| 1000 | 0.0 | 0.20 | ±1.0 |
| 8000 | -0.3 | 0.20 | ±5.0 |

**Note: Acoustical signal test of frequency weightings are not accredited**

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%

Calibrated By: ..
(Mr.

Approved By: .....
(Mr

**Date of calibration :** 2024-10-02
**Date of issue :** 2024-10-03

**------- End of Calibration Certificate -------**

Registration number 0105564086235
6/57 Poemsin Soi 42, Sai Mai, 10220 Bangkok Thailand
Tel (+66) 02-1296780 Email: info@altbkk.com
www.altbkk.com

ALT Acoustic Laboratory Thailand

*Certificate No.: S2409-0832*

**C-Weighting acoustic frequency response meter free-field acoustic response at a level of 80.0 dB**

| Frequency Weighting (Hz) | Deviation from various frequency weighting response curve | | |
|---|---|---|---|
| | C-Weighting (dB) | Uncertainty (dB) | Acceptance limit (dB) |
| 125 | 0.1 | 0.20 | ±1.5 |
| 1000 | 0.1 | 0.20 | ±1.0 |
| 8000 | 3.0 | 0.20 | ±5.0 |

**Note: Acoustical signal test of frequency weightings are not accredited**

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%

Calibrated By: ... Approved By: .....
(Mr (M

**Date of calibration :** 2024-10-01
**Date of issue :** 2024-10-02

-------- End of Calibration Certificate -------





ALT Acoustic Laboratory Thailand

*Certificate No.: S2409-0832*

| Environmental conditions: | Pressure: | Temperature: | Relative humidity: |
|---|---|---|---|
| Reference conditions: | 101.325 kPa | 23.0 °C | 50 %RH |
| Measurement conditions: | 100.38 ± 0.50 kPa | 23.0 ± 0.5 °C | 53.4 ± 5.0 %RH |

**1. Indication at the calibration check frequency**

| Reference Acoustic Signal (dB) | Measured value (dB) | | Deviated value (dB) | Uncertainty (dB) | Acceptant limit (dB) |
|---|---|---|---|---|---|
| | Before adjust | After adjust | | | |
| 93.9 | 93.6 | 93.9 | 0.0 | 0.12 | ±1.0 |

Note: Indication at the checked calibration frequency was adjusted to 93.9 dB by the sound calibrator BSWA model:CA111 S/N:550482

**2. Frequency Weighting at 1 kHz**

| Frequency Weighting | Measured value (dB) | Deviated value (dB) | Uncertainty (dB) | Acceptance limit (dB) |
|---|---|---|---|---|
| A-Weighting | 94.0 | 0.0 | 0.20 | ±0.3 |
| C-Weighting | 94.1 | 0.0 | 0.20 | ±0.3 |

**Note: Frequency weighting at 1 kHz are not accredited**

**3. Time Weighting at 1 kHz**

| Time Weighting | Measured value (dB) | Deviated value (dB) | Uncertainty (dB) | Acceptance limit (dB) |
|---|---|---|---|---|
| Fast | 94.0 | 0.0 | 0.20 | ±0.3 |
| Slow | 94.1 | 0.1 | 0.20 | ±0.3 |

**Note: Time Weighting at 1 kHz are not accredited**

**4. Acoustical signal test of frequency weightings**

**A-Weighting acoustic frequency response meter free-field acoustic response at a level of 80.0 dB**

| Frequency Weighting (Hz) | Deviation from various frequency weighting response curve | | |
|---|---|---|---|
| | A-Weighting (dB) | Uncertainty (dB) | Acceptance limit (dB) |
| 125 | 0.0 | 0.20 | ±1.5 |
| 1000 | -0.2 | 0.20 | ±1.0 |
| 8000 | 2.2 | 0.20 | ±5.0 |

**Note: Acoustical signal test of frequency weightings are not accredited**

**Date of calibration :** 2024-10-01
**Date of Issue :** 2024-10-02

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๔. ให้ยกเลิกขอบข่ายรายการสารมลพิษในน้ำเสีย น้ำใต้ดิน และสิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว ตามรายการเอกสารแนบท้ายหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ที่ อก ๐๓๑๐(๑)/ ๑๘๗๙ ลงวันที่ ๙ กุมภาพันธ์ ๒๕๖๕

๕. ให้วิเคราะห์สารมลพิษตามขอบข่ายที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำ/น้ำเสีย น้ำใต้ดิน และสิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว ตามเอกสารแนบท้ายหนังสือเปลี่ยนแปลงบุคลากร สารมลพิษที่วิเคราะห์และเอกสารอ้างอิงวิธีวิเคราะห์สารมลพิษ ดังสิ่งที่ส่งมาด้วย

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

อธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและเตือนภัยมลพิษโรงงาน
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียน
โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕
โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๙
ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th

สำเนาถูกต้อง

"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"

ที่ อก ๐๓๑๐(๑)/ ๔๓๓๕

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๐๓ พฤษภาคม ๒๕๖๗

เรื่อง เปลี่ยนแปลงบุคลากร สารมลพิษที่วิเคราะห์และเอกสารอ้างอิงวิธีวิเคราะห์สารมลพิษ

เรียน กรรมการผู้จัดการ บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด

อ้างถึง ๑. คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๔ มีนาคม ๒๕๖๗
๒. คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๑๒ มีนาคม ๒๕๖๗

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือเปลี่ยนแปลงบุคลากร สารมลพิษที่วิเคราะห์และเอกสารอ้างอิงวิธีวิเคราะห์สารมลพิษ บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด จำนวน ๑๙ แผ่น

ตามคำขอที่อ้างถึง ๑ และ ๒ บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๑๔๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากร สารมลพิษที่วิเคราะห์และเอกสารอ้างอิงวิธีวิเคราะห์สารมลพิษ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นให้เปลี่ยนแปลงดังนี้

๑. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย
๑)
๒)

๒. ให้เพิ่มผู้ควบคุมห้องปฏิบัติการวิเคราะห์เอกชน จำนวน ๑ ราย
นา

๓. ให้เพิ่มเจ้าหน้าที่ห้องปฏิบัติการวิเคราะห์เอกชน จำนวน ๒๗ ราย
๑)
๒)
๓)
๔)
๕)
๖)
๗)
๘)
๙)
๑๐
๑๑
๑๒) นางสาว

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 17 | 4,4'-DDD | Liquid-Liquid Extraction, Gas Chromatographic Method[3] |
| 18 | 4,4'-DDE | Liquid-Liquid Extraction, Gas Chromatographic Method[3] |
| 19 | 4,4'-DDT | Liquid-Liquid Extraction, Gas Chromatographic Method[3] |
| 20 | Dieldrin | Liquid-Liquid Extraction, Gas Chromatographic Method[3] |
| 21 | Endosulfan I | Liquid-Liquid Extraction, Gas Chromatographic Method[3] |
| 22 | Endosulfan II | Liquid-Liquid Extraction, Gas Chromatographic Method[3] |
| 23 | Endosulfan sulfate | Liquid-Liquid Extraction, Gas Chromatographic Method[3] |
| 24 | Endrin | Liquid-Liquid Extraction, Gas Chromatographic Method[3] |
| 25 | Endrin aldehyde | Liquid-Liquid Extraction, Gas Chromatographic Method[3] |
| 26 | Formaldehyde | Distillation, Colorimetric Method[2] |
| 27 | Free Chlorine | 1) Iodometric Method[3]<br>2) DPD Ferrous Titrimetric Method[3] |
| 28 | Heptachlor | Liquid-Liquid Extraction, Gas Chromatographic Method[3] |
| 29 | Heptachlor Epoxide | Liquid-Liquid Extraction, Gas Chromatographic Method[3] |
| 30 | Hexavalent Chromium | 1) Colorimetric Method[3]<br>2) Extraction, Direct Air-Acetylene Flame Method[3] |
| 31 | Lead | 1) Digestion, Direct Air-Acetylene Flame Method[3]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[3]<br>3) Digestion, Inductively Coupled Plasma Method[3] |
| 32 | Manganese | 1) Digestion, Direct Air-Acetylene Flame Method[3]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[3]<br>3) Digestion, Inductively Coupled Plasma Method[3] |
| 33 | Mercury | Digestion, Cold-Vapor Atomic Absorption Spectrometric Method[3] |
| 34 | Methoxychlor | Liquid-Liquid Extraction, Gas Chromatographic Method[3] |
| 35 | Nickel | 1) Digestion, Direct Air-Acetylene Flame Method[3]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[3]<br>3) Digestion, Inductively Coupled Plasma Method[3] |
| 36 | Oil & Grease | 1) Liquid-Liquid Partition Gravimetric Method[3]<br>2) Soxhlet Extraction Method[3] |
| 37 | pH | Electrometric Method[3] |



UAE UNITED ANALYST AND ENGINEERING สำเนาถูกต้อง

เอกสารแนบท้ายหนังสือเปลี่ยนแปลงบุคลากร สารมลพิษที่วิเคราะห์และเอกสารอ้างอิงวิธีวิเคราะห์สารมลพิษ
บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด เลขทะเบียน ว-๑๔๕
ที่ อก ๐๓๑๐(๑)/ ๔๓๓๕ ลงวันที่ ๐๓ พฤษภาคม ๒๕๖๗

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๒๐๗ รายการ

น้ำ/น้ำเสีย จำนวน 46 รายการ

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 1 | Aldrin | Liquid-Liquid Extraction, Gas Chromatographic Method[3] |
| 2 | Arsenic | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[3]<br>2) Digestion, Inductively Coupled Plasma Method[3] |
| 3 | Barium | Digestion, Inductively Coupled Plasma Method[3] |
| 4 | α-BHC | Liquid-Liquid Extraction, Gas Chromatographic Method[3] |
| 5 | β-BHC | Liquid-Liquid Extraction, Gas Chromatographic Method[3] |
| 6 | δ-BHC | Liquid-Liquid Extraction, Gas Chromatographic Method[3] |
| 7 | γ-BHC | Liquid-Liquid Extraction, Gas Chromatographic Method[3] |
| 8 | Biochemical Oxygen Demand | 1) 5-Day BOD Test, Azide Modification Method[3]<br>2) 5-Day BOD Test, Membrane Electrode Method[3] |
| 9 | Cadmium | 1) Digestion, Direct Air-Acetylene Flame Method[3]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[3]<br>3) Digestion, Inductively Coupled Plasma Method[3] |
| 10 | Chemical Oxygen Demand | 1) Closed Reflux, Titrimetric Method[3]<br>2) Closed Reflux, Colorimetric Method[3]<br>3) Open Reflux, Titrimetric Method[3] |
| 11 | Chlordane | Liquid-Liquid Extraction, Gas Chromatographic Method[3] |
| 12 | Chromium | 1) Digestion, Direct Air-Acetylene Flame Method[3]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[3]<br>3) Digestion, Inductively Coupled Plasma Method[3] |
| 13 | Color | ADMI Weighted-Ordinate Spectrophotometric Method[3] |
| 14 | Copper | 1) Digestion, Direct Air-Acetylene Flame Method[3]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[3]<br>3) Digestion, Inductively Coupled Plasma Method[3] |
| 15 | Cyanide | 1) Distillation, Colorimetric Method[3]<br>2) Flow Injection Analysis Method[3] |
| 16 | o,p'-DDT | Liquid-Liquid Extraction, Gas Chromatographic Method[3] |

UAE UNITED ANALYST AND ENGINEERING สำเนาถูกต้อง

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 5 | Antimony | Digestion, Inductively Coupled Plasma Method[3] |
| 6 | Arsenic | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[3]<br>2) Digestion, Inductively Coupled Plasma Method[3] |
| 7 | Atrazine | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 8 | Barium | 1) Digestion, Electrothermal Atomic Absorption Spectrometric Method[3]<br>2) Digestion, Inductively Coupled Plasma Method[3] |
| 9 | Benz(a)anthracene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 10 | Benzene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[3] |
| 11 | Benzo(b)fluoranthene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 12 | Benzo(k)fluoranthene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 13 | Benzoic acid | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 14 | Benzo(a)pyrene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 15 | Benzo(g,h,i)perylene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 16 | Beryllium | Digestion, Inductively Coupled Plasma Method[3] |
| 17 | Bis(2-chloroethyl)ether | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 18 | Bis(2-ethylhexyl)phthalate | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED
สำเนาถูกต้อง





| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 38 | Phenols | 1) Distillation, Chloroform Extraction Method[3]<br>2) Distillation, Direct Photometric Method[3] |
| 39 | Selenium | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[3]<br>2) Digestion, Inductively Coupled Plasma Method[3] |
| 40 | Sulfide | 1) Iodometric Method[3]<br>2) Methylene Blue Method[3] |
| 41 | Temperature | Laboratory and Field Methods[3] |
| 42 | Total Dissolved Solids | Dried at 180 °C[3] |
| 43 | Total Kjeldahl Nitrogen | Semi-Micro-Kjeldahl Method[3] |
| 44 | Total Suspended Solids | Dried from 103 to 105 °C[3] |
| 45 | Trivalent Chromium | 1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation[3]<br>2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation[3] |
| 46 | Zinc | 1) Digestion, Direct Air-Acetylene Flame Method[3]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[3]<br>3) Digestion, Inductively Coupled Plasma Method[3] |

น้ำใต้ดิน จำนวน 126 รายการ

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 1 | Acenaphthene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method[3] |
| 2 | Acetone | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[3] |
| 3 | Aldrin | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 4 | Anthracene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED
สำเนาถูกต้อง

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 19 | Bromodichloromethane | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 20 | Bromoform | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 21 | Butanol | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 22 | Butyl benzyl phthalate | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 23 | Cadmium | 1) Digestion, Direct Air-Acetylene Flame Method[3]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[3]<br>3) Digestion, Inductively Coupled Plasma Method[3] |
| 24 | Carbazole | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 25 | Carbon disulfide | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 26 | Carbon tetrachloride | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 27 | Chlordane | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 28 | p-Chloroaniline | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 29 | Chlorobenzene | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 30 | Chlorodibromomethane | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 31 | Chloroform | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 32 | 2-Chlorophenol | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 33 | Chromium | 1) Digestion, Direct Air-Acetylene Flame Method[3]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[3]<br>3) Digestion, Inductively Coupled Plasma Method[3] |

UAE UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED สำเนาถูกต้อง

34 Chromium (III)...



| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 34 | Chromium (III) | 1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation[3]<br>2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation[3] |
| 35 | Chromium (VI) | 1) Colorimetric Method[3]<br>2) Extraction, Air-Acetylene Flame Method[3] |
| 36 | Chrysene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 37 | Cyanide | Distillation, Colorimetric Method[3] |
| 38 | 2,4-D | Liquid-Liquid Extraction, Gas Chromatographic Method[3] |
| 39 | DDD | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 40 | DDE | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 41 | DDT | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 42 | Dibenz(a,h)anthracene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 43 | Di-n-butyl phthalate | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 44 | 1,2-Dichlorobenzene | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 45 | 1,3-Dichlorobenzene | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 46 | 1,4-Dichlorobenzene | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 47 | 3,3′-Dichlorobenzidine | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |

UAE UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED สำเนาถูกต้อง

48 1,1-Dichloroethane...

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 65 | Endrin | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 66 | Ethylbenzene | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 67 | Fluoranthene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 68 | Fluorene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 69 | Heptachlor | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 70 | Heptachlor epoxide | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 71 | Hexachlorobenzene | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 72 | Hexachloro-1,3-butadiene | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 73 | n-Hexane | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 74 | α-HCH | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 75 | β-HCH | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |

UAE UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED สำเนาถูกต้อง

76 γ-HCH...



| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 48 | 1,1-Dichloroethane | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 49 | 1,2-Dichloroethane | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 50 | 1,1-Dichloroethylene | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 51 | cis-1,2-Dichloroethylene | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 52 | trans-1,2-Dichloroethylene | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 53 | 2,4-Dichlorophenol | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 54 | 1,2-Dichloropopane | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 55 | 1,3-Dichloropropane | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 56 | 1,3-Dichloropropene | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 57 | Dieldrin | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 58 | Diethyl phthalate | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 59 | 2,4-Dimethylphenol | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 60 | 2,4-Dinitrophenol | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 61 | 2,4-Dinitrotoluene | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 62 | 2,6-Dinitrotoluene | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 63 | Di-n-Octyl phthalate | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 64 | Endosulfan | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |

UAE UNITED ANALYST AND ENGINEERING สำเนาถูกต้อง

65 Endrin...

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 91 | Naphthalene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 92 | Nickel | 1) Digestion, Direct Air-Acetylene Flame Method[3]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[3]<br>3) Digestion, Inductively Coupled Plasma Method[3] |
| 93 | Nitrobenzene | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 94 | N-Nitrosodiphenylamine | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 95 | N-Nitrosodi-n-propylamine | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 96 | Polychlorinated Biphenyls<br>- PCB 1016<br>- PCB 1221<br>- PCB 1232<br>- PCB-1242<br>- PCB-1248<br>- PCB-1254<br>- PCB-1260 | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 97 | Pentachlorophenol | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 98 | pH | Electrometric Method[3] |
| 99 | Phenanthrene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 100 | Phenol | 1) Distillation, Chloroform Extraction Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 101 | Pyrene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED สำเนาถูกต้อง

102 Selenium...



| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 76 | γ-HCH | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 77 | Hexachlorocyclopentadiene | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 78 | Hexachloroethane | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 79 | Indeno(1,2,3-cd)pyrene | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 80 | Isophorone | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 81 | Lead | 1) Digestion, Direct Air-Acetylene Flame Method[3]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[3]<br>3) Digestion, Inductively Coupled Plasma Method[3] |
| 82 | Manganese | 1) Digestion, Direct Air-Acetylene Flame Method[3]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[3]<br>3) Digestion, Inductively Coupled Plasma Method[3] |
| 83 | Mercury | Digestion, Cold-Vapor Atomic Absorption Spectrometric Method[3] |
| 84 | Methanol | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 85 | Methoxychlor | Liquid-Liquid Extraction, Gas Chromatographic Method[3] |
| 86 | Methyl bromide | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 87 | Methylene chloride | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 88 | 2-Methylphenol | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 89 | 2-Methylnaphthalene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 90 | Methyl tert-butyl ether | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |

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91 Naphthalene...

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 119 | Vanadium | Digestion, Inductively Coupled Plasma Method[3] |
| 120 | Vinyl acetate | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 121 | Vinyl chloride | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 122 | m-Xylene | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 123 | o-Xylene | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 124 | p-Xylene | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 125 | Xylene (Total) | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 126 | Zinc | 1) Digestion, Direct Air-Acetylene Flame Method[3]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[3]<br>3) Digestion, Inductively Coupled Plasma Method[3] |

<u>สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 35 รายการ</u>

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 1 | Aldrin | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[1,7,21]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[8,21] |
| 2 | Antimony | Digestion, Inductively Coupled Plasma Method[5,12] |
| 3 | Arsenic | 1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[1,4,14]<br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,4,12]<br>3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[5,14]<br>4) Digestion, Inductively Coupled Plasma Method[5,12] |
| 4 | Barium | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,4,12]<br>2) Digestion, Inductively Coupled Plasma Method[5,12] |

DATE สำเนาถูกต้อง
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5 Beryllium...



| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 102 | Selenium | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[3]<br>2) Digestion, Inductively Coupled Plasma Method[3] |
| 103 | Silver | Digestion, Inductively Coupled Plasma Method[3] |
| 104 | Styrene | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 105 | 1,1,2,2-Tetrachloroethane | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 106 | Tetrachloroethylene | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 107 | Toluene | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 108 | Toxaphene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[3]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 109 | TPH ($C_5$ - $C_8$) | 1) Purge and Trap, Gas Chromatographic Method[10,20]<br>2) Purge and Trap, Gas Chromatographic/ Mass spectrometric Method[10,23] |
| 110 | TPH ($C_{>8}$ – $C_{16}$) | Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[7,20] |
| 111 | TPH ($C_{>16}$ – $C_{35}$) | Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[7,20] |
| 112 | 1,2,4-Trichlorobenzene | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 113 | 1,1,1-Trichloroethane | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 114 | 1,1,2-Trichloroethane | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 115 | Trichloroethylene | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |
| 116 | 2,4,5-Trichlorophenol | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 117 | 2,4,6-Trichlorophenol | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[3] |
| 118 | 1,3,5-Trimethylbenzene | Purge and Trap Gas Chromatographic/ Mass Spectrometric Method[3] |

DATE สำเนาถูกต้อง
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119 Vanadium...

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 5 | Beryllium | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,4,12]<br>2) Digestion, Inductively Coupled Plasma Method[5,12] |
| 6 | Cadmium | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[1,4,13]<br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,4,12]<br>3) Digestion, Flame Atomic Absorption Spectrometric Method[5,13]<br>4) Digestion, Inductively Coupled Plasma Method[5,12] |
| 7 | Chlordane | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[1,7,21]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[8,21] |
| 8 | Chromium | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[1,4,13]<br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,4,12]<br>3) Digestion, Flame Atomic Absorption Spectrometric Method[5,13]<br>4) Digestion, Inductively Coupled Plasma Method[5,12] |
| 9 | Chromium (III) | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation[1,4,13,15]<br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation[1,4,12,15]<br>3) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation[5,6,13,15]<br>4) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation[5,6,12,15] |
| 10 | Chromium (VI) | 1) Waste Extraction, Colorimetric Method[1,15]<br>2) Alkaline Digestion, Colorimetric Method[6,15] |
| 11 | Cobalt | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,4,12]<br>2) Digestion, Inductively Coupled Plasma Method[5,12] |

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12 Copper...



| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 12 | Copper | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[1,4,13]<br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,4,12]<br>3) Digestion, Flame Atomic Absorption Spectrometric Method[5,13]<br>4) Digestion, Inductively Coupled Plasma Method[5,12] |
| 13 | 2,4-D | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[1,7,21]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[8,21] |
| 14 | DDD | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[1,7,21]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[8,21] |
| 15 | DDE | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[1,7,21]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[8,21] |
| 16 | DDT | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[1,7,21]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[8,21] |
| 17 | Dieldrin | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[1,7,21]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[8,21] |
| 18 | Endrin | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[1,7,21]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[8,21] |
| 19 | Heptachlor | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[1,7,21]<br>2) Ultrasonic Extraction, Gas Chromatographic Method |

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20 Lead...

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 26 | Polychlorinated Biphenyls<br>- Aroclor 1016<br>- Aroclor 1221<br>- Aroclor 1232<br>- Aroclor 1242<br>- Aroclor 1248<br>- Aroclor 1254<br>- Aroclor 1260<br>- 2-Chlorobiphenyl<br>- 2,3-Dichlorobiphenyl<br>- 2,2',5-Trichlorobiphenyl<br>- 2,4',5-Trichlorobiphenyl<br>- 2,2',3,5'-Tetrachlorobiphenyl<br>- 2,2',5,5'-Tetrachlorobiphenyl<br>- 2,3',4,4'-Tetrachlorobiphenyl<br>- 2,2',3,4,5'-Pentachlorobiphenyl<br>- 2,2',4,5,5'-Pentachlorobiphenyl<br>- 2,3,3',4',6-Pentachlorobiphenyl<br>- 2,2',3,4,4',5'-Hexachlorobiphenyl<br>- 2,2',3,4,5,5'-Hexachlorobiphenyl<br>- 2,2',3,5,5',6-Hexachlorobiphenyl<br>- 2,2',4,4',5,5'-Hexachlorobiphenyl<br>- 2,2',3,3',4,4',5-Heptachlorobiphenyl<br>- 2,2',3,4,4',5,5'-Heptachlorobiphenyl<br>- 2,2',3,4,4',5',6-Heptachlorobiphenyl<br>- 2,2',3,4',5,5',6-Heptachlorobiphenyl<br>- 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[1,7,22]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[8,22] |

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| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 20 | Lead | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[1,4,13]<br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,4,12]<br>3) Digestion, Flame Atomic Absorption Spectrometric Method[5,13]<br>4) Digestion, Inductively Coupled Plasma Method[5,12] |
| 21 | Lindane | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[1,7,21]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[8,21] |
| 22 | Mercury | 1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method[1,16]<br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,4,12]<br>3) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method[17]<br>4) Digestion, Inductively Coupled Plasma Method[5,12]<br>5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method[18] |
| 23 | Methoxychlor | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[1,7,21]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[8,21] |
| 24 | Molybdenum | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,4,12]<br>2) Digestion, Inductively Coupled Plasma Method[5,12] |
| 25 | Nickel | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[1,4,13]<br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,4,12]<br>3) Digestion, Flame Atomic Absorption Spectrometric Method[5,13]<br>4) Digestion, Inductively Coupled Plasma Method[5,12] |

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| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 27 | Pentachlorophenol | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method[1,7,24]<br>2) Ultrasonic Extraction, Gas Chromatographic/ Mass Spectrometric Method[8,24] |
| 28 | pH | Electrometric Method[25,26] |
| 29 | Selenium | 1) Waste Extraction, Digestion, Hydride Generation/ Atomic Absorption Spectrometric Method[1,4,19]<br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,4,12]<br>3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[5,19]<br>4) Digestion, Inductively Coupled Plasma Method[5,12] |
| 30 | Silver | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,4,12]<br>2) Digestion, Inductively Coupled Plasma Method[5,12] |
| 31 | Thallium | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,4,12]<br>2) Digestion, Inductively Coupled Plasma Method[5,12] |
| 32 | Toxaphene | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[1,7,21]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[8,21] |
| 33 | Trichloroethylene | 1) Waste Extraction, Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[1,10,23]<br>2) Waste Extraction, Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method[1,9,23]<br>3) Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method[11,23]<br>4) Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method[9,23] |
| 34 | Vanadium | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,4,12]<br>2) Digestion, Inductively Coupled Plasma Method[5,12] |





| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 35 | Zinc | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[1,4,13]<br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,4,12]<br>3) Digestion, Flame Atomic Absorption Spectrometric Method[5,13]<br>4) Digestion, Inductively Coupled Plasma Method[5,12] |

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MM-NE07

ที่ อก ๐๓๑๐(๑)/ ๘๗๒๔

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒๕ พฤษภาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๑๖ พฤษภาคม ๒๕๖๖

ตามหนังสือที่อ้างถึง บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๑๔๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ ราย

๑)
๒)
๓)
๔)
๕)

๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๔ ราย

๑)
๒)
๓)
๔)

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม
UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

สำเนาถูกต้อง

กองวิจัยและเตือนภัยมลพิษโรงงาน
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ
โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕
โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๙
ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th



ที่ อก ๐๓๑๐(๑)/ ๑๖๙๑๘

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๑๓ ธันวาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๗ พฤศจิกายน ๒๕๖๖

ตามหนังสือที่อ้างถึง บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๑๔๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๖ ราย ได้แก่

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อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม
UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

สำเนาถูกต้อง

กองวิจัยและเตือนภัยมลพิษโรงงาน
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ
โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕
โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๙
ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ที่ อก ๐๓๑๐(๑)/๑๘๗๙ ลงวันที่ ๙ กุมภาพันธ์ ๒๕๖๕ คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเตือนภัยมลพิษโรงงาน
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ
โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕ โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๙
ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th

UAE UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED สำเนาถูกต้อง



ที่ อก ๐๓๑๐(๑)/ ๖๐๒๘

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒๒ มีนาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๓๐ มกราคม ๒๕๖๖

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือเปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์ บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด จำนวน ๒ แผ่น

ตามหนังสือที่อ้างถึง บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๑๔๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย
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๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๑ ราย
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๓. ให้เพิ่มขอบข่ายสารมลพิษที่วิเคราะห์ในดิน ตามสิ่งที่ส่งมาด้วย

UAE UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED สำเนาถูกต้อง

อนึ่ง...

**เอกสารอ้างอิง**

1. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Volatile Organic Compounds in Various Sample Matrices Using Equilibrium Headspace Analysis. SW-846 Method 5021A**, 2014.

2. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Volatile Organic Compounds by Gas Chromatography/ Mass Spectrometry. SW-846 Method 8260D**, 2018.


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ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๑๖ รายการ

**ดิน จำนวน 16 รายการ**

| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 1 | Benzene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method [1,2] |
| 2 | Carbon tetrachloride | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method [1,2] |
| 3 | 1,2-Dichloroethane | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method [1,2] |
| 4 | 1,1-Dichloroethylene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method [1,2] |
| 5 | cis-1,2-Dichloroethylene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method [1,2] |
| 6 | trans-1,2-Dichloroethylene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method [1,2] |
| 7 | Ethylbenzene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method [1,2] |
| 8 | Methylene chloride | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method [1,2] |
| 9 | Styrene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method [1,2] |
| 10 | Tetrachloroethylene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method [1,2] |
| 11 | Toluene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method [1,2] |
| 12 | Trichloroethylene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method [1,2] |
| 13 | m-Xylene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method [1,2] |
| 14 | o-Xylene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method [1,2] |
| 15 | p-Xylene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method [1,2] |
| 16 | Xylene (Total) | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method [1,2] |

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เอกสารอ้างอิง...

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ที่ อก ๐๓๑๐(๑)/๑๘๗๙ ลงวันที่ ๙ กุมภาพันธ์ ๒๕๖๕ คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเตือนภัยมลพิษโรงงาน
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ
โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕
โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๙
ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th

UAE UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED สำเนาถูกต้อง



ที่ อก ๐๓๑๐(๑)/ ๑๕๕๕๓

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒๕ ตุลาคม ๒๕๖๕

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๑๘ ตุลาคม ๒๕๖๕

ตามหนังสือที่อ้างถึง บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๑๔๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๔ ราย
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๒. ให้เพิ่มผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย
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๓. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๒ ราย
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UA UNITED ANALYST AN CONSULTANT COM ง

อนึ่ง หนังสือฉบับนี้...

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ที่ อก ๐๓๑๐(๑)/๑๘๗๙ ลงวันที่ ๙ กุมภาพันธ์ ๒๕๖๕ คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเตือนภัยมลพิษโรงงาน
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ
โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕
โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๙
ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th

UAE UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

สำเนาถูกต้อง



ที่ อก ๐๓๑๐(๑)/ ๑๒๑๗๓

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๐๑ กันยายน ๒๕๖๕

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๒๖ สิงหาคม ๒๕๖๕

ตามหนังสือที่อ้างถึง บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๑๔๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๘ ราย

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๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๑ ราย

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อนึ่ง หนังสือฉบับนี้...

ที่ อก ๐๓๑๐(๑)/ ๑๘๗๙

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๐๙ กุมภาพันธ์ ๒๕๖๕

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๒๗ ธันวาคม ๒๕๖๔

สิ่งที่ส่งมาด้วย ๑. รายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย
๒. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๖ ราย
๓. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม

ตามหนังสือที่อ้างถึง บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด ขอต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๑๔๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย ตามสิ่งที่ส่งมาด้วย ๑

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๖ ราย ตามสิ่งที่ส่งมาด้วย ๒

ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย น้ำใต้ดิน อากาศเสีย สิ่งปฏิกูล หรือวัสดุที่ไม่ใช้แล้ว และดิน ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะหมดอายุในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ หากประสงค์จะต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อกรมโรงงานอุตสาหกรรมภายใน ๓๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

สำเนาถูกต้อง

กองวิจัยและเตือนภัยมลพิษโรงงาน
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ
โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕
โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๙
ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.gmail.go.th

ที่ อก ๐๓๑๐(๑)/ ๔๗๘๗

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒๑ เมษายน ๒๕๖๕

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๓๐ มีนาคม ๒๕๖๕

ตามหนังสือที่อ้างถึง บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๑๔๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ยกเลิกผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย
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๒. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย
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๓. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย
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อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ที่ อก ๐๓๑๐(๑)/๑๘๗๙ ลงวันที่ ๙ กุมภาพันธ์ ๒๕๖๕ คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

สำเนาถูกต้อง

กองวิจัยและเตือนภัยมลพิษโรงงาน
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ
โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕ โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๙
ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th

Green Industry
"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"

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ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

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สำเนาถูกต้อง

สิ่งที่ส่งมาด้วย ๑

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด เลขทะเบียน ว-๑๔๕
ที่ อก ๐๓๑๐(๑)/ ๑๘๗๙ ลงวันที่ ๐๙ กุมภาพันธ์ ๒๕๖๕

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย

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ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

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เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด เลขทะเบียน ว-๑๔๕
ที่ อก ๐๓๑๐(๑)/ ๑๘๗๙ ลงวันที่ ๐๙ กุมภาพันธ์ ๒๕๖๕

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๖ ราย

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สิ่งที่ส่งมาด้วย ๓

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด เลขทะเบียน ว-๑๔๕
ที่ อก ๐๓๑๐(๑)/ ๑๘๗๙ ลงวันที่ ๐ ๙ กุมภาพันธ์ ๒๕๖๕

ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๕๗ รายการ

น้ำเสีย จำนวน 46 รายการ

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 1 | Aldrin | Liquid-Liquid Extraction, Gas Chromatographic Method[4] |
| 2 | Arsenic | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[4]<br>2) Digestion, Inductively Coupled Plasma Method[4] |
| 3 | Barium | Digestion, Inductively Coupled Plasma Method[4] |
| 4 | α-BHC | Liquid-Liquid Extraction, Gas Chromatographic Method[4] |
| 5 | β-BHC | Liquid-Liquid Extraction, Gas Chromatographic Method[4] |
| 6 | δ-BHC | Liquid-Liquid Extraction, Gas Chromatographic Method[4] |
| 7 | γ-BHC | Liquid-Liquid Extraction, Gas Chromatographic Method[4] |
| 8 | Biochemical Oxygen Demand | 1) 5-Day BOD Test, Azide Modification Method[4]<br>2) 5-Day BOD Test, Membrane Electrode Method[4] |
| 9 | Cadmium | 1) Digestion, Direct Air-Acetylene Flame Method[4]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma Method[4] |
| 10 | Chemical Oxygen Demand | 1) Closed Reflux, Titrimetric Method[4]<br>2) Closed Reflux, Colorimetric Method[4]<br>3) Open Reflux, Titrimetric Method[4] |
| 11 | Chlordane | Liquid-Liquid Extraction, Gas Chromatographic Method[4] |
| 12 | Chromium | 1) Digestion, Direct Air-Acetylene Flame Method[4]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>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]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma Method[4] |
| 15 | Cyanide | 1) Distillation, Colorimetric Method[4]<br>2) Flow Injection Analysis Method[4] |

UAE UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED
สำเนาถูกต้อง

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UNITED ANALYST AND ENGINEERING
สำเนาถูกต้อง

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 36 | Oil & Grease | 1) Liquid-Liquid, Partition-Gravimetric Method[4]<br>2) Soxhlet Extraction Method[4] |
| 37 | pH | Electrometric Method[4] |
| 38 | Phenols | 1) Distillation, Chloroform Extraction Method[4]<br>2) Distillation, Direct Photometric Method[4] |
| 39 | Selenium | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[4]<br>2) Digestion, Inductively Coupled Plasma Method[4] |
| 40 | Sulfide | 1) Iodometric Method[4]<br>2) Methylene Blue Method[4] |
| 41 | Temperature | Laboratory and Field Methods[4] |
| 42 | Total Dissolved Solids | Dried at 180 °C[4] |
| 43 | Total Kjeldahl Nitrogen | Semi-Micro-Kjeldahl Method[4] |
| 44 | Total Suspended Solids | Dried at 103-105 °C[4] |
| 45 | Trivalent Chromium | 1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation[4]<br>2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation[4] |
| 46 | Zinc | 1) Digestion, Direct Air-Acetylene Flame Method[4]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma Method[4] |

น้ำใต้ดิน จำนวน 126 รายการ

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 1 | Acenaphthene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) 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]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |

UAE UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED สำเนาถูกต้อง





| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 16 | o,p'-DDT | Liquid-Liquid Extraction, Gas Chromatographic Method[4] |
| 17 | 4,4'-DDD | Liquid-Liquid Extraction, Gas Chromatographic Method[4] |
| 18 | 4,4'-DDE | Liquid-Liquid Extraction, Gas Chromatographic Method[4] |
| 19 | 4,4'-DDT | Liquid-Liquid Extraction, Gas Chromatographic Method[4] |
| 20 | Dieldrin | Liquid-Liquid Extraction, Gas Chromatographic Method[4] |
| 21 | Endosulfan I | Liquid-Liquid Extraction, Gas Chromatographic Method[4] |
| 22 | Endosulfan II | Liquid-Liquid Extraction, Gas Chromatographic Method[4] |
| 23 | Endosulfan sulfate | Liquid-Liquid Extraction, Gas Chromatographic Method[4] |
| 24 | Endrin | Liquid-Liquid Extraction, Gas Chromatographic Method[4] |
| 25 | Endrin aldehyde | Liquid-Liquid Extraction, Gas Chromatographic Method[4] |
| 26 | Formaldehyde | Distillation, Colorimetric Method[3] |
| 27 | Free Chlorine | 1) Iodometric Method[4]<br>2) DPD Ferrous Titrimetric Method[4] |
| 28 | Heptachlor | Liquid-Liquid Extraction, Gas Chromatographic Method[4] |
| 29 | Heptachlor Epoxide | Liquid-Liquid Extraction, Gas Chromatographic Method[4] |
| 30 | Hexavalent Chromium | 1) Colorimetric Method[4]<br>2) Extraction, Direct Air-Acetylene Flame Method[4] |
| 31 | Lead | 1) Digestion, Direct Air-Acetylene Flame Method[4]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma Method[4] |
| 32 | Manganese | 1) Digestion, Direct Air-Acetylene Flame Method[4]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma Method[4] |
| 33 | Mercury | Digestion, Cold-Vapor Atomic Absorption Spectrometric Method[4] |
| 34 | Methoxychlor | Liquid-Liquid Extraction, Gas Chromatographic Method[4] |
| 35 | Nickel | 1) Digestion, Direct Air-Acetylene Flame Method[4]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma Method[4] |

UAE UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED สำเนาถูกต้อง

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 4 | Anthracene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |
| 5 | Antimony | Digestion, Inductively Coupled Plasma Method[4] |
| 6 | Arsenic | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[4]<br>2) Digestion, Inductively Coupled Plasma Method[4] |
| 7 | Atrazine | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |
| 8 | Barium | 1) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>2) Digestion, Inductively Coupled Plasma Method[4] |
| 9 | Benz(a)anthracene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |
| 10 | Benzene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[4] |
| 11 | Benzo(b)fluoranthene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |
| 12 | Benzo(k)fluoranthene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |
| 13 | Benzoic acid | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |
| 14 | Benzo(a)pyrene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED สำเนาถูกต้อง





| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 15 | Benzo(g,h,i)perylene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |
| 16 | Beryllium | Digestion, Inductively Coupled Plasma 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]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma 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] |
| 27 | Chlordane | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>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] |

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED สำเนาถูกต้อง

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 42 | Dibenz(a,h)anthracene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) 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] |
| 50 | 1,1-Dichloroethylene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[4] |
| 51 | cis-1,2-Dichloroethylene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[4] |
| 52 | trans-1,2-Dichloroethylene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[4] |
| 53 | 2,4-Dichlorophenol | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method[4] |
| 54 | 1,2-Dichloropopane | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[4] |
| 55 | 1,3-Dichloropropane | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[4] |
| 56 | 1,3-Dichloropropene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[4] |
| 57 | Dieldrin | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |

UAE UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED สำเนาถูกต้อง





| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 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]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma Method[4] |
| 34 | Chromium (III) | 1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation[4]<br>2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation[4] |
| 35 | Chromium (VI) | 1) Colorimetric Method[4]<br>2) Extraction, Air-Acetylene Flame Method[4] |
| 36 | Chrysene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |
| 37 | Cyanide | 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]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |
| 40 | DDE | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |
| 41 | DDT | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |

UAE UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED สำเนาถูกต้อง

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 70 | Heptachlor epoxide | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |
| 71 | Hexachlorobenzene | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |
| 72 | Hexachloro-1,3-butadiene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[4] |
| 73 | n-Hexane | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[4] |
| 74 | α-HCH | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |
| 75 | β-HCH | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |
| 76 | γ-HCH | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |
| 77 | Hexachlorocyclopentadiene | 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]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma Atomic Emission Spectrometric Method[4] |

UAE UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED สำเนาถูกต้อง





| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 58 | Diethyl phthalate | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method[4] |
| 59 | 2,4-Dimethylphenol | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method[4] |
| 60 | 2,4-Dinitrophenol | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method[4] |
| 61 | 2,4-Dinitrotoluene | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method[4] |
| 62 | 2,6-Dinitrotoluene | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method[4] |
| 63 | Di-n-Octyl phthalate | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method[4] |
| 64 | Endosulfan | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |
| 65 | Endrin | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |
| 66 | Ethylbenzene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[4] |
| 67 | Fluoranthene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |
| 68 | Fluorene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |
| 69 | Heptachlor | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |

UAE UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED สำเนาถูกต้อง

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 96 | Polychlorinated Biphenyls<br>- PCB 1016<br>- PCB 1221<br>- PCB 1232<br>- PCB-1242<br>- PCB-1248<br>- PCB-1254<br>- PCB-1260 | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method[4] |
| 97 | Pentachlorophenol | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method[4] |
| 98 | pH | Electrometric Method[4] |
| 99 | Phenanthrene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method[4] |
| 100 | Phenol | 1) Distillation, Chloroform Extraction Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |
| 101 | Pyrene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method[4] |
| 102 | Selenium | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[4]<br>2) Digestion, Inductively Coupled Plasma Method[4] |
| 103 | Silver | 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] |

UAE UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED สำเนาถูกต้อง





| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 82 | Manganese | 1) Digestion, Direct Air-Acetylene Flame Method[4]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma 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 | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[4] |
| 88 | 2-Methylphenol | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method[4] |
| 89 | 2-Methylnaphthalene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) 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 | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method[4] |
| 92 | Nickel | 1) Digestion, Direct Air-Acetylene Flame Method[4]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma 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] |

UAE UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED สำเนาถูกต้อง

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 124 | p-Xylene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[4] |
| 125 | Xylene (Total) | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[4] |
| 126 | Zinc | 1) Digestion, Direct Air-Acetylene Flame Method[4]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma Method[4] |

<u>อากาศเสีย (ปล่องระบาย) จำนวน 25 รายการ</u>

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 1 | Antimony | Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |
| 2 | Arsenic | 1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[5]<br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |
| 3 | Cadmium | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method[5]<br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |
| 4 | Carbon Monoxide | Instrumental Analyzer Method[5] |
| 5 | Chlorine | Isokinetic Sampling, Ion Chromatographic Method[5] |
| 6 | Chromium | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method[5]<br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |
| 7 | Cobalt | Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |
| 8 | Copper | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method[5]<br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |
| 9 | Cresol | Absorption Sampling, Gas Chromatographic Method[5] |

UAE สำเนาถูกต้อง
UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED





| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 108 | Toxaphene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method[4]<br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method[4] |
| 109 | TPH ($C_5$ - $C_8$) | 1) Purge and Trap, Gas Chromatographic Method[11,21]<br>2) Purge and Trap, Gas Chromatographic/Mass spectrometric Method[11,25] |
| 110 | TPH ($C_{>8}$ – $C_{16}$) | Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[9,21] |
| 111 | TPH ($C_{>16}$ – $C_{35}$) | Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[9,21] |
| 112 | 1,2,4-Trichlorobenzene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[4] |
| 113 | 1,1,1-Trichloroethane | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[4] |
| 114 | 1,1,2-Trichloroethane | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[4] |
| 115 | Trichloroethylene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[4] |
| 116 | 2,4,5-Trichlorophenol | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |
| 117 | 2,4,6-Trichlorophenol | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method[4] |
| 118 | 1,3,5-Trimethylbenzene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[4] |
| 119 | Vanadium | Digestion, Inductively Coupled Plasma Method[4] |
| 120 | Vinyl acetate | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[4] |
| 121 | Vinyl chloride | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[4] |
| 122 | m-Xylene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[4] |
| 123 | o-Xylene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method[4] |

UAE สำเนาถูกต้อง
UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 10 | Dioxins/Furans | Isokinetic Sampling[5] |
| 11 | Hydrogen Chloride | Isokinetic Sampling, Ion Chromatographic Method[5] |
| 12 | Hydrogen Fluoride | Isokinetic Sampling, Ion Chromatographic Method[5] |
| 13 | Hydrogen Sulfide | Absorption Sampling, Iodometric Method[5] |
| 14 | Lead | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method[5]<br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |
| 15 | Manganese | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method[5]<br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |
| 16 | Mercury | Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method[5] |
| 17 | Nickel | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method[5]<br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |
| 18 | Opacity | Ringelmann's Method[1] |
| 19 | Oxides of Nitrogen | 1) Absorption Sampling, Phenoldisulfonic acid Method[5]<br>2) Instrumental Analyzer Method[5] |
| 20 | Selenium | 1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[5]<br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |
| 21 | Sulfur Dioxide | 1) Absorption Sampling, Barium-Thorin Titrimetric Method[5]<br>2) Instrumental Analyzer Method[5] |
| 22 | Sulfuric Acid | Isokinetic Sampling, Barium-Thorin Titrimetric Method[5] |
| 23 | Total Suspended Particulate | Isokinetic Sampling, Gravimetric Method[5] |
| 24 | Vanadium | Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |
| 25 | Xylene | 1) Bag Sampling, Gas Chromatographic Method[5]<br>2) Adsorption Sampling, Gas Chromatographic Method[5] |





สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 35 รายการ

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 1 | Aldrin | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[2,9,22]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[10,22] |
| 2 | Antimony | Digestion, Inductively Coupled Plasma Method[7,13] |
| 3 | Arsenic | 1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[2,6,15]<br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method[2,6,13]<br>3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[7,15]<br>4) Digestion, Inductively Coupled Plasma Method[7,13] |
| 4 | Barium | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method[2,6,13]<br>2) Digestion, Inductively Coupled Plasma Method[7,13] |
| 5 | Beryllium | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method[2,6,13]<br>2) Digestion, Inductively Coupled Plasma Method[7,13] |
| 6 | Cadmium | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[2,6,14]<br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method[2,6,13]<br>3) Digestion, Flame Atomic Absorption Spectrometric Method[7,14]<br>4) Digestion, Inductively Coupled Plasma Method[7,13] |
| 7 | Chlordane | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[2,9,22]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[10,22] |
| 8 | Chromium | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[2,6,14]<br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method[2,6,13] |



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| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| | | 3) Digestion, Flame Atomic Absorption Spectrometric Method[7,14]<br>4) Digestion, Inductively Coupled Plasma Method[7,13] |
| 9 | Chromium (III) | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation[2,6,14,16]<br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation[2,6,13,16]<br>3) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation[7,8,14,16]<br>4) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation[7,8,13,16] |
| 10 | Chromium (VI) | 1) Waste Extraction, Colorimetric Method[2,16]<br>2) Alkaline Digestion, Colorimetric Method[8,16] |
| 11 | Cobalt | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method[2,6,13]<br>2) Digestion, Inductively Coupled Plasma Method[7,13] |
| 12 | Copper | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[2,6,14]<br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method[2,6,13]<br>3) Digestion, Flame Atomic Absorption Spectrometric Method[7,14]<br>4) Digestion, Inductively Coupled Plasma Method[7,13] |
| 13 | 2,4-D | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[2,9,22]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[10,22] |
| 14 | DDD | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method<br>2) Ultrasonic Extraction, Gas Chromatographic Method |

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| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 15 | DDE | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[2,9,22]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[10,22] |
| 16 | DDT | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[2,9,22]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[10,22] |
| 17 | Dieldrin | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[2,9,22]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[10,22] |
| 18 | Endrin | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[2,9,22]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[10,22] |
| 19 | Heptachlor | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[2,9,22]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[10,22] |
| 20 | Lead | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[2,6,14]<br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method[2,6,13]<br>3) Digestion, Flame Atomic Absorption Spectrometric Method[7,14]<br>4) Digestion, Inductively Coupled Plasma Method[7,13] |
| 21 | Lindane | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[2,9,22]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[10,22] |
| 22 | Mercury | 1) Waste Extraction, Digestion, Cold Vapor Atomic Absorption Spectrometric Method[2,17]<br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method[2,6,13] |

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| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| | - 2,2',4,5,5'-Pentachlorobiphenyl<br>- 2,3,3',4',6-Pentachlorobiphenyl<br>- 2,2',3,4,4',5'-Hexachlorobiphenyl<br>- 2,2',3,4,5,5'-Hexachlorobiphenyl<br>- 2,2',3,5,5',6-Hexachlorobiphenyl<br>- 2,2',4,4',5,5'-Hexachlorobiphenyl<br>- 2,2',3,3',4,4',5-Heptachlorobiphenyl<br>- 2,2',3,4,4',5,5'-Heptachlorobiphenyl<br>- 2,2',3,4,4',5',6-Heptachlorobiphenyl<br>- 2,2',3,4',5,5',6-Heptachlorobiphenyl<br>- 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl | |
| 27 | Pentachlorophenol | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method[2,9,28]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 28 | pH | Electrometric Method[31,32] |
| 29 | Selenium | 1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[2,6,20]<br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method[2,6,13]<br>3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method<br>4) Digestion, Inductively Coupled Plasma Method[7,13] |

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| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| | | 3) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method[18]<br>4) Digestion, Inductively Coupled Plasma Method[7,13]<br>5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method[19] |
| 23 | Methoxychlor | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[2,9,22]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[10,22] |
| 24 | Molybdenum | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method[2,6,13]<br>2) Digestion, Inductively Coupled Plasma Method[7,13] |
| 25 | Nickel | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[2,6,14]<br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method[2,6,13]<br>3) Digestion, Flame Atomic Absorption Spectrometric Method[7,14]<br>4) Digestion, Inductively Coupled Plasma Method[7,13] |
| 26 | Polychlorinated Biphenyls<br>- Aroclor 1016<br>- Aroclor 1221<br>- Aroclor 1232<br>- Aroclor 1242<br>- Aroclor 1248<br>- Aroclor 1254<br>- Aroclor 1260<br>- 2-Chlorobiphenyl<br>- 2,3-Dichlorobiphenyl<br>- 2,2',5-Trichlorobiphenyl<br>- 2,4',5-Trichlorobiphenyl<br>- 2,2',3,5'-Tetrachlorobiphenyl<br>- 2,2',5,5'-Tetrachlorobiphenyl<br>- 2,3',4,4'-Tetrachlorobiphenyl<br>- 2,2',3,4,5'-Pentachlorobiphenyl | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[2,9,23]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[10,23] |

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| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 3 | Aldrin | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,22]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 4 | Anthracene | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,26]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 5 | Antimony | Digestion, Inductively Coupled Plasma Method[7,13] |
| 6 | Arsenic | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[7,15]<br>2) Digestion, Inductively Coupled Plasma Method[7,13] |
| 7 | Atrazine | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 8 | Barium | Digestion, Inductively Coupled Plasma Method[7,13] |
| 9 | Benz(a)anthracene | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,24]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 10 | Benzene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 11 | Benzo(b)fluoranthene | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,24]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 12 | Benzo(k)fluoranthene | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,24]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 13 | Benzoic acid | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 14 | Benzo(a)pyrene | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,24]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |

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| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 30 | Silver | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method[2,6,13]<br>2) Digestion, Inductively Coupled Plasma Method[7,13] |
| 31 | Thallium | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method[2,6,13]<br>2) Digestion, Inductively Coupled Plasma Method[7,13] |
| 32 | Toxaphene | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method[2,9,22]<br>2) Ultrasonic Extraction, Gas Chromatographic Method[10,22] |
| 33 | Trichloroethylene | 1) Waste Extraction, Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[2,12,25]<br>2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 34 | Vanadium | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method[2,6,13]<br>2) Digestion, Inductively Coupled Plasma Method[7,13] |
| 35 | Zinc | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[2,6,14]<br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method[2,6,13]<br>3) Digestion, Flame Atomic Absorption Spectrometric Method[7,14]<br>4) Digestion, Inductively Coupled Plasma Method[7,13] |

<u>ดิน จำนวน 125 รายการ</u>

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 1 | Acenaphthene | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,24]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 2 | Acetone | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |

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| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 15 | Benzo(g,h,i)perylene | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,22]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 16 | Beryllium | Digestion, Inductively Coupled Plasma Method[7,13] |
| 17 | Bis(2-chloroethyl)ether | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 18 | Bis(2-ethylhexyl)phthalate | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 19 | Bromodichloromethane | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 20 | Bromoform | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 21 | Butanol | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 22 | Butyl benzyl phthalate | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 23 | Cadmium | 1) Digestion, Flame Atomic Absorption Spectrometric Method[7,14]<br>2) Digestion, Inductively Coupled Plasma Method[7,13] |
| 24 | Carbazole | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 25 | Carbon disulfide | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 26 | Carbon tetrachloride | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 27 | Chlordane | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,22]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 28 | p-Chloroaniline | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 29 | Chlorobenzene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 30 | Chlorodibromomethane | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |

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| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 31 | Chloroform | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 32 | 2 Chlorophenol | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 33 | Chromium | 1) Digestion, Flame Atomic Absorption Spectrometric Method[7,14]<br>2) Digestion, Inductively Coupled Plasma Method[7,13] |
| 34 | Chromium (III) | 1) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation[7,8,14,16]<br>2) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation[7,8,13,16] |
| 35 | Chromium (VI) | Alkaline Digestion, Colorimetric Method[8,16] |
| 36 | Chrysene | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,24]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 37 | Cyanide | Extraction, Distillation, Colorimetric Method[28,29,30] |
| 38 | 2,4-D | Ultrasonic Extraction, Gas Chromatographic Method[27] |
| 39 | DDD | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,22]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 40 | DDE | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,22]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 41 | DDT | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,22]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 42 | Dibenz(a,h)anthracene | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,22]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |

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| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 43 | Di-n-butyl phthalate | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 44 | 1,2-Dichlorobenzene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 45 | 1,3-Dichlorobenzene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 46 | 1,4-Dichlorobenzene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 47 | 3,3'-Dichlorobenzidine | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 48 | 1,1-Dichloroethane | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 49 | 1,2-Dichloroethane | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 50 | 1,1-Dichloroethylene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 51 | cis-1,2-Dichloroethylene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 52 | trans-1,2-Dichloroethylene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 53 | 2,4-Dichlorophenol | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 54 | 1,2-Dichlorpopane | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 55 | 1,3-Dichloropropane | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 56 | 1,3-Dichloropropene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 57 | Dieldrin | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,22]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 58 | Diethyl phthalate | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 59 | 2,4-Dimethylphenol | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |

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|---|---|---|
| 60 | 2,4-Dinitrophenol | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 61 | 2,4-Dinitrotoluene | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 62 | 2,6-Dinitrotoluene | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 63 | Di-n-Octyl phthalate | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 64 | Endosulfan | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,22]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 65 | Endrin | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,22]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 66 | Ethylbenzene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 67 | Fluoranthene | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,24]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 68 | Fluorene | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,24]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 69 | Heptachlor | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,22]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 70 | Heptachlor epoxide | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,22]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |

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|---|---|---|
| 83 | Mercury | 1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method[18]<br>2) Digestion, Inductively Coupled Plasma Method[7,13]<br>3) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method[19] |
| 84 | Methanol | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 85 | Methoxychlor | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,22]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 86 | Methyl bromide | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 87 | Methylene chloride | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 88 | 2-Methylphenol | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 89 | 2-Methylnaphthalene | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 90 | Methyl tert-butyl ether | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 91 | Naphthalene | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,24]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 92 | Nickel | 1) Digestion, Flame Atomic Absorption Spectrometric Method[7,14]<br>2) Digestion, Inductively Coupled Plasma Method[7,13] |
| 93 | Nitrobenzene | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 94 | N-Nitrosodiphenylamine | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 95 | N-Nitrosodi-n-propylamine | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |

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|---|---|---|
| 71 | Hexachlorobenzene | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,22]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 72 | Hexachloro-1,3-butadiene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 73 | n-Hexane | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 74 | α-HCH | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,22]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 75 | β-HCH | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,22]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 76 | γ-HCH | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,22]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 77 | Hexachlorocyclopentadiene | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 78 | Hexachloroethane | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 79 | Indeno(1,2,3-cd)pyrene | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,24]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 80 | Isophorone | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 81 | Lead | 1) Digestion, Flame Atomic Absorption Spectrometric Method[7,14]<br>2) Digestion, Inductively Coupled Plasma Method[7,13] |
| 82 | Manganese | 1) Digestion, Flame Atomic Absorption Spectrometric Method[7,14]<br>2) Digestion, Inductively Coupled Plasma Method[7,13] |

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|---|---|---|
| | - 2,2',3,4',5,5',6-Heptachlorobiphenyl<br>- 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl | |
| 97 | Pentachlorophenol | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 98 | Phenanthrene | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,24]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 99 | Phenol | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 100 | Pyrene | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,24]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 101 | Selenium | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[7,22]<br>2) Digestion, Inductively Coupled Plasma Method[7,13] |
| 102 | Silver | Digestion, Inductively Coupled Plasma Method[7,13] |
| 103 | Styrene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 104 | 1,1,2,2-Tetrachloroethane | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 105 | Tetrachloroethylene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 106 | Toluene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 107 | Toxaphene | Ultrasonic Extraction, Gas Chromatographic Method[10,22] |
| 108 | TPH ($C_5$-$C_8$) | 1) Purge and Trap, Gas Chromatographic Method[12,21]<br>2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 109 | TPH ($C_{>8}$-$C_{16}$) | Ultrasonic Extraction, Gas Chromatographic Method[10,21] |
| 110 | TPH ($C_{>16}$-$C_{35}$) | Ultrasonic Extraction, Gas Chromatographic Method[10,21] |
| 111 | 1,2,4-Trichlorobenzene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |

UAE UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED สำเนาถูกต้อง





| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 96 | Polychlorinated Biphenyls<br>- Aroclor 1016<br>- Aroclor 1221<br>- Aroclor 1232<br>- Aroclor 1242<br>- Aroclor 1248<br>- Aroclor 1254<br>- Aroclor 1260 | 1) Ultrasonic Extraction, Gas Chromatographic Method[10,23]<br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| | Polychlorinated Biphenyls<br>- 2-Chlorobiphenyl<br>- 2,3-Dichlorobiphenyl<br>- 2,2',5-Trichlorobiphenyl<br>- 2,4',5-Trichlorobiphenyl<br>- 2,2',3,5'-Tetrachlorobiphenyl<br>- 2,2',5,5'-Tetrachlorobiphenyl<br>- 2,3',4,4'-Tetrachlorobiphenyl<br>- 2,2',3,4,5'-Pentachlorobiphenyl<br>- 2,2',4,5,5'-Pentachlorobiphenyl<br>- 2,3,3',4',6-Pentachlorobiphenyl<br>- 2,2',3,4,4',5'-Hexachlorobiphenyl<br>- 2,2',3,4,5,5'-Hexachlorobiphenyl<br>- 2,2',3,5,5',6-Hexachlorobiphenyl<br>- 2,2',4,4',5,5'-Hexachlorobiphenyl<br>- 2,2',3,3',4,4',5-Heptachlorobiphenyl<br>- 2,2',3,4,4',5,5'-Heptachlorobiphenyl<br>- 2,2',3,4,4',5',6-Heptachlorobiphenyl | Ultrasonic Extraction, Gas Chromatographic Method[10,23] |

UAE UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED สำเนาถูกต้อง

3. สมาคมวิศวกรรมสิ่งแวดล้อมแห่งประเทศไทย. **คู่มือวิเคราะห์น้ำเสีย.** พิมพ์ครั้งที่ 4. กรุงเทพฯ: เรือนแก้วการพิมพ์, 2547.

4. APHA, AWWA, WEF. **Standard Methods for the Examination of Water and Wastewater.** 23rd ed. Washington, DC: APHA, 2017.

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8. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Alkaline Digestion for Hexavalent Chromium. SW-846 Method 3060A**, 1996.

9. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste 3. Physical/Chemical Methods. **Separatory Funnel Liquid-Liquid Extraction. SW-846 Method 3510C**, 1996.

10. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Ultrasonic Extraction. SW-846 Method 3550C**, 2007.

11. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Purge and Trap for Aqueous Samples. SW-846 Method 5030C**, 2003.

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13. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Inductively Coupled Plasma-Optical Emission Spectrometry. SW-846 Method 6010D**, 2014.

14. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Flame Atomic Absorption Spectrophotometry. SW-846 Method 7000B**, 2007.

15. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Arsenic (Atomic Absorption, Gaseous Hydride). SW-846 Method 7061A**, 1992.

UAE UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED สำเนาถูกต้อง





| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 112 | 1,1,1-Trichloroethane | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 113 | 1,1,2-Trichloroethane | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 114 | Trichloroethylene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 115 | 2,4,5-Trichlorophenol | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 116 | 2,4,6-Trichlorophenol | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method[10,26] |
| 117 | 1,3,5-Trimethylbenzene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 118 | Vanadium | Digestion, Inductively Coupled Plasma Method[7,13] |
| 119 | Vinyl acetate | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 120 | Vinyl chloride | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 121 | m-Xylene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 122 | o-Xylene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 123 | p-Xylene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 124 | Xylene (Total) | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25] |
| 125 | Zinc | 1) Digestion, Flame Atomic Absorption Spectrometric Method[7,14]<br>2) Digestion, Inductively Coupled Plasma Method[7,13] |

<u>เอกสารอ้างอิง</u>

1. กระทรวงอุตสาหกรรม. ประกาศกระทรวงอุตสาหกรรม. พ.ศ. 2549. เรื่อง กำหนดค่าปริมาณเขม่าควันที่เจือปนในอากาศที่ระบายออกจากปล่องของหม้อน้ำโรงสีข้าวที่ใช้แกลบเป็นเชื้อเพลิง. **ราชกิจจานุเบกษา.** 4 ธันวาคม 2549. เล่มที่ 123 ตอนพิเศษ 125 ง.

2. กระทรวงอุตสาหกรรม. ประกาศกระทรวงอุตสาหกรรม. พ.ศ. 2548. เรื่อง การกำจัดสิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว.**ราชกิจจานุเบกษา.** 25 มกราคม 2549. เล่มที่ 123 ตอนพิเศษ 11ง.

UAE UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED สำเนาถูกต้อง

16. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Chromium, Hexavalent (Colorimetric). SW-846 Method 7196A**, 1992.

17. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Mercury in Liquid Waste (Manual Cold Vapor Technique). SW-846 Method 7470A**, 1994.

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20. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Selenium (Atomic Absorption, Borohydride Reduction). SW-846 Method 7742**, 1994.

21. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Nonhalogenated Organics Using GC/FID. SW-846 Method 8015D**, 2003.

22. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Organochlorine Pesticides by Gas Chromatography. SW-846 Method 8081B**, 2007.

23. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Polychlorinated Biphenyls (PCBs) by Gas Chromatography. SW-846 Method 8082A**, 2007.

24. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Polynuclear Aromatic Hydrocarbons. SW-846 Method 8100**, 1980.

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26. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry. SW-846 Method 8270E**, 2018.

27. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Chlorinated Herbicides by GC Using Methylation or Pentafluorobenzylation Derivatization. SW-846 Method 8151A**, 1996.

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32. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Soil and Waste pH. SW-846 Method 9045D**, 2004.

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED สำเนาถูกต้อง

สถาบันอาหาร
กรมพัฒนาอุตสาหกรรม
ศูนย์บริการห้องปฏิบัติการอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center

NSC-TISI-TIS 17025
CALIBRATION 0061

# Calibration Report

**Certificate No.:** 2402420-001-01

**Equipment:** Electronic Balance
**Manufacturer:** METTLER TOLEDO
**Model:** AB204-S/FACT
**Resolution:** 0.0001 g
**Serial No.:** B108115858
**ID No.:** UAE.AIR.016/2555
**Capacity:** 220 g

**Date of Calibration:** 19 April 2024



**Environment Condition:** Ambient Temperature: 22.1 ± 0.6 °C Relative Humidity: 49 ± 1.9 %

**Place of Calibration:** Room 206 Balance Room 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

**Condition of Equipment:** Good Condition

**Condition of This Results of Calibration:**

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019
2. Reference Standards:

| Reference Standard | Model | Serial No. | Calibrated By | Certificate No. | Due Date |
|---|---|---|---|---|---|
| Standard Weight Class E2 | 1-500mg | 15880 | TCS | M231118 1S | 28 November 2024 |
| Standard Weight Class E2 | 1-500g | 15882 | TCS | M231118 2S | 28 November 2024 |

| Instrument | Model | Serial No. | Calibrated By | Certificate No. | Due Date |
|---|---|---|---|---|---|
| Thermo-Hygro Meter | 608-H1 | NFI.BTH 019/23 | Quality Reborn | QR24-0492 | 4 March 2025 |

3. This certification is traceable to SI UNIT
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.

**Calibration Results:**

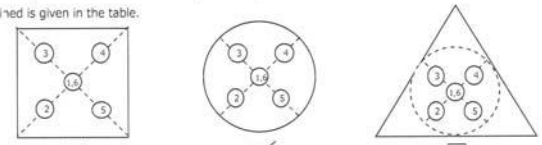
**1. Repeatability of Reading:**

| Nominal Value ( g ) | Standard Deviation of Reading ( g ) |
|---|---|
| 100 | 0.000057 |
| 200 | 0.000079 |

**2. Off-Center Error:**

A mass of 100 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.




☐ ☑ ☐

| 1 ( g ) | 2 ( g ) | 3 ( g ) | 4 ( g ) | 5 ( g ) | 6 ( g ) | (Maximum Difference) ( g ) |
|---|---|---|---|---|---|---|
| 99.9999 | 99.9997 | 99.9996 | 99.9998 | 100.0000 | 99.9998 | 0.0003 |

23 April 2024

F-CS-012 Revision: 01 Date: 20-04-65

2008 ซอยอรุณอมรินทร์ 36 ถนนอรุณอมรินทร์ แขวงบางยี่ขัน เขตบางพลัด กรุงเทพมหานคร 10700
2008 Soi 36, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700, Thailand
Tel: +66(0) 2422 8688 Fax: +66(0) 2422 8545

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กรมพัฒนาอุตสาหกรรม
ศูนย์บริการห้องปฏิบัติการอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center

NSC-TISI-TIS 17025
CALIBRATION 0061

# Calibration Certificate

**Certificate No.:** 2402420-001-01
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhanong, Bangkok 10260



**Equipment:** Electronic Balance

**Manufacturer:** METTLER TOLEDO

**Model:** AB204-S/FACT

**Serial No.:** B108115858

**ID No.:** UAE.AIR.016/2555

**Order No.:** 2402420

**Operation No.:** 2402420-001

**Date of Receipt:** 19 April 2024

**Date of Calibration:** 19 April 2024

**Calibrated by** Mr.Pheraphat Tuanjit
Scientist

**Approved by** (Mi
Vice President, Department of Laboratory Services
Responsible for the Technical Management Team

**Date of Issue:** 23 April 2024

**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.

F-CS-009 Revision: 01 Date: 20-04-65

2008 ซอยอรุณอมรินทร์ 36 ถนนอรุณอมรินทร์ แขวงบางยี่ขัน เขตบางพลัด กรุงเทพมหานคร 10700
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DQE Services Co.,Ltd.
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Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

NSC-TISI-TIS 17025 CALIBRATION 0404

# CERTIFICATE OF CALIBRATION

**Certificate No. :** SP24-018 Page 1 of 5

**Customer :** United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

**Address :** 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

**Location of calibration :** Laboratory 315

**Equipment :** UV-Vis Spectrophotometer

**Manufacturer :** Agilent Technologies

**Model :** Cary 60

**Serial No. :** MY15410009

**ID No. :** UAE.WAT.020/2558

**Received Date :** 7 May 2024

**Calibration Date :** 7 May 2024

**Issue Date :** 9 May 2024

**Condition Instrument :** Good

**Calibrated by :** ( Mr )
Technical Manager

**Approved by :** ( Ms. )
Quality Manager

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit 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 DQE Services Co., Ltd.

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ศูนย์บริการห้องปฏิบัติการอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center

ilac-MRA

NSC-TISI-TIS 17025 CALIBRATION 0061

# Calibration Report

**Certificate No.:** 2402420-001-01

**Equipment:** Electronic Balance
**Manufacturer:** METTLER TOLEDO
**Model:** AB204-S/FACT
**Resolution:** 0.0001 g
**Serial No.:** B108115858
**ID No.:** UAE.AIR.016/2555
**Capacity:** 220 g

**Date of Calibration:** 19 April 2024 **Page 3 of 3**

**Calibration Results:** **(Continued)**

**Calibration Range:** 0-200 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:**

| Nominal Value ( g ) | Standard Value ( g ) | Average Reading ( g ) | Correction ( g ) | Uncertainty ( ± g ) | Coverage Factor k |
|---|---|---|---|---|---|
| Unload | 0.00000 | 0.0000 | 0.0000 | 0.000089 | 2.00 |
| 0.1 | 0.10000 | 0.1000 | 0.0000 | 0.000089 | 2.00 |
| 1 | 0.99998 | 1.0000 | 0.0000 | 0.000092 | 2.00 |
| 5 | 4.99997 | 5.0000 | 0.0000 | 0.000091 | 2.00 |
| 10 | 10.00002 | 10.0001 | -0.0001 | 0.00012 | 2.00 |
| 20 | 20.00003 | 20.0001 | -0.0001 | 0.00014 | 2.00 |
| 50 | 49.99998 | 50.0000 | 0.0000 | 0.00012 | 2.00 |
| 70 | 70.00000 | 69.9999 | 0.0001 | 0.00016 | 2.00 |
| 100 | 99.99997 | 100.0000 | 0.0000 | 0.00017 | 2.00 |
| 150 | 149.99994 | 149.9997 | 0.0002 | 0.00022 | 2.00 |
| 200 | 200.00001 | 199.9995 | 0.0005 | 0.00028 | 2.00 |

23 April 2024

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 %.

---------- End ----------

F-CS-012 Revision: 01 Date: 20-04-65

2008 ซอยอรุณอมรินทร์ 36 ถนนอรุณอมรินทร์ แขวงบางยี่ขัน เขตบางพลัด กรุงเทพมหานคร 10700
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Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

NSC-TISI-TIS 17025 CALIBRATION 0404

# REPORT OF CALIBRATION

**Certificate No. :** SP24-018



**Calibration Results :** Without adjustment

**Photometric Accuracy :**

| Wavelength (nm.) | CRMs Values (Abs) | UUC Reading (Abs) | Correction (Abs) | Uncertainty (Abs) | Coverage factor *k* |
|---|---|---|---|---|---|
| 420 | 0.0000 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5780 | 0.5747 | 0.0033 | 0.0031 | 2.00 |
| | 1.0484 | 1.0438 | 0.0046 | 0.0029 | 2.00 |
| | 2.1876 | 2.1832 | 0.0044 | 0.0080 | 2.00 |
| 440 | 0.0000 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5595 | 0.5581 | 0.0014 | 0.0034 | 2.00 |
| | 1.0239 | 1.0231 | 0.0008 | 0.0035 | 2.00 |
| | 2.1230 | 2.1219 | 0.0011 | 0.0080 | 2.00 |
| 465 | 0.0000 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5230 | 0.5184 | 0.0046 | 0.0030 | 2.00 |
| | 0.9633 | 0.9614 | 0.0019 | 0.0029 | 2.00 |
| | 1.9753 | 1.9731 | 0.0022 | 0.0070 | 2.00 |
| 546.1 | 0.0000 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5181 | 0.5150 | 0.0031 | 0.0031 | 2.00 |
| | 1.0002 | 0.9964 | 0.0038 | 0.0033 | 2.00 |
| | 1.9973 | 1.9914 | 0.0059 | 0.0088 | 2.00 |
| 590 | 0.0000 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5517 | 0.5485 | 0.0032 | 0.0030 | 2.00 |
| | 1.0803 | 1.0772 | 0.0031 | 0.0030 | 2.00 |
| | 2.0373 | 2.0293 | 0.0080 | 0.0080 | 2.00 |
| 635 | 0.0000 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5591 | 0.5565 | 0.0026 | 0.0031 | 2.00 |
| | 1.0518 | 1.0482 | 0.0036 | 0.0030 | 2.00 |
| | 1.9274 | 1.9202 | 0.0072 | 0.0079 | 2.00 |

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DQE Services

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NSC-TISI-TIS 17025 CALIBRATION 0404

# REPORT OF CALIBRATION

**Certificate No. :** SP24-018



**Environment Condition :** Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

**Calibration method :** In-house method CP-01 Based on ASTM E275-08

**Certified Reference Materials :**

| Material | Serial No. | Certificate No. | Due date |
|---|---|---|---|
| Absobance Standard set | 25760 | 115663 | 25 October 2025 |
| Absobance Standard set | 25757 | 115638 | 25 October 2025 |
| Wavelength Standard set | 25806 | 115657 | 25 October 2025 |
| Wavelength Standard set | 25758 | 115665 | 25 October 2025 |

**Traceability** : This certification is traceable to the International System of Unit maintained at National - Institute of Standards and Technology (NIST) through Starna Scientific Limited

**Spectral Band Width of UUC :** 1.5 nm.

**Scan Speed of UUC :** 60 nm/min

**Scan Interval of UUC :** 0.15 nm.

**Resolution of UUC :** Photometric 0.0001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

DQE Services Co.,Ltd.
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NSC-TISI-TIS 17025 CALIBRATION 0404

# REPORT OF CALIBRATION

**Certificate No. :** SP24-018



**Wavelength Accuracy :**

| CRMs Values (nm.) | UUC Reading (nm.) | Correction (nm.) | Uncertainty (nm.) | Coverage factor *k* |
|---|---|---|---|---|
| 241.72 | 242.0 | -0.28 | 0.18 | 2.00 |
| 279.45 | 279.5 | -0.05 | 0.18 | 2.00 |
| 287.81 | 287.9 | -0.09 | 0.18 | 2.00 |
| 334.06 | 333.9 | 0.16 | 0.18 | 2.00 |
| 360.93 | 360.5 | 0.43 | 0.18 | 2.00 |
| 418.59 | 418.1 | 0.49 | 0.18 | 2.00 |
| 445.94 | 445.6 | 0.34 | 0.18 | 2.00 |
| 453.66 | 453.3 | 0.36 | 0.18 | 2.00 |
| 460.02 | 459.8 | 0.22 | 0.18 | 2.00 |
| 536.59 | 536.0 | 0.59 | 0.18 | 2.00 |
| 637.98 | 638.7 | -0.72 | 0.18 | 2.00 |
| 431.38 | 430.8 | 0.58 | 0.18 | 2.00 |
| 472.50 | 472.4 | 0.10 | 0.18 | 2.00 |
| 513.47 | 513.7 | -0.23 | 0.18 | 2.00 |
| 528.88 | 529.1 | -0.22 | 0.18 | 2.00 |
| 573.17 | 573.5 | -0.33 | 0.18 | 2.00 |
| 585.35 | 585.2 | 0.15 | 0.20 | 2.00 |
| 684.40 | 685.1 | -0.70 | 0.18 | 2.00 |
| 740.72 | 741.4 | -0.68 | 0.20 | 2.00 |
| 748.55 | 749.1 | -0.55 | 0.18 | 2.00 |
| 807.03 | 807.3 | -0.27 | 0.18 | 2.00 |
| 879.28 | 879.3 | -0.02 | 0.18 | 2.00 |

Remark : - UUC = Unit Under Calinration

- N/A = Not Avaiable
- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor *k* , which for a normal distribution corresponds to a coverage probability of approximately 95%
- * Indicates non TISI accredited

- End of Certificate -

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NSC-TISI-TIS 17025 CALIBRATION 0404

# REPORT OF CALIBRATION

**Certificate No. :** SP24-018



**Photometric Accuracy :**

| Wavelength (nm.) | CRMs Values (Abs) | UUC Reading (Abs) | Correction (Abs) | Uncertainty (Abs) | Coverage factor *k* |
|---|---|---|---|---|---|
| 235 | 0.0000 | 0.0000 | 0.0000 | 0.0050 | 2.00 |
| | 0.7469 | 0.7435 | 0.0034 | 0.0057 | 2.00 |
| 257 | 0.0000 | 0.0000 | 0.0000 | 0.0050 | 2.00 |
| | 0.8674 | 0.8639 | 0.0035 | 0.0060 | 2.00 |
| 313 | 0.0000 | 0.0000 | 0.0000 | 0.0050 | 2.00 |
| | 0.2919 | 0.2907 | 0.0012 | 0.0051 | 2.00 |
| 350 | 0.0000 | 0.0000 | 0.0000 | 0.0050 | 2.00 |
| | 0.6430 | 0.6402 | 0.0028 | 0.0055 | 2.00 |

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MM-NE07

**Equipment :** Hot Air Oven
**Condition As-Received :** Used Item
**Reference :** 2404-0004OC-3

**Cert. No.:** 24TM589
**Page :** 2 of 3

**Procedure Used :-**

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector ( RTD ) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

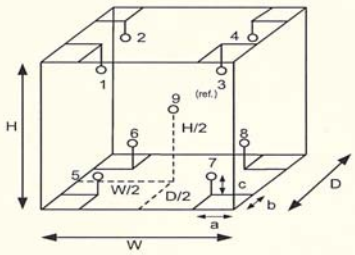
| Instrument | Serial No. | Cert. No. | Traceable | Due Date |
|---|---|---|---|---|
| 1 ) Data Acquisition | MY57013711 | 23LM115 | TPA | 11 Jul 2024 |

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

**Remark :** TPA : Technology Promotion Association ( Thailand - Japan )

**Result of Calibration :-** ( * ) Without Adjustment
**Function of UUC* :** Temperature Source
**Fresh air setting :** Close

| Environment during calibration | | |
|---|---|---|
| | Beginning | Finished |
| Temp. ( °C ) | 27 | 26 |
| REL.Humid. ( % ) | 47 | 48 |
| AC Supply ( Volt ) | 221 | 220 |




| Position : | Ref. Std. ID No.: @ Calibration Point ( 120 to 180 ) °C | ( 104 ) °C |
|---|---|---|
| 1 | 21-18TC-01 | 22-18RTD-2/1 |
| 2 | 21-18TC-02 | 18RTD-2/2 |
| 3 | 21-18TC-03 | 18RTD-2/3 |
| 4 | 21-18TC-04 | 18RTD-2/4 |
| 5 | 21-18TC-05 | 18RTD-2/5 |
| 6 | 21-18TC-06 | 18RTD-2/6 |
| 7 | 21-18TC-07 | 18RTD-2/7 |
| 8 | 21-18TC-08 | 18RTD-2/8 |
| 9 (ref.) | 21-18TC-09 | 18RTD-2/9 |

**Probe Installation Details :**

| | | |
|---|---|---|
| a = | 5.0 | cm |
| b = | 5.0 | cm |
| c = | 5.0 | cm |

**Dimension of Chamber :**

| | | |
|---|---|---|
| D = | 0.50 | m |
| W = | 0.80 | m |
| H = | 0.75 | m |
| Capacity = | 0.30 | m³ |

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL. 0-2717-3000-29 FAX. 0-2719-9484


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NSC-TISI-TIS17025 CALIBRATION 0008

**Cert. No.:** 24TM589
**Page :** 1 of 3

# Certificate of Calibration

**Equipment :** Hot Air Oven

**Manufacturer :** Memmert

**Model :** UF 55

**Serial No. :** B212.0411

**ID No. :** UAE.WAO.005/2556

**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260

**Location :** Lab Floor 2

**Received Order :** 01 April 2024
**Calibration Date :** 01 - 02 April 2024
**Ambient Temperature :** ( 26 ± 10 ) °C
**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :** Krisda Malee

**Approved by :**

Approved Signatory

( ) Ponpan Paipim
(✓) Suwit Imjai
( ) Kunchit Promprat

**Issue Date :** 5 April 2024

**The Uncertainties are for a confidence probability of approximately 95%**


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MM-NE07

Request No. 25-67 / 0275

MTC. ACL.No. 358 / 67

# CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies"
Model AA240FS, Serial No. MY13160001
2. Working standard solution "Inorganic Ventures"
Multi Analyte Custom Grade Solution, Lot No. S2-MEB675610

SUBMITTED BY : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

CALIBRATION PROCEDURE : 1. Performance Verification of Atomic Absorption Spectrophotometer (WI-500-02-30)
2. Estimation Uncertainty of Measurement in Analytical Chemistry (QP-513)

CALIBRATION RANGE: 0.02, 0.10, 0.30, 0.50, 0.70 mg/l at 228.8 nm.Cd, 0.10, 0.20, 0.30, 0.50, 0.70 mg/l at 357.9 nm.Cr, 0.05, 0.10, 0.30, 0.50, 0.70 mg/l at 324.7 nm.Cu, 0.10, 0.30, 0.50, 0.70, 1.00 mg/l at 248.3 nm.Fe, 0.20, 0.50, 0.70, 1.00, 1.50 mg/l at 217.0 nm.Pb, 0.05, 0.10, 0.30, 0.50, 0.70 mg/l at 279.5 nm.Mn, 0.10, 0.30, 0.50, 0.70, 1.00 mg/l at 232.0 nm.Ni, 0.05, 0.10, 0.30, 0.50, 0.70 mg/l at 213.9 nm.Zn

CALIBRATION DATE : 2 February 2024

REFERENCE MATERIAL : Traceable to NIST "Agilent Technologies", "CARLO ERBA"
Cadmium Lot No. 0006589926, Chromium Lot No. 0112384886, Copper Batch No. T117098A, Iron Batch No. T126087A, Lead Lot No. 1227873, Manganese Batch No. T109228A, Nickel Batch No. T270178A, Zinc Batch No. T820140A

AMBIENT CONDITIONS : Temperature 25 ± 5 °C Relative humidity 50 ± 20 %

The Atomic Absorption Spectrophotometer has been calibrated against Reference Material traceable to National Institute of Standards and Technology ( NIST ) by The Analytical Chemistry Laboratory. The results are attached herewith.

Calibrated by .....
( Mr. )

Approved by.....
(Miss )
Director of Analytical Chemistry Laboratory

Ref. 2015267020100454001

Issued Date : 11 March 2024

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**Equipment :** Hot Air Oven
**Condition As-Received :** Used Item
**Reference :** 2404-0004OC-3
**Result of Calibration :-** ( * ) Without Adjustment
**Function of UUC* :** Temperature Source
**Fresh air setting :** Close

**Cert. No.:** 24TM589
**Page :** 3 of 3

| Calibration Point ( °C ) | UUC* Setting ( °C ) | UUC* Reading ( °C ) | Temperature stability ( ± °C ) | Temperature uniformity ( °C ) | Overall Variation ( °C ) | Coverage Factor *k* |
|---|---|---|---|---|---|---|
| 104.0 | 104.0 | 104.0 | 0.032 | 0.47 | 0.84 | 2 |
| 120.0 | 120.0 | 120.0 | 0.12 | 0.72 | 1.3 | 2 |
| 180.0 | 180.0 | 180.0 | 0.13 | 1.2 | 1.5 | 2 |

| Calibration Point ( °C ) | Measured Temperature ( °C ) Position | | | | | | | | | Uncertainty ( ±°C ) |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 (ref.) | |
| 104.0 | 104.464 | 103.847 | 104.226 | 104.232 | 104.106 | 103.691 | 104.275 | 104.127 | 104.013 | 0.42 |
| 120.0 | 120.486 | 120.089 | 120.635 | 120.596 | 119.531 | 119.644 | 120.364 | 120.144 | 120.158 | 1.1 |
| 180.0 | 180.574 | 179.769 | 180.285 | 180.870 | 179.594 | 179.790 | 180.287 | 179.961 | 179.802 | 1.1 |

**Average* :** The average of 30 values in each position.
**Temperature stability :** One-half of the greatest maximum difference of measured temperature at any one sensor.
**Temperature 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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
**Overall Variation :** The Difference of the maximum and minimum measured temperatures throughout observation.
**UUC* :** Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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 %.

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## 2. Precision

| Element | Conc. (mg/l) | Absorbance | | | | | | | | | | Ave. Abs. | SD | %RSD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cd | 0.02 | 0.0078 | 0.0076 | 0.0069 | 0.0075 | 0.0071 | 0.0070 | 0.0076 | 0.0074 | 0.0077 | 0.0067 | 0.007 | 0.0004 | 5.15 |
| | 0.30 | 0.1008 | 0.1007 | 0.0999 | 0.0997 | 0.1000 | 0.0996 | 0.1008 | 0.1002 | 0.1005 | 0.0999 | 0.100 | 0.0005 | 0.46 |
| | 0.70 | 0.2301 | 0.2306 | 0.2277 | 0.2305 | 0.2310 | 0.2295 | 0.2290 | 0.2293 | 0.2305 | 0.2296 | 0.230 | 0.0010 | 0.42 |
| Cr | 0.10 | 0.0094 | 0.0093 | 0.0093 | 0.0098 | 0.0094 | 0.0095 | 0.0090 | 0.0090 | 0.0094 | 0.0090 | 0.009 | 0.0003 | 2.75 |
| | 0.30 | 0.0241 | 0.0236 | 0.0221 | 0.0238 | 0.0231 | 0.0226 | 0.0231 | 0.0223 | 0.0230 | 0.0231 | 0.023 | 0.0006 | 2.75 |
| | 0.70 | 0.0500 | 0.0500 | 0.0500 | 0.0524 | 0.0499 | 0.0511 | 0.0509 | 0.0512 | 0.0515 | 0.0504 | 0.051 | 0.0008 | 1.63 |
| Cu | 0.05 | 0.0061 | 0.0062 | 0.0064 | 0.0061 | 0.0069 | 0.0069 | 0.0061 | 0.0062 | 0.0064 | 0.0061 | 0.006 | 0.0003 | 5.00 |
| | 0.30 | 0.0419 | 0.0411 | 0.0402 | 0.0407 | 0.0405 | 0.0404 | 0.0399 | 0.0400 | 0.0399 | 0.0400 | 0.040 | 0.0006 | 1.58 |
| | 0.70 | 0.0960 | 0.0960 | 0.0960 | 0.0959 | 0.0947 | 0.0955 | 0.0952 | 0.0952 | 0.0951 | 0.0955 | 0.096 | 0.0005 | 0.48 |
| Fe | 0.10 | 0.0096 | 0.0101 | 0.0103 | 0.0100 | 0.0099 | 0.0096 | 0.0106 | 0.0099 | 0.0105 | 0.0102 | 0.010 | 0.0003 | 3.38 |
| | 0.50 | 0.0424 | 0.0415 | 0.0428 | 0.0427 | 0.0421 | 0.0426 | 0.0413 | 0.0430 | 0.0421 | 0.0419 | 0.042 | 0.0006 | 1.33 |
| | 1.00 | 0.0830 | 0.0839 | 0.0847 | 0.0834 | 0.0832 | 0.0820 | 0.0839 | 0.0838 | 0.0837 | 0.0845 | 0.084 | 0.0008 | 0.92 |
| Pb | 0.20 | 0.0078 | 0.0074 | 0.0078 | 0.0078 | 0.0076 | 0.0078 | 0.0077 | 0.0078 | 0.0078 | 0.0077 | 0.008 | 0.0001 | 1.71 |
| | 0.70 | 0.0278 | 0.0273 | 0.0271 | 0.0267 | 0.0270 | 0.0264 | 0.0274 | 0.0273 | 0.0269 | 0.0269 | 0.027 | 0.0004 | 1.45 |
| | 1.50 | 0.0551 | 0.0548 | 0.0552 | 0.0555 | 0.0547 | 0.0546 | 0.0544 | 0.0544 | 0.0549 | 0.0547 | 0.055 | 0.0004 | 0.64 |
| Mn | 0.05 | 0.0116 | 0.0107 | 0.0110 | 0.0103 | 0.0108 | 0.0108 | 0.0112 | 0.0107 | 0.0109 | 0.0108 | 0.011 | 0.0003 | 3.15 |
| | 0.30 | 0.0650 | 0.0649 | 0.0649 | 0.0651 | 0.0646 | 0.0646 | 0.0649 | 0.0646 | 0.0640 | 0.0648 | 0.065 | 0.0003 | 0.48 |
| | 0.70 | 0.1463 | 0.1465 | 0.1459 | 0.1471 | 0.1475 | 0.1474 | 0.1487 | 0.1473 | 0.1462 | 0.1468 | 0.147 | 0.0008 | 0.56 |
| Ni | 0.10 | 0.0095 | 0.0100 | 0.0096 | 0.0103 | 0.0102 | 0.0096 | 0.0100 | 0.0095 | 0.0097 | 0.0096 | 0.010 | 0.0003 | 3.04 |
| | 0.50 | 0.0443 | 0.0433 | 0.0438 | 0.0444 | 0.0430 | 0.0437 | 0.0444 | 0.0437 | 0.0438 | 0.0434 | 0.044 | 0.0005 | 1.09 |
| | 1.00 | 0.0812 | 0.0820 | 0.0834 | 0.0829 | 0.0818 | 0.0829 | 0.0831 | 0.0835 | 0.0816 | 0.0819 | 0.082 | 0.0008 | 0.99 |
| Zn | 0.05 | 0.0374 | 0.0377 | 0.0373 | 0.0377 | 0.0374 | 0.0377 | 0.0373 | 0.0371 | 0.0371 | 0.0374 | 0.037 | 0.0002 | 0.61 |
| | 0.30 | 0.1985 | 0.1993 | 0.1975 | 0.1992 | 0.1979 | 0.1988 | 0.1995 | 0.1985 | 0.1974 | 0.2004 | 0.199 | 0.0009 | 0.47 |
| | 0.70 | 0.4027 | 0.4031 | 0.4019 | 0.4021 | 0.4023 | 0.3981 | 0.4042 | 0.4025 | 0.3993 | 0.3997 | 0.402 | 0.0019 | 0.48 |

Continue 3 / 5



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## CALIBRATION DATA

### 1. Noise Level

| Element | Cd | Cr | Cu | Fe | Pb | Mn | Ni | Zn |
|---|---|---|---|---|---|---|---|---|
| Absorbance | 0.0006 | 0.0004 | -0.0003 | 0.0001 | -0.0011 | -0.0005 | 0.0008 | 0.0004 |
| | 0.001 | 0.0017 | -0.0009 | 0.0008 | 0.0001 | 0.0002 | -0.0003 | 0.0007 |
| | 0.0006 | 0.0017 | -0.0020 | 0.0005 | 0.0005 | 0.0004 | 0.0013 | 0.0014 |
| | 0.0001 | 0.0018 | -0.0007 | 0.0005 | 0.0004 | -0.0003 | -0.0001 | 0.0010 |
| | -0.0001 | 0.0019 | -0.0014 | 0.0003 | 0.0010 | 0.0000 | 0.0002 | -0.0001 |
| | 0.0011 | 0.0014 | -0.0017 | 0.0009 | -0.0008 | 0.0004 | 0.0006 | 0.0010 |
| | -0.0002 | 0.0015 | -0.0015 | 0.0003 | 0.0002 | -0.0008 | 0.0009 | 0.0013 |
| | 0.0006 | 0.0012 | -0.0001 | 0.0006 | 0.0008 | 0.0001 | -0.0002 | 0.0013 |
| | 0.0008 | 0.0009 | -0.0003 | 0.0003 | 0.0005 | 0.0002 | 0.0001 | 0.0007 |
| | 0.0012 | 0.0011 | -0.0012 | 0.0008 | 0.0003 | 0.0004 | 0.0004 | 0.0013 |
| | 0.0003 | 0.0015 | -0.0019 | 0.0001 | -0.0002 | 0.0000 | -0.0003 | 0.0003 |
| | 0.0005 | 0.0017 | -0.0019 | -0.0007 | 0.0000 | -0.0007 | 0.0005 | 0.0005 |
| | -0.0006 | 0.0016 | 0.0000 | 0.0006 | -0.0001 | 0.0013 | 0.0006 | 0.0010 |
| | 0.0003 | 0.0011 | -0.0002 | 0.0001 | -0.0007 | 0.0009 | 0.0009 | 0.0002 |
| | 0.0003 | 0.0012 | -0.0011 | 0.0007 | -0.0003 | -0.0003 | 0.0010 | 0.0009 |
| | 0.0004 | 0.0018 | -0.0016 | -0.0004 | -0.0006 | 0.0008 | 0.0007 | 0.0007 |
| | -0.0001 | 0.0018 | -0.0018 | 0.0013 | -0.0006 | -0.0001 | 0.0014 | 0.0006 |
| | 0.0003 | 0.0017 | -0.0001 | 0.0001 | -0.0012 | -0.0004 | 0.0001 | 0.0002 |
| | 0.0010 | 0.0018 | -0.0007 | 0.0003 | -0.0005 | -0.0002 | 0.001 | 0.0003 |
| | 0.0004 | 0.0019 | -0.0008 | -0.0001 | -0.0004 | 0.0003 | 0.0002 | 0.0008 |
| Average Absorbance | 0.000 | 0.001 | -0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |

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3. Trueness

3.1 Reading on wavelength- Cadmium(Cd) at 228.8 nm.

| Element | Standard Value of RM (mg/l) | Reading (mg/l) | Error of Measurement (mg/l) | Error of Measurement (%) | Uncertainty (mg/l) |
|---|---|---|---|---|---|
| Cd | 0.020 | 0.020 | 0.000 | 1.10 | ± 0.005 |
| | 0.301 | 0.301 | 0.000 | 0.11 | ± 0.005 |
| | 0.707 | 0.693 | -0.013 | 1.85 | ± 0.008 |

3.2 Reading on wavelength- Chromium (Cr) at 357.9 nm.

| Element | Standard Value of RM (mg/l) | Reading (mg/l) | Error of Measurement (mg/l) | Error of Measurement (%) | Uncertainty (mg/l) |
|---|---|---|---|---|---|
| Cr | 0.1007 | 0.104 | 0.004 | 3.49 | ± 0.009 |
| | 0.3035 | 0.297 | -0.006 | 2.11 | ± 0.012 |
| | 0.7071 | 0.685 | -0.023 | 3.19 | ± 0.023 |

3.3 Reading on wavelength- Copper (Cu) at 324.7 nm.

| Element | Standard Value of RM (mg/l) | Reading (mg/l) | Error of Measurement (mg/l) | Error of Measurement (%) | Uncertainty (mg/l) |
|---|---|---|---|---|---|
| Cu | 0.051 | 0.047 | -0.004 | 7.58 | ± 0.003 |
| | 0.303 | 0.296 | -0.007 | 2.19 | ± 0.009 |
| | 0.704 | 0.698 | -0.005 | 0.74 | ± 0.020 |

Continue 4 / 5



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3.4 Reading on wavelength- Iron (Fe) at 248.3 nm.

| Element | Standard Value of RM (mg/l) | Reading (mg/l) | Error of Measurement (mg/l) | Error of Measurement (%) | Uncertainty (mg/l) |
|---|---|---|---|---|---|
| Fe | 0.100 | 0.104 | 0.005 | 4.60 | ± 0.014 |
| | 0.500 | 0.482 | -0.018 | 3.55 | ± 0.016 |
| | 1.006 | 0.968 | -0.038 | 3.75 | ± 0.029 |

3.5 Reading on wavelength- Lead (Pb) at 217.0 nm.

| Element | Standard Value of RM (mg/l) | Reading (mg/l) | Error of Measurement (mg/l) | Error of Measurement (%) | Uncertainty (mg/l) |
|---|---|---|---|---|---|
| Pb | 0.201 | 0.202 | 0.001 | 0.34 | ± 0.014 |
| | 0.706 | 0.719 | 0.012 | 1.73 | ± 0.030 |
| | 1.513 | 1.459 | -0.054 | 3.57 | ± 0.061 |

3.6 Reading on wavelength- Manganese (Mn) at 279.5 nm.

| Element | Standard Value of RM (mg/l) | Reading (mg/l) | Error of Measurement (mg/l) | Error of Measurement (%) | Uncertainty (mg/l) |
|---|---|---|---|---|---|
| Mn | 0.0505 | 0.050 | 0.000 | 0.83 | ± 0.005 |
| | 0.3031 | 0.306 | 0.003 | 1.12 | ± 0.007 |
| | 0.7023 | 0.698 | -0.004 | 0.62 | ± 0.014 |

Continue 5 / 5



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Agilent Technologies

**Agilent 5110 and 5100 ICP-OES**
**Preventive Maintenance Checklist**

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results. Delivered by highly-trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak.

For more information about Agilent Technologies services please visit our web site using the following URL http://www.agilent.com/en-us/services/analytical-instrument-services

## Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- For customers using HF applications, the instrument should be returned to its standard sample introduction system.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of additional or special procedures and/or parts for the instrument service, then these must be ordered separately and charged as a repair, which may incur additional

## Service Engineer's Responsibilities

- Only complete/printout pages that relate to the system being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using a "X" or tick mark "✓" in the checkbox.
- Complete Not Applicable check boxes to indicate services not delivered, as needed.
- Complete the PM service in the order of the tasks listed.
- Complete the Service Review section together with the customer.



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TISTR



3.7 Reading on wavelength- Nickel (Ni) at 232.0 nm.

| Element | Standard Value of RM (mg/l) | Reading (mg/l) | Error of Measurement (mg/l) | Error of Measurement (%) | Uncertainty (mg/l) |
|---|---|---|---|---|---|
| Ni | 0.101 | 0.098 | -0.003 | 2.90 | ± 0.013 |
| | 0.508 | 0.502 | -0.006 | 1.16 | ± 0.018 |
| | 1.012 | 0.962 | -0.051 | 5.02 | ± 0.032 |

3.8 Reading on wavelength- Zinc (Zn) at 213.9 nm.

| Element | Standard Value of RM (mg/l) | Reading (mg/l) | Error of Measurement (mg/l) | Error of Measurement (%) | Uncertainty (mg/l) |
|---|---|---|---|---|---|
| Zn | 0.050 | 0.045 | -0.005 | 9.39 | ± 0.013 |
| | 0.303 | 0.324 | 0.021 | 7.04 | ± 0.013 |
| | 0.707 | 0.675 | -0.032 | 4.52 | ± 0.019 |

**Remark :** The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 (k = 2) which gives a level of confidence of approximately 95%

Calibrated by .....
(Mr. )

Approved by .....
(Miss
Director of Analytical Chemistry Laboratory
Issued Date : 11 March 2024

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE
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## General Preparation

- ☑ Discuss any specific questions or issues with the customer prior to starting.
- ☑ Review the instrument logbook.
- ☑ Perform general external inspection of system for cleanliness.
- ☑ Check for proper installation of safety-related parts, assemblies, sensors etc.
- ☑ Check for required firmware/software updates and verify with customers if they would like it installed.
- ☑ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. N/A
- ☑ Run Instrument Performance test and record results in Instrument Performance Test Results Table - Pre PM.

## Inspect and clean the system

- ☑ Look for any obvious external damage or problems.
- ☑ Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- ☑ Perform a general internal inspection of the system for excessive dust accumulation, clean if necessary.
- ☑ Inspect sample introduction components and record any required maintenance in the Service Engineer Comments and notify the customer as the required actions required.
- ☑ Record the instrument operating conditions in the ICP-OES Status Results Table.
- ☑ Replace the polychromator purge filter.
- ☑ Replace the radial pre-optics window
- ☑ Replace the axial pre-optics window for SVDV and VDV instruments.
- ☑ Check exhaust flow for the correct positive extraction at the exhaust duct to insure they meet minimum specifications.
- ☑ Replace air inlet dust filter.
- ☑ Replace high capacity air inlet dust filter element if installed. N/A
- ☑ Remove and clean instrument water inlet filter.

## G8481A Cooling water system

- ☐ **Section NOT Applicable**
- ☑ Drain cooling fluid and remove any particles from the chiller reservoir
- ☑ Remove, clean and reinstall water inlet metal mesh filter.
- ☑ Re fill with Polyclear cooling fluid.
- ☑ Clean the cooling system Air filter and the condenser by compressed air or vacuum cleaner.



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## System Information

| | |
|---|---|
| **Instrument system name and ID** | ICP 5110 VDV |
| **Instrument system site and location** | UAE / 3rd Floor Laboratory |
| **List system component product numbers** | **List the serial numbers of each component** |
| 1. G8015A | 1. MY18030001 |
| 2. G8481A | 2. 1801-01988 |
| 3. | 3. |
| 4. | 4. |
| 5. | 5. |
| 6. | 6. |
| 7. | 7. |
| 8. | 8. |
| 9. | 9. |
| 10. | 10. |

| ICP-OES Configuration table | Circle the type or write in the type if other |
|---|---|
| Nebulizer Type | SeaSpray \| OneNeb \| other |
| Spray Chamber | Cyclonic Single Pass \| Cyclonic Double Pass \| other |
| Torch | Radial \| Dual View \| other |
| Injector Diameter | 2.4mm \| 1.8mm \| 1.4mm \| 0.8mm \| other |
| Injector Material | Quartz \| Ceramic \| other |



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- ☑ Water Flow
- ☑ Gas Flows
- ☑ RF Generator
- ☑ Camera Test
- ☑ Optics Test
- ☑ Nebulizer Test

## Instrument Performance Test Results Table

Note: These measurements do not form part of any specification and are for reference only.

| | Pre PM Sensitivity Check | | Post PM Sensitivity Check | |
|---|---|---|---|---|
| | Radial | Axial * | Radial | Axial* |
| Zn 213.857 nm SRBR | 4106.6 | 8364.0 | 4375.0 | 8400.8 |
| Mn 257.610 nm SRBR | 11064.7 | 31848.1 | 12801.7 | 30846.8 |
| Al 396.152 nm SBR | 7.5 | 14.9 | 9.9 | 16.8 |
| K 766.491 nm SBR | 5.1 | 36.8 | 6.4 | 39.7 |

* Axial result is not applicable for G8016AA, G8012AA Radial View instruments.

## Instrument Test Results Table

Note: The Instrument Test results are for systems using ICP Expert version 7.3 and above only.

| Instrument Test | Result |
|---|---|
| Subsystem Communications Test | pass |
| Air Flow | pass |
| Water Flow | pass |
| Gas Flows | pass |
| RF Generator | pass |
| Camera Test | pass |
| Optics Test | pass |
| Nebulizer test | pass |



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## SPS 3 Auto Sampler

- ☑ **Section NOT Applicable**
- ☐ Power cycle the autosampler and verify successful initialization.
- ☐ Inspect X and Z axis belts for wear. Replace is necessary.
- ☐ Clean X and Z axis slide shafts.
- ☐ Using customer's racks and the Agilent software move the sample probe to the 4 outermost corners and rinse port, ensure that the probe is approximately centered in the vial.

## SPS 4 Auto Sampler

- ☑ **Section NOT Applicable**
- ☐ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- ☐ Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner
- ☐ Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☐ Check the X-axis, Theta-axis and Z-axis FFC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- ☐ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles

## AVS 4, 6, 7

- ☑ **Section NOT Applicable**
- ☐ Replace valve rotor seal
- ☐ Check fittings for signs of leaks
- ☐ Check tubing including autosampler tubing for kinks or excessive wear
- ☐ Check high flow pump for signs of leaks

## Instrument Adjustment

- ☑ Check position of Zn peak, adjust if required.
- ☑ Check Argon Ratio, adjust to specified value if required.
- ☑ Perform Detector Calibration.
- ☑ Perform Instrument Calibration.
- ☑ Run Instrument Performance Test and record results in Instrument Performance Test Results Table - Post PM.
- ☑ For systems using ICP Expert version 7.3 and above run the following Instrument tests and record the result in the Instrument Test Results Table
  - ☑ Subsystem Communications Test
  - ☑ Air Flow



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## ICP-OES Parts List Table

| Part description | Part Number | Product /Model # where used | Quantity Consumed |
|---|---|---|---|
| Axial Pre-Optic Window | G8010-68014 | G8010A, G8011A, G8014A/G8015A | 1 |
| Radial Pre-Optic Window | G8010-68015 | All | 1 |
| Polyclear Cooling Fluid | G3292-80010 | G8481A | |
| Purge Gas Filter | G8010-60136 | All | 1 |
| Air inlet filter | G8000-68002 | All | 1 |
| High Capacity Air Filter | G8010-60189 | Optional | |
| Rotor seal for 6-7 port valve for AVS6/7 | G8494-60002 | G8494A/G8495 | |
| Rotor seal for 4 port valve for AVS4 | G8493-60002 | G8493A | |
| Rinse solution to rinse station 2.5mm id x 1m | G8410-80123 | SPS 4 | |
| Barb connector 2.5mm-1.5mm ID | G8410-80124 | SPS 4 | |
| PVC waste tubing,8mm od x 5mm id, 2m | G8410-80122 | SPS 4 | |
| **Additional Parts may be required from engineers stock:** | | | |
| X axis drive belt | 5410047500 | SPS 3 | |
| Z axis drive belt | 5410047400 | SPS 3 | |
| Peristaltic pump tubing, PVC SolvaFlex, 3 bridged, | 3710049000 | SPS 4 | |

## Restore system

For HF applications, ask the customer to reinstall their sample introduction system.

Leave system in an idle state: on and purging.

Guidance: If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

## Service Review

- ☑ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☑ Complete the Service Engineer Comments section below if there are additional comments.



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## ICP-OES Status Results Table

Note: These measurements do not form part of any specification and are for reference only.

| Measurement | Standby Mode | | Plasma On | |
|---|---|---|---|---|
| Mains Voltage | 224.540 | VAC | 217.973 | VAC |
| Mains Current | 0.204 | A | 0.104 | A |
| Instrument Temperature | 22.8 | °C | 22.7 | °C |
| RF Air Flow (sensor speed) | 15.0 | Hz | 19.0 | Hz |
| Plasma Exhaust Temperature | No measurement | | 26.7 | °C |
| Water Flow Oscillator | No measurement | | 1.64 | L/min |
| Water Flow Detector | 1.06 | L/min | 1.06 | L/min |
| Water Inlet Temperature | 18.0 | °C | 18.0 | °C |
| Polychromator Temperature | 35.0 | °C | 35.0 | °C |
| CCD Temperature | -39.8 | °C | -39.8 | °C |
| Thermal Stabilizer | 35.0 | °C | 35.0 | °C |
| Argon Supply Pressure | 671.94 | kPa | 687.33 | kPa |
| Purge Gas Supply Pressure*1 | 674.90 | kPa | 645.40 | kPa |
| Option Gas Supply Pressure*1 | N/A | kPa | N/A | kPa |
| Nebulizer Flow | No measurement | | 0.70 | L/min |
| Nebulizer Back Pressure | No measurement | | 164.63 | kPa |
| Plasma Gas Flow | No measurement | | 11.98 | L/min |
| Auxiliary Gas Flow | No measurement | | 1.00 | L/min |
| RF Power | No measurement | | 1800 | W |
| RF Supply Current | No measurement | | 8.663 | A |
| RF Supply Voltage | No measurement | | 184.660 | V |

*1 If option installed



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**Report Summary**

| | |
|---|---|
| Instrument Model | Agilent 5100/5110 VDV ICP-OES |
| Instrument ID | G8011A/G8015A |
| Instrument Serial Number | MY18030001 |
| Software Version | 7.3.1.9507 |
| Firmware Version | 3442 |
| Tested By | Test Before PM |
| Test Completed On | 11/30/2022 9:35:32 AM |

**Result Summary**

| | |
|---|---|
| Subsystem Communications Test | Skipped |
| Air Flow Test | Skipped |
| Water Flow Test | Skipped |
| Gas Flows Test | Skipped |
| RF Generator Test | Skipped |
| Camera Test | Skipped |
| Optics Test | Skipped |
| Advanced Valve System Test | Skipped |
| Resolution Test | Pass |
| Sensitivity Test | Pass |
| Precision Test | Pass |



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Agilent Technologies

**Agilent 5110 and 5100 ICP-OES**
**Preventive Maintenance Checklist**

- ☑ Review the service and any test results with the customer.
- ☑ If the Instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.

## Service Engineer Comments (optional)

If there are any specific points you wish to note as part of performing the installation or other items of interest for the customer, please write in this box.

## Other Important Customer Web Links

How to get information on your product:

- ☑ Literature Library - http://www.agilent.com/en-us/products/icp-oes/icp-oes-systems/5110-icp-oes#literature
- ☑ Need to know more? - http://www.agilent.com/crosslab/university/
- ☑ Need technical support, FAQs? - http://www.agilent.com/en-us/support/landing/icp-oes
- ☑ Need supplies? - www.agilent.com/chem/supplies

## Service Completion

Service request number 6005625287 Date service completed 30 NOV 2022

Agilent signature _____ Customer signature _____

Document part number: G8014-90075


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**Sensitivity Test** **Pass**

Radial

| Element Wavelength | Specification | Method | Ratio | Standard | Blank |
|---|---|---|---|---|---|
| As (188.980 nm) | ≥ 46.0 | SRBR | 147.7 | 1156.5 | 55.5 |
| Se (196.026 nm) | ≥ 41.0 | SRBR | 111.1 | 1195.3 | 97.7 |
| Zn (213.857 nm) | ≥ 1421.0 | SRBR | 4100.6 | 51959.5 | 159.6 |
| Pb (220.353 nm) | ≥ 46.0 | SRBR | 192.5 | 2808.6 | 185.7 |
| Mn (257.610 nm) | ≥ 3518.0 | SRBR | 11064.7 | 264165.0 | 567.6 |
| Al (396.152 nm) | ≥ 3.4 | SBR | 7.5 | 49047.9 | 5770.5 |
| Ba (493.408 nm) | ≥ 34.0 | SBR | 107.4 | 1887710.3 | 17407.5 |
| K (766.491 nm) | ≥ 1.8 | SBR | 5.1 | 100805.9 | 16626.4 |

Axial

| Element Wavelength | Specification | Method | Ratio | Standard | Blank |
|---|---|---|---|---|---|
| As (188.980 nm) | ≥ 208.0 | SRBR | 234.9 | 3056.4 | 152.9 |
| Se (196.026 nm) | ≥ 159.0 | SRBR | 218.1 | 3865.1 | 271.6 |
| Zn (206.200 nm) | ≥ 234.0 | SRBR | 1306.5 | 15850.4 | 144.5 |
| Zn (213.857 nm) | ≥ 1743.0 | SRBR | 8364.0 | 183037.8 | 476.4 |
| Cd (214.439 nm) | ≥ 4227.0 | SRBR | 7718.5 | 143240.2 | 342.8 |
| Pb (220.353 nm) | ≥ 320.0 | SRBR | 576.3 | 14465.2 | 580.4 |
| Mn (257.610 nm) | ≥ 10625.0 | SRBR | 31842.1 | 1411257.3 | 1958.9 |
| Cr (267.716 nm) | ≥ 1048.0 | SRBR | 4492.1 | 183110.6 | 1632.2 |
| Cu (324.754 nm) | ≥ 19.0 | SBR | 46.2 | 371487.5 | 7862.9 |
| Al (396.152 nm) | ≥ 6.0 | SBR | 14.9 | 278447.4 | 17552.6 |
| Ba (493.408 nm) | ≥ 60.0 | SBR | 190.6 | 10061527.3 | 52519.8 |
| K (766.491 nm) | ≥ 24.0 | SBR | 36.8 | 1922163.4 | 50858.1 |



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**Resolution Test** **Pass**

| Element Wavelength | Specification | Width |
|---|---|---|
| N (174.213 nm) | ≤ 9.40 | 6.62 |
| As (188.980 nm) | ≤ 8.20 | 6.20 |
| C (193.027 nm) | ≤ 11.50 | 8.35 |
| Mo (202.032 nm) | ≤ 8.20 | 6.41 |
| Cr (206.158 nm) | ≤ 13.40 | 9.04 |
| Zn (213.857 nm) | ≤ 8.70 | 6.62 |
| Pb (220.353 nm) | ≤ 9.50 | 7.13 |
| Co (228.615 nm) | ≤ 17.20 | 11.71 |
| Ba (230.424 nm) | ≤ 9.40 | 7.21 |
| Mn (257.610 nm) | ≤ 13.30 | 9.50 |
| Mn (260.568 nm) | ≤ 20.30 | 14.33 |
| Cr (267.716 nm) | ≤ 11.00 | 8.14 |
| Cu (324.754 nm) | ≤ 25.00 | 18.98 |
| Cu (327.395 nm) | ≤ 14.20 | 11.24 |
| Sr (338.071 nm) | ≤ 33.50 | 24.47 |
| Ba (455.403 nm) | ≤ 44.00 | 33.88 |
| Sr (460.733 nm) | ≤ 36.00 | 17.22 |
| Ba (493.408 nm) | ≤ 36.00 | 25.48 |
| Ba (614.171 nm) | ≤ 42.00 | 25.47 |
| Ar (675.283 nm) | ≤ 74.00 | 59.82 |
| K (766.491 nm) | ≤ 80.00 | 64.94 |



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**Report Summary**

| | |
|---|---|
| Instrument Model | Agilent 5100/5110 VDV ICP-OES |
| Instrument ID | G8011A/G8015A |
| Instrument Serial Number | MY18030001 |
| Software Version | 7.3.1.9507 |
| Firmware Version | 3442 |
| Tested By | PM Functional test |
| Test Completed On | 11/30/2022 11:43:36 AM |

**Result Summary**

| | |
|---|---|
| Subsystem Communications Test | Pass |
| Air Flow Test | Pass |
| Water Flow Test | Pass |
| Gas Flows Test | Pass |
| RF Generator Test | Pass |
| Camera Test | Pass |
| Optics Test | Skipped |
| Advanced Valve System Test | Skipped |
| Resolution Test | Skipped |
| Sensitivity Test | Skipped |
| Precision Test | Skipped |

**Subsystem Communications Test** **Pass**

**Air Flow Test** **Pass**

| 30% Air Flow (relative speed) | 75% Air Flow (relative speed) |
|---|---|
| 14.00 | 19.00 |

**Water Flow Test** **Pass**

| RF Water Flow(L/min) | Camera Water Flow (L/min) | Water Inlet Temperature (°C) |
|---|---|---|
| 1.44 | 1.05 | 18.51 |



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**Precision Test** **Pass**

Radial

| Element Wavelength | Specification | Measured Value % RSD |
|---|---|---|
| As (188.980 nm) | ≤ 2.60 | 0.82 |
| Se (196.026 nm) | ≤ 2.60 | 0.71 |
| Zn (213.857 nm) | ≤ 1.50 | 0.43 |
| Pb (220.353 nm) | ≤ 2.60 | 0.76 |
| Mn (257.610 nm) | ≤ 1.50 | 0.60 |
| Al (396.152 nm) | ≤ 1.50 | 0.48 |
| Ba (493.408 nm) | ≤ 1.50 | 0.89 |
| K (766.491 nm) | ≤ 1.50 | 0.42 |

Axial

| Element Wavelength | Specification | Measured Value % RSD |
|---|---|---|
| As (188.980 nm) | ≤ 1.50 | 0.57 |
| Se (196.026 nm) | ≤ 1.50 | 0.76 |
| Zn (206.200 nm) | ≤ 1.50 | 0.61 |
| Zn (213.857 nm) | ≤ 1.50 | 0.51 |
| Cd (214.439 nm) | ≤ 1.50 | 0.55 |
| Pb (220.353 nm) | ≤ 1.50 | 0.52 |
| Mn (257.610 nm) | ≤ 1.50 | 0.54 |
| Cr (267.716 nm) | ≤ 1.50 | 0.54 |
| Cu (324.754 nm) | ≤ 1.50 | 0.69 |
| Al (396.152 nm) | ≤ 1.50 | 0.91 |
| Ba (493.408 nm) | ≤ 1.50 | 0.85 |
| K (766.491 nm) | ≤ 1.50 | 1.22 |



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## Report Summary

| | |
|---|---|
| Instrument Model | Agilent 5100/5110 VDV ICP-OES |
| Instrument ID | G8011A/G8015A |
| Instrument Serial Number | MY18030001 |
| Software Version | 7.3.1.9507 |
| Firmware Version | 3442 |
| Tested By | PM Performance test |
| Test Completed On | 11/30/2022 12:10:42 PM |

## Result Summary

| | |
|---|---|
| Subsystem Communications Test | Skipped |
| Air Flow Test | Skipped |
| Water Flow Test | Skipped |
| Gas Flows Test | Skipped |
| RF Generator Test | Skipped |
| Camera Test | Skipped |
| Optics Test | Pass |
| Advanced Valve System Test | Skipped |
| Resolution Test | Pass |
| Sensitivity Test | Pass |
| Precision Test | Pass |

## Optics Test

Pass

| | Radial | Axial |
|---|---|---|
| Intensity | 5674608 | 5823476 |
| Wavelength | 737.212 | 737.212 |



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## Gas Flows Test

Pass

| Nebulizer Target Flow | Actual Flow | Back Pressure | Auxiliary Target Flow | Actual Flow | Back Pressure |
|---|---|---|---|---|---|
| 0.70 | 0.70 | 163.37 | 2.00 | 1.99 | 108.49 |

| Makeup Target Flow | Actual Flow | Back Pressure | Plasma Target Flow | Actual Flow | Back Pressure |
|---|---|---|---|---|---|
| 2.00 | 2.00 | 112.85 | 18.00 | 17.91 | 23.46 |

## RF Generator Test

Pass

| | |
|---|---|
| RF Power Supply Test | Passed |
| RF Power Supply (V) | 147.437 |
| RF Oscillator Test | Passed |
| RF Oscillator Frequency (MHz) | 0.000 |
| Work Coil Current (A) | 45.069 |
| RF Power Supply Current (A) | 1.997 |

## Camera Test

Pass

| | Integration Time (ms) | Standard Deviation | Status |
|---|---|---|---|
| Electronic Offset Test | 1000 | 5.305 | Passed |
| Dark Current Test | 6000 | 0.578 | Passed |
| Array Test | 5 | 0.024 | Passed |
| Linearity Test | | 0.118 | Passed |



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**Sensitivity Test** **Pass**

Radial

| Element Wavelength | Specification | Method | Ratio | Standard | Blank |
|---|---|---|---|---|---|
| As (188.980 nm) | ≥ 46.0 | SRBR | 147.8 | 1149.3 | 54.8 |
| Se (196.026 nm) | ≥ 41.0 | SRBR | 111.6 | 1222.8 | 101.0 |
| Zn (213.857 nm) | ≥ 1421.0 | SRBR | 4375.0 | 52592.3 | 143.7 |
| Pb (220.353 nm) | ≥ 46.0 | SRBR | 199.8 | 2744.4 | 166.5 |
| Mn (257.610 nm) | ≥ 3518.0 | SRBR | 12801.7 | 285591.3 | 496.0 |
| Al (396.152 nm) | ≥ 3.4 | SBR | 9.9 | 52888.6 | 4873.6 |
| Ba (493.408 nm) | ≥ 34.0 | SBR | 154.6 | 2287291.6 | 14698.1 |
| K (766.491 nm) | ≥ 1.8 | SBR | 6.4 | 106701.6 | 14350.9 |

Axial

| Element Wavelength | Specification | Method | Ratio | Standard | Blank |
|---|---|---|---|---|---|
| As (188.980 nm) | ≥ 208.0 | SRBR | 242.4 | 3170.1 | 154.8 |
| Se (196.026 nm) | ≥ 159.0 | SRBR | 226.1 | 4134.5 | 289.3 |
| Zn (206.200 nm) | ≥ 234.0 | SRBR | 1126.6 | 13782.0 | 146.5 |
| Zn (213.857 nm) | ≥ 1743.0 | SRBR | 8400.8 | 177166.3 | 442.5 |
| Cd (214.439 nm) | ≥ 4227.0 | SRBR | 7001.9 | 125884.2 | 321.6 |
| Pb (220.353 nm) | ≥ 320.0 | SRBR | 536.3 | 12909.3 | 532.6 |
| Mn (257.610 nm) | ≥ 10625.0 | SRBR | 30846.2 | 1287989.0 | 1738.8 |
| Cr (267.716 nm) | ≥ 1048.0 | SRBR | 4396.0 | 167335.6 | 1424.4 |
| Cu (324.754 nm) | ≥ 19.0 | SBR | 52.1 | 373690.7 | 7033.1 |
| Al (396.152 nm) | ≥ 6.0 | SBR | 16.8 | 268357.7 | 15112.4 |
| Ba (493.408 nm) | ≥ 60.0 | SBR | 225.2 | 10173441.5 | 44971.7 |
| K (766.491 nm) | ≥ 24.0 | SBR | 39.7 | 1874136.2 | 46055.7 |



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**Resolution Test** **Pass**

| Element Wavelength | Specification | Width |
|---|---|---|
| N (174.213 nm) | ≤ 9.40 | 6.79 |
| As (188.980 nm) | ≤ 8.20 | 6.09 |
| C (193.027 nm) | ≤ 11.50 | 8.29 |
| Mo (202.032 nm) | ≤ 8.20 | 6.30 |
| Cr (206.158 nm) | ≤ 13.40 | 9.05 |
| Zn (213.857 nm) | ≤ 8.70 | 6.77 |
| Pb (220.353 nm) | ≤ 9.50 | 7.02 |
| Co (228.615 nm) | ≤ 17.20 | 11.67 |
| Ba (230.424 nm) | ≤ 9.40 | 7.39 |
| Mn (257.610 nm) | ≤ 13.30 | 9.48 |
| Mn (260.568 nm) | ≤ 20.30 | 14.25 |
| Cr (267.716 nm) | ≤ 11.00 | 7.94 |
| Cu (324.754 nm) | ≤ 25.00 | 18.99 |
| Cu (327.395 nm) | ≤ 14.20 | 11.33 |
| Sr (338.071 nm) | ≤ 33.50 | 24.44 |
| Ba (455.403 nm) | ≤ 44.00 | 33.86 |
| Sr (460.733 nm) | ≤ 36.00 | 17.51 |
| Ba (493.408 nm) | ≤ 36.00 | 25.56 |
| Ba (614.171 nm) | ≤ 42.00 | 24.96 |
| Ar (675.283 nm) | ≤ 74.00 | 59.38 |
| K (766.491 nm) | ≤ 80.00 | 65.63 |



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**Precision Test** **Pass**

Radial

| Element Wavelength | Specification | Measured Value % RSD |
|---|---|---|
| As (188.980 nm) | ≤ 2.60 | 0.60 |
| Se (196.026 nm) | ≤ 2.60 | 0.84 |
| Zn (213.857 nm) | ≤ 1.50 | 0.29 |
| Pb (220.353 nm) | ≤ 2.60 | 0.59 |
| Mn (257.610 nm) | ≤ 1.50 | 0.28 |
| Al (396.152 nm) | ≤ 1.50 | 0.28 |
| Ba (493.408 nm) | ≤ 1.50 | 0.59 |
| K (766.491 nm) | ≤ 1.50 | 0.23 |

Axial

| Element Wavelength | Specification | Measured Value % RSD |
|---|---|---|
| As (188.980 nm) | ≤ 1.50 | 0.71 |
| Se (196.026 nm) | ≤ 1.50 | 0.43 |
| Zn (206.200 nm) | ≤ 1.50 | 0.46 |
| Zn (213.857 nm) | ≤ 1.50 | 0.37 |
| Cd (214.439 nm) | ≤ 1.50 | 0.48 |
| Pb (220.353 nm) | ≤ 1.50 | 0.48 |
| Mn (257.610 nm) | ≤ 1.50 | 0.74 |
| Cr (267.716 nm) | ≤ 1.50 | 0.26 |
| Cu (324.754 nm) | ≤ 1.50 | 0.51 |
| Al (396.152 nm) | ≤ 1.50 | 0.45 |
| Ba (493.408 nm) | ≤ 1.50 | 0.81 |
| K (766.491 nm) | ≤ 1.50 | 0.84 |



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