

ภาคผนวก ณ

ใบรับรองการสอบเทียบเครื่องมือ



## รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

| Sample Name | Parameter                    | Equipment Name                  | ID No.     | Calibrated Date | Next Cal  | Freq. Calibrate (Months) |
|-------------|------------------------------|---------------------------------|------------|-----------------|-----------|--------------------------|
| Noise       | Leq 24 hrs                   | Sound Calibrator                | BKK_FS0607 | 26-Jan-23       | 26-Jan-24 | 12                       |
| Noise       | Leq 24 hrs                   | Sound Level Meter               | BKK_FS0028 | 14-Mar-23       | 14-Mar-24 | 12                       |
| Noise       | Leq 24 hrs                   | Sound Level Meter               | BKK_FS0033 | 2-Nov-22        | 2-Nov-23  | 12                       |
| Noise       | Leq 24 hrs                   | Sound Level Meter               | BKK_FS0097 | 13-Dec-22       | 13-Dec-23 | 12                       |
| Noise       | Leq 24 hrs                   | Sound Calibrator                | BKK_FS0617 | 19-Oct-23       | 19-Oct-24 | 12                       |
| Noise       | Leq 24 hrs                   | Sound Level Meter               | BKK_FS0108 | 19-Jan-23       | 19-Jan-24 | 12                       |
| Noise       | Leq 24 hrs                   | Sound Level Meter               | BKK_FS0115 | 3-Jan-23        | 3-Jan-24  | 12                       |
| Noise       | Leq 24 hrs                   | Sound Level Meter               | BKK_FS0971 | 19-Jan-23       | 19-Jan-24 | 12                       |
| Water Lab   | pH at 25 °C                  | pH meter                        | BKK_EN0072 | 12-Sep-22       | 12-Mar-24 | 18                       |
| Water Lab   | Total Alkalinity             | Burette                         | BKK_EN0171 | 30-Aug-22       | 1-Mar-24  | 18                       |
| Water Lab   | Total Hardness               | Burette                         | BKK_EN0171 | 30-Aug-22       | 1-Mar-24  | 18                       |
| Water Lab   | Color                        | Chamber (Cold Room)             | BKK_EN0167 | 30-Jun-22       | 30-Dec-23 | 18                       |
| Water Lab   | Turbidity                    | Chamber (Cold Room)             | BKK_EN0167 | 30-Jun-22       | 30-Dec-23 | 18                       |
| Water Lab   | Dissolved Oxygen             | Burette                         | BKK_EN0171 | 30-Aug-22       | 1-Mar-24  | 18                       |
| Water Lab   | Dissolved Oxygen             | Chamber (Cold Room)             | BKK_EN0167 | 30-Jun-22       | 30-Dec-23 | 18                       |
| Water Lab   | Nitrate                      | Ion Chromatography              | BKK_EN0069 | 12-Jan-23       | 12-Jan-24 | 12                       |
| Water Lab   | Phosphate                    | Ion Chromatography              | BKK_EN0069 | 12-Jan-23       | 12-Jan-24 | 12                       |
| Water Lab   | Chloride                     | Ion Chromatography              | BKK_EN0069 | 12-Jan-23       | 12-Jan-24 | 12                       |
| Water Lab   | Sulfate                      | Ion Chromatography              | BKK_EN0069 | 12-Jan-23       | 12-Jan-24 | 12                       |
| Water Lab   | Total Suspended Solids       | Electronic Top-Loading Balance  | BKK_EN0002 | 8-Feb-23        | 8-Feb-24  | 12                       |
| Water Lab   | Total Suspended Solids       | Oven                            | BKK_EN0273 | 29-Nov-22       | 29-May-24 | 18                       |
| Water Lab   | Total Solids                 | Electronic Top-Loading Balance  | BKK_EN0002 | 8-Feb-23        | 8-Feb-24  | 12                       |
| Water Lab   | Total Solids                 | Oven                            | BKK_EN0273 | 29-Nov-22       | 29-May-24 | 18                       |
| Water Lab   | Total Dissolved Solids 180°C | Electronic Top-Loading Balance  | BKK_EN0002 | 8-Feb-23        | 8-Feb-24  | 12                       |
| Water Lab   | Total Dissolved Solids 180°C | Oven                            | BKK_EN0273 | 29-Nov-22       | 29-May-24 | 18                       |
| Water Lab   | Total Kjeldahl Nitrogen      | Digestion Unit                  | BKK_EN0366 | 17-May-23       | 17-May-24 | 12                       |
| Water Lab   | Total Kjeldahl Nitrogen      | Discrete analyzer               | BKK_EN0037 | 12-Jul-23       | 12-Jul-24 | 12                       |
| Water Lab   | Conductivity                 | Conductivity meter              | BKK_EN0373 | 3-Jan-23        | 3-Jan-24  | 12                       |
| Water Lab   | Salinity                     | Conductivity meter              | BKK_EN0373 | 3-Jan-23        | 3-Jan-24  | 12                       |
| Water Lab   | BOD                          | DO Meter                        | BKK_EN0205 | 3-Aug-22        | 3-Feb-24  | 18                       |
| Water Lab   | BOD                          | Incubator                       | BKK_EN0272 | 5-Jul-23        | 5-Jul-24  | 12                       |
| Water Lab   | COD                          | Hot Block                       | BKK_EN0222 | 25-Apr-23       | 25-Apr-24 | 12                       |
| Water Lab   | COD                          | Spectrophotometer               | BKK_EN0018 | 15-Sep-23       | 15-Sep-24 | 12                       |
| Water Lab   | Oil & Grease                 | Electronic Top-Loading Balance  | BKK_EN0002 | 8-Feb-23        | 8-Feb-24  | 12                       |
| Water Lab   | Oil & Grease                 | Water Bath                      | BKK_EN0148 | 4-Jul-23        | 4-Jan-25  | 18                       |
| Water Lab   | Temperature                  | Digital Thermometer With Sensor | BKK_LG0055 | 24-Aug-23       | 24-Aug-24 | 12                       |
| Water Lab   | Temperature                  | Digital Thermometer With Sensor | BKK_LG0054 | 24-Aug-23       | 24-Aug-24 | 12                       |
| Water Lab   | Hexavalent Chromium          | Spectrophotometer               | BKK_EN0018 | 15-Sep-23       | 15-Sep-24 | 12                       |
| Water Lab   | Iron                         | ICP-MS                          | BKK_EL0043 | 6-Apr-23        | 6-Oct-24  | 18                       |
| Water Lab   | Iron                         | Hot Block                       | BKK_EL0054 | 22-Sep-23       | 22-Mar-25 | 18                       |
| Water Lab   | Iron                         | Chamber (Cold Room)             | BKK_EN0167 | 30-Jun-22       | 30-Dec-23 | 18                       |
| Water Lab   | Lead                         | ICP-MS                          | BKK_EL0043 | 6-Apr-23        | 6-Oct-24  | 18                       |
| Water Lab   | Lead                         | Hot Block                       | BKK_EL0054 | 22-Sep-23       | 22-Mar-25 | 18                       |
| Water Lab   | Lead                         | Chamber (Cold Room)             | BKK_EN0167 | 30-Jun-22       | 30-Dec-23 | 18                       |
| Water Lab   | Manganese                    | ICP-MS                          | BKK_EL0043 | 6-Apr-23        | 6-Oct-24  | 18                       |
| Water Lab   | Manganese                    | Hot Block                       | BKK_EL0054 | 22-Sep-23       | 22-Mar-25 | 18                       |
| Water Lab   | Manganese                    | Chamber (Cold Room)             | BKK_EN0167 | 30-Jun-22       | 30-Dec-23 | 18                       |
| Water Lab   | Calcium                      | ICP-OES                         | BKK_EL0037 | 20-Mar-23       | 19-Sep-24 | 18                       |
| Water Lab   | Calcium                      | Hot Block                       | BKK_EL0054 | 22-Sep-23       | 22-Mar-25 | 18                       |
| Water Lab   | Calcium                      | Chamber (Cold Room)             | BKK_EN0167 | 30-Jun-22       | 30-Dec-23 | 18                       |
| Water Lab   | Magnesium                    | ICP-OES                         | BKK_EL0037 | 20-Mar-23       | 19-Sep-24 | 18                       |
| Water Lab   | Magnesium                    | Hot Block                       | BKK_EL0054 | 22-Sep-23       | 22-Mar-25 | 18                       |
| Water Lab   | Magnesium                    | Chamber (Cold Room)             | BKK_EN0167 | 30-Jun-22       | 30-Dec-23 | 18                       |
| Water Lab   | Copper                       | ICP-MS                          | BKK_EL0043 | 6-Apr-23        | 6-Oct-24  | 18                       |
| Water Lab   | Copper                       | Hot Block                       | BKK_EL0054 | 22-Sep-23       | 22-Mar-25 | 18                       |
| Water Lab   | Copper                       | Chamber (Cold Room)             | BKK_EN0167 | 30-Jun-22       | 30-Dec-23 | 18                       |
| Water Lab   | Cadmium                      | ICP-MS                          | BKK_EL0043 | 6-Apr-23        | 6-Oct-24  | 18                       |
| Water Lab   | Cadmium                      | Hot Block                       | BKK_EL0054 | 22-Sep-23       | 22-Mar-25 | 18                       |
| Water Lab   | Cadmium                      | Chamber (Cold Room)             | BKK_EN0167 | 30-Jun-22       | 30-Dec-23 | 18                       |



## รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

| Sample Name | Parameter      | Equipment Name      | ID No.     | Calibrated Date | Next Cal  | Freq. Calibrate (Months) |
|-------------|----------------|---------------------|------------|-----------------|-----------|--------------------------|
| Water Lab   | Zinc           | ICP-MS              | BKK_EL0043 | 6-Apr-23        | 6-Oct-24  | 18                       |
| Water Lab   | Zinc           | Hot Block           | BKK_EL0054 | 22-Sep-23       | 22-Mar-25 | 18                       |
| Water Lab   | Zinc           | Chamber (Cold Room) | BKK_EN0167 | 30-Jun-22       | 30-Dec-23 | 18                       |
| Water Lab   | Nickel         | ICP-MS              | BKK_EL0043 | 6-Apr-23        | 6-Oct-24  | 18                       |
| Water Lab   | Nickel         | Hot Block           | BKK_EL0054 | 22-Sep-23       | 22-Mar-25 | 18                       |
| Water Lab   | Nickel         | Chamber (Cold Room) | BKK_EN0167 | 30-Jun-22       | 30-Dec-23 | 18                       |
| Water Lab   | Selenium       | ICP-MS              | BKK_EL0043 | 6-Apr-23        | 6-Oct-24  | 18                       |
| Water Lab   | Selenium       | Hot Block           | BKK_EL0054 | 22-Sep-23       | 22-Mar-25 | 18                       |
| Water Lab   | Selenium       | Chamber (Cold Room) | BKK_EN0167 | 30-Jun-22       | 30-Dec-23 | 18                       |
| Water Lab   | Barium         | ICP-MS              | BKK_EL0043 | 6-Apr-23        | 6-Oct-24  | 18                       |
| Water Lab   | Barium         | Hot Block           | BKK_EL0054 | 22-Sep-23       | 22-Mar-25 | 18                       |
| Water Lab   | Barium         | Chamber (Cold Room) | BKK_EN0167 | 30-Jun-22       | 30-Dec-23 | 18                       |
| Water Lab   | Arsenic        | ICP-MS              | BKK_EL0043 | 6-Apr-23        | 6-Oct-24  | 18                       |
| Water Lab   | Arsenic        | Hot Block           | BKK_EL0054 | 22-Sep-23       | 22-Mar-25 | 18                       |
| Water Lab   | Arsenic        | Chamber (Cold Room) | BKK_EN0167 | 30-Jun-22       | 30-Dec-23 | 18                       |
| Water Lab   | Mercury        | DUO-CVAFS / CVAAS   | BKK_EL0023 | 24-May-23       | 24-May-24 | 12                       |
| Water Lab   | Total Coliform | Autoclave           | BKK_ML0037 | 17-Jul-23       | 17-Jan-25 | 18                       |
| Water Lab   | Total Coliform | Incubator           | BKK_ML0010 | 17-Jul-23       | 17-Jan-25 | 18                       |
| Water Lab   | Total Coliform | Hot Air Oven        | BKK_ML0013 | 21-Nov-22       | 21-May-24 | 18                       |
| Water Lab   | Fecal Coliform | Autoclave           | BKK_ML0037 | 17-Jul-23       | 17-Jan-25 | 18                       |
| Water Lab   | Fecal Coliform | Incubator           | BKK_ML0010 | 17-Jul-23       | 17-Jan-25 | 18                       |
| Water Lab   | Fecal Coliform | Hot Air Oven        | BKK_ML0013 | 21-Nov-22       | 21-May-24 | 18                       |
| Water Lab   | Fecal Coliform | Water Bath          | BKK_ML0056 | 20-Apr-23       | 20-Apr-24 | 12                       |

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACC23008  
Pages : 1 of 3

## Calibration Certificate

Equipment : SOUND CALIBRATOR  
Manufacturer : RION  
Model : NC-73  
Serial No. : 10196929  
ID No. : BKK\_FS0607

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTANAKAN 40, PHATTANAKAN ROAD,  
KHWAENG PHATTANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location : -  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 24 JANUARY 2023  
Calibration Date : 26 JANUARY 2023  
Date of Issue : 27 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced  
other than in full, except with the prior written approval of the head of Calibration Laboratory.

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACC23008  
Job No. : VC66AC0031  
Pages : 2 of 3

Calibration Procedure : CP-AC-03

## Calibration Method :

This equipment was calibrated by based on IEC-60942-2003 Standard.

The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

| Instrument              | Model     | Serial No. | Cert. No.      | Due Date  |
|-------------------------|-----------|------------|----------------|-----------|
| Waveform Generator      | 33511B    | MY52302742 | EF-0008-22     | 04-Feb-23 |
| Digital Multimeter      | 33461A    | MY53220104 | EEL_BP_04/0265 | 09-Feb-23 |
| Digital Multimeter      | 33461A    | MY53220076 | EEL_BP_03/0265 | 09-Feb-23 |
| Digital Multimeter      | 33461A    | MY60024273 | EEL_BP_05/0265 | 09-Feb-23 |
| Programmable Attenuator | MAT-1070  | 62100114   | EF-0009-22     | 07-Feb-23 |
| Condenser Microphone    | 4180      | 2977900    | AA-1013-22     | 24-Feb-23 |
| Measuring Amplifier     | NA-42KAI  | 34560495   | AA-3005-22     | 22-Feb-23 |
| Audio Analyzer          | AVR-3360A | V744B6069  | EF-0010-22     | 07-Feb-23 |

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Cert. No. : ACC23008  
Job No. : VC66AC0031  
Pages : 3 of 3

**Result of calibration :**

**1. Sound pressure level**

| Specified sound pressure level (dB) | Measured value (dB) | Deviated value (dB) | Uncertainty (dB) | Tolerance limit (dB) |
|-------------------------------------|---------------------|---------------------|------------------|----------------------|
| 94                                  | 93.7                | -0.30               | 3.91             | 0.40                 |

**2. Frequency**

| Specified Frequency (Hz) | Measured value (Hz) | Deviated value (%) | Uncertainty (%) | Tolerance limit (%) |
|--------------------------|---------------------|--------------------|-----------------|---------------------|
| 1000                     | 978.7               | -2.1               | 0.1             | 1.0                 |

**3. Total distortion**

| Measured value (%) | Uncertainty (%) | Tolerance limit (%) |
|--------------------|-----------------|---------------------|
| 1.70               | 0.10            | 3.0                 |

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

End of Calibration Certificate

QF-TS12-04-04-020664

**Certificate of Calibration**

**Customer**

Name : ALS Laboratory Group Thailand Co., Ltd.  
Address : 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang, Bangkok 10250

Certificate No : 23-SLM-091  
Request No : Req-2023-0517

**Unit Under Calibration Details**

Measurement item : Sound Level Meter  
Microphone Class : 2  
Manufacturer : RION  
Microphone Model : UC-52  
Model : NL-42  
Microphone S/N : 157228  
Serial Number : 00710644  
Preamplifier Model : NH-24  
ID : BKCF-50028  
Preamplifier S/N : 10645  
Resolution : 0.1 dB  
Instrument Status : Used

**Calibration Environment and Details**

Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 1 March 2023  
Calibrated Date : 14 March 2023  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

**Reference Standard**

| Instrument                 | Brand   | Model     | S/N       | Due calibration | Traceability |
|----------------------------|---------|-----------|-----------|-----------------|--------------|
| Standard Microphone        | GRAS    | 40AN      | 188273    | 6 October 2023  | GRAS         |
| Multi-frequency Calibrator | Quest   | Quest-cal | EFA000234 | 29 June 2023    | TSH          |
| Audio Generator            | Svanick | Svan401   | 131       | 12 October 2023 | WK Electric  |

**Note**

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

Calibrated By : *me*

Mr. Noppon Luangrat  
Calibration Officer

Approved By : *me*

Mr. Pait Mahaveen  
Calibration Engineer Supervisor

Issue Date : 14 March 2023

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ISM-709-SLM-01 Rev.0 Issue date 01/07/19

Certificate No : 23-SLM-091  
Request No : Req-2023-0517

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

| UUC Setting        | Nominal    | Before Adjust | Adjust   | UNCERTAINTY | Acceptance |
|--------------------|------------|---------------|----------|-------------|------------|
| FAST / A / 30-130  | Level (dB) | UUC (dB)      | ERR (dB) | UUC (dB)    | ERR (dB)   |
| Calibrator Setting | (dB)       | (dB)          | (dB)     | (± dB)      | (± dB)     |
| 1000 Hz 114.00 dB  | 113.79     | 113.9         | +0.11    | 113.8       | +0.01      |
|                    |            |               |          | 0.20        | 0.3        |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 58079

**2. Self-generated noise, Microphone installed**

| UUC Setting   | Measured | UNCERTAINTY |
|---------------|----------|-------------|
| FAST / 30-130 | (dB)     | (± dB)      |
| UUC Weighting | (dB)     | (± dB)      |
| A             | 14.9     | 0.10        |

**3. Self-generated noise, Microphone replaced by the electrical input signal device**

| UUC Setting   | Measured | UNCERTAINTY |
|---------------|----------|-------------|
| FAST / 30-130 | (dB)     | (± dB)      |
| UUC Weighting | (dB)     | (± dB)      |
| A             | 11.7     | 0.10        |
| C             | 16.1     | 0.10        |
| Z             | 20.6     | 0.10        |

**4. Acoustic signal test of frequency weightings (Without Windscreen)**

| UUC Setting   | Deviation from various Frequency Weighting Response curve | UNCERTAINTY | Acceptance   |
|---------------|---|-------------|--------------|
| FAST / 30-130 | A C Z   | (± dB)      | Limit (± dB) |
| STD Setting   | (dB) (dB) (dB)  | (± dB)      | (± dB)       |
| 125 Hz        | 0.4 0.5 0.5   | 0.50        | 1.5          |
| 1000 Hz       | 0.0 0.0 0.0   | 0.60        | 1.0          |
| 4000 Hz       | -1.1 -1.1 -1.1  | 0.60        | 3.0          |
| 8000 Hz       | -1.8 -1.7 -1.8  | 0.70        | 3.0          |

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**5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz**

| UUC Setting   | Deviation from various Frequency Weighting Response curve | UNCERTAINTY | Acceptance   |
|---------------|---|-------------|--------------|
| FAST / 30-130 | A (dB) C (dB) Z (dB)                                      | (± dB)      | Limit (± dB) |
| STD Setting   | (dB) (dB) (dB)  | (± dB)      | (± dB)       |
| 63 Hz         | -0.2 -0.1 -0.1  | 0.2         | 2.0          |
| 125 Hz        | -0.1 0.0 -0.1   | 0.2         | 1.5          |
| 250 Hz        | -0.1 0.0 0.0  | 0.2         | 1.5          |
| 500 Hz        | -0.1 0.0 0.0  | 0.2         | 1.5          |
| 1000 Hz       | 0.0 0.0 0.0   | 0.2         | 1.0          |
| 2000 Hz       | 0.0 0.0 0.0   | 0.2         | 2.0          |
| 4000 Hz       | 0.0 0.0 0.0   | 0.2         | 3.0          |
| 8000 Hz       | 0.0 0.0 0.0   | 0.2         | 5            |
| 16000 Hz      | -1.4 -1.4 0.0   | 0.2         | +5, -INF.    |

**6. Frequency and time weightings at 1kHz**

| UUC Setting       | STD    | Measured  | UNCERTAINTY | Acceptance   |
|-------------------|--------|-----------|-------------|--------------|
| FAST / 30-130     | REF    | UUC ERR   | (± dB)      | Limit (± dB) |
| UUC Weighting     | (dB)   | (dB) (dB) | (± dB)      | (± dB)       |
| A                 | 114.00 | 114.0 0.0 | 0.2         | 0.2          |
| C                 | 114.00 | 114.0 0.0 | 0.2         | 0.2          |
| Z                 | 114.00 | 114.0 0.0 | 0.2         | 0.2          |
| UUC Setting       | STD    | Measured  | UNCERTAINTY | Acceptance   |
| 30-130 / A        | REF    | UUC ERR   | (± dB)      | Limit (± dB) |
| UUC Time Response | (dB)   | (dB) (dB) | (± dB)      | (± dB)       |
| Fast              | 114.00 | 114.0 0.0 | 0.2         | 0.1          |
| Slow              | 114.00 | 114.0 0.0 | 0.2         | 0.1          |
| Leq               | 114.00 | 114.0 0.0 | 0.2         | 0.1          |

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#### 7. Long Term Stability

| UUC Setting       | Measured | UNCERTAINTY | Acceptance |
|-------------------|----------|-------------|------------|
| FAST / A / 30-130 | UUC      |             | Limit      |
| STD Setting       | (dB)     | (± dB)      | (± dB)     |
| Initial           | 114.0    |             |            |
| Final             | 114.0    |             |            |
| Deviated          | 0.0      | 0.1         | 0.3        |

#### 8. Level linearity on the reference level range

| UUC Setting       | Anticipated | Deviation | UNCERTAINTY | Acceptance |
|-------------------|-------------|-----------|-------------|------------|
| FAST / A / 30-130 | REF         | UUC       | ERR         | Limit      |
| STD dB            | (dB)        | (dB)      | (dB)        | (± dB)     |
| 130.00            | 130         | 130.0     | 0.0         | 1.1        |
| 129.00            | 129         | 129.0     | 0.0         | 1.1        |
| 124.00            | 124         | 124.0     | 0.0         | 1.1        |
| 119.00            | 119         | 119.0     | 0.0         | 1.1        |
| 114.00            | 114         | 114.0     | 0.0         | 1.1        |
| 109.00            | 109         | 109.0     | 0.0         | 1.1        |
| 104.00            | 104         | 104.0     | 0.0         | 1.1        |
| 99.00             | 99          | 99.0      | 0.0         | 1.1        |
| 94.00             | 94          | 94.0      | 0.0         | 1.1        |
| 89.00             | 89          | 89.0      | 0.0         | 1.1        |
| 84.00             | 84          | 84.0      | 0.0         | 1.1        |
| 79.00             | 79          | 79.0      | 0.0         | 1.1        |
| 74.00             | 74          | 74.0      | 0.0         | 1.1        |
| 69.00             | 69          | 69.0      | 0.0         | 1.1        |
| 64.00             | 64          | 64.0      | 0.0         | 1.1        |
| 59.00             | 59          | 59.0      | 0.0         | 1.1        |
| 54.00             | 54          | 54.0      | 0.0         | 1.1        |
| 49.00             | 49          | 49.0      | 0.0         | 1.1        |
| 44.00             | 44          | 44.0      | 0.0         | 1.1        |
| 39.00             | 39          | 39.1      | 0.1         | 1.1        |
| 34.00             | 34          | 34.2      | 0.2         | 1.1        |
| 29.00             | 29          | 29.5      | 0.5         | 1.1        |
| 24.00             | 24          | 24.6      | 0.6         | 1.1        |

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FSM-700-SLM-01 Rev.0 Issue date 01/07/19

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Request No : Req-2023-0517

#### 12. Overload indication

| UUC Setting             | Measured | UNCERTAINTY | Acceptance |
|-------------------------|----------|-------------|------------|
| FAST / A / 30-130       | UUC      |             | Limit      |
| STD Setting             | (dB)     | (± dB)      | (± dB)     |
| Positive one-half cycle | 139.5    |             |            |
| Negative one-half cycle | 139.3    |             |            |
| Deviated                | 0.2      | 0.2         | 1.5        |

#### 13. High Level Stability

| UUC Setting       | Measured | UNCERTAINTY | Acceptance |
|-------------------|----------|-------------|------------|
| FAST / A / 30-130 | UUC      |             | Limit      |
| STD Setting       | (dB)     | (± dB)      | (± dB)     |
| Initial           | 129.0    |             |            |
| Final             | 129.0    |             |            |
| Deviated          | 0.0      | 0.1         | 0.3        |

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FSM-700-SLM-01 Rev.0 Issue date 01/07/19

## SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthon Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL22253  
Pages : 1 of 8

### Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 01122504 / 169436 / 72457  
**ID No.:** BKK\_FS0033

**Condition As Found :** GOOD

**Customer :** ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

**Location :** -  
**Ambient Temperature :** ( 23.0 ± 3 ) °C  
**Pressure :** ( 101.3 ± 3 ) kPa  
**Relative Humidity :** ( 50.0 ± 20 ) %

**Received Date :** 01 NOVEMBER 2022  
**Calibration Date :** 02-03 NOVEMBER 2022  
**Date of Issue :** 04 NOVEMBER 2022



**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

*T. Petchur*  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

## SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

### Continuation of Calibration Certificate

Cert. No. : ACL22253  
Job No. : VC66AC0004  
Pages : 2 of 8

**Calibration Procedure :** CP-AC-01

#### Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

#### Condition of this result of calibration :

##### 1. Reference Standard Instruments :

| Instrument              | Model    | Serial No. | Cert. No.      | Due Date  |
|-------------------------|----------|------------|----------------|-----------|
| Waveform Generator      | 33210A   | MY48017076 | EF-0007-22     | 04-Feb-23 |
| Waveform Generator      | 33511B   | MY52302742 | EF-0008-22     | 04-Feb-23 |
| Digital Multimeter      | 33461A   | MY53220104 | EEL-BP_04/0265 | 09-Feb-23 |
| Digital Multimeter      | 33461A   | MY53220076 | EEL-BP_03/0265 | 09-Feb-23 |
| Digital Multimeter      | 34461A   | MY60024273 | EEL-BP_05/0265 | 09-Feb-23 |
| Programmable Attenuator | MAT-1070 | 62100114   | EF-0009-22     | 07-Feb-23 |
| Condenser Microphone    | 4180     | 2977900    | AA-1013-22     | 24-Feb-23 |
| Measuring Amplifier     | NA-42KA1 | 34560495   | AA-3005-22     | 22-Feb-23 |

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

*T. Petchur*



## Continuation of Calibration Certificate

Cert. No. : ACL22253  
Job No. : VC66AC0004  
Pages : 3 of 8

## Summary of Measurement Result :

| Parameter  | Pass | Fail | Uncertainty (dB) | Maximum-permitted uncertainty of measurement (dB) |
|--|------|------|------------------|---|
| 1. Absolute sensitivity                              | ✓    | -    | 0.2              | N/A   |
| 2. Self-generated noise                              | ✓    | -    | 0.2              | N/A   |
| 3. Acoustical signal tests of frequency weightings   |      |      |                  |   |
| 125 Hz   | ✓    | -    | 0.3              | 0.6   |
| 1000 Hz  | ✓    | -    | 0.3              | 0.6   |
| 8000 Hz  | ✓    | -    | 0.3              | 0.7   |
| 4. Electrical signal tests of frequency weightings   |      |      |                  |   |
| For 10 Hz to 4 kHz                                   | ✓    | -    | 0.3              | 0.6   |
| For > 4 kHz to 10 kHz                                | ✓    | -    | 0.3              | 0.7   |
| For > 10 kHz to 20 kHz                               | -    | -    | -                | 1.0   |
| 5. Frequency and time weightings at 1 kHz            | ✓    | -    | 0.2              | 0.2   |
| 6. Long - term stability                             | ✓    | -    | 0.1              | 0.1   |
| 7. Level linearity on the reference level range      | ✓    | -    | 0.2              | 0.3   |
| 8. Level linearity including the level range control | ✓    | -    | 0.2              | 0.3   |
| 9. Tone burst response                               | ✓    | -    | 0.2              | 0.3   |
| 10. Peak C sound level                               | ✓    | -    | 0.2              | 0.35  |
| 11. Overload indication                              | ✓    | -    | 0.2              | 0.25  |
| 12. High level stability                             | ✓    | -    | 0.1              | 0.1   |

QF-TS12-04-04-020664

T. Retch.

## Continuation of Calibration Certificate

Cert. No. : ACL22253  
Job No. : VC66AC0004  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|--------------------------------|---------------------|----------------|-----------------------|
| 93.9 (93.95)                   | 93.9                | 0.0            | ±0.3                  |

## 2. Self-generated noise

## 2.1 Normal test

| Measured Value (dB) |
|---------------------|
| 16.4                |

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

| Frequency Weighting | Measured value (dB) |
|---------------------|---------------------|
| A - weight          | 13.8                |
| C - weight          | 19.9                |
| Flat                | 25.7                |

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) |          |          |                   |
|----------------|--|----------|----------|-------------------|
|                | Flat   | C-weight | A-weight | Acceptance Limits |
| 125            | 0.4  | 0.4      | 0.4      | ± 1.5             |
| 1000           | 0.0  | 0.0      | 0.0      | ± 1.0             |
| 8000           | -1.3   | -1.2     | -1.1     | ±5.0              |

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T. Retch.

## Continuation of Calibration Certificate

Cert. No. : ACL22253  
Job No. : VC66AC0004  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) |          |          |                   |
|----------------|--|----------|----------|-------------------|
|                | Flat   | C-weight | A-weight | Acceptance Limits |
| 63             | 0.0  | 0.0      | -0.1     | ±2.0              |
| 125            | 0.0  | 0.0      | 0.0      | ±1.5              |
| 250            | 0.0  | 0.0      | 0.0      | ±1.5              |
| 500            | 0.0  | 0.0      | 0.0      | ±1.5              |
| 1000           | 0.0  | 0.0      | 0.0      | ±1.0              |
| 2000           | 0.0  | 0.1      | 0.0      | ±2.0              |
| 4000           | 0.0  | 0.0      | 0.0      | ±3.0              |
| 8000           | 0.0  | 0.1      | 0.1      | ±5.0              |

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

| Frequency Weighting | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|---------------------|---------------------|---------------------|------------------------|
| A - weight          | 94.0                | 0.0                 | -                      |
| C - weight          | 94.0                | 0.0                 | ± 0.2                  |
| Flat                | 94.0                | 0.0                 | ± 0.2                  |

## 5.2 Time weighting at 1 kHz

| Frequency Weighting | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|---------------------|---------------------|---------------------|------------------------|
| Fast                | 94.0                | 0.0                 | -                      |
| Slow                | 94.0                | 0.0                 | ± 0.1                  |
| Leq                 | 94.0                | 0.0                 | ± 0.1                  |

## 6. Long - term stability

| Frequency Weighting | SLM Display at initial (dB) | SLM Display at final (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|---------------------|-----------------------------|---------------------------|---------------------|------------------------|
| A - weight          | 94.0                        | 94.0                      | 0.0                 | ± 0.3                  |

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T. Retch.

## Continuation of Calibration Certificate

Cert. No. : ACL22253  
Job No. : VC66AC0004  
Pages : 6 of 8

## 7. Level linearity on the reference level range

| Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|---------------------|---------------------|------------------------|
| 137.0                  | 137.0               | 0.0                 | ± 1.1                  |
| 136.0                  | 136.0               | 0.0                 | ± 1.1                  |
| 135.0                  | 135.0               | 0.0                 | ± 1.1                  |
| 134.0                  | 134.0               | 0.0                 | ± 1.1                  |
| 133.0                  | 133.0               | 0.0                 | ± 1.1                  |
| 132.0                  | 132.0               | 0.0                 | ± 1.1                  |
| 131.0                  | 131.0               | 0.0                 | ± 1.1                  |
| 129.0                  | 129.0               | 0.0                 | ± 1.1                  |
| 124.0                  | 124.0               | 0.0                 | ± 1.1                  |
| 119.0                  | 119.0               | 0.0                 | ± 1.1                  |
| 114.0                  | 114.0               | 0.0                 | ± 1.1                  |
| 109.0                  | 109.0               | 0.0                 | ± 1.1                  |
| 104.0                  | 104.0               | 0.0                 | ± 1.1                  |
| 99.0                   | 99.0                | 0.0                 | ± 1.1                  |
| 94.0                   | 94.0                | 0.0                 | ± 1.1                  |
| 89.0                   | 89.0                | 0.0                 | ± 1.1                  |
| 84.0                   | 84.0                | 0.0                 | ± 1.1                  |
| 79.0                   | 79.0                | 0.0                 | ± 1.1                  |
| 74.0                   | 74.0                | 0.0                 | ± 1.1                  |
| 69.0                   | 69.0                | 0.0                 | ± 1.1                  |
| 64.0                   | 64.0                | 0.0                 | ± 1.1                  |
| 59.0                   | 59.0                | 0.0                 | ± 1.1                  |
| 54.0                   | 54.0                | 0.0                 | ± 1.1                  |
| 49.0                   | 49.0                | 0.0                 | ± 1.1                  |
| 44.0                   | 44.0                | 0.0                 | ± 1.1                  |
| 39.0                   | 38.9                | -0.1                | ± 1.1                  |
| 34.0                   | 33.9                | -0.1                | ± 1.1                  |
| 30.0                   | 29.9                | -0.1                | ± 1.1                  |
| 29.0                   | 28.8                | -0.2                | ± 1.1                  |
| 28.0                   | 27.9                | -0.1                | ± 1.1                  |
| 27.0                   | 26.9                | -0.1                | ± 1.1                  |
| 26.0                   | 25.9                | -0.1                | ± 1.1                  |
| 25.0                   | 24.8                | -0.2                | ± 1.1                  |

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T. Retch.



## Continuation of Calibration Certificate

Cert. No. : ACL22253  
Job No. : VC66AC0004  
Pages : 7 of 8

## 8. Level linearity including the level range control

| Range | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------|------------------------|---------------------|---------------------|------------------------|
| Auto  | 94.0                   | 94.0                | 0.0                 | ±1.1                   |

## 9. Tone burst response

| Time Weighting | Tone burst duration, Tb (ms) | Cycle | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|----------------|------------------------------|-------|------------------------|---------------------|---------------------|------------------------|
| Fast           | 0.25                         | 1     | 108.0                  | 107.9               | -0.1                | 1.5 ; -5.0             |
|                | 2                            | 8     | 117.0                  | 117.0               | 0.0                 | 1.0 ; -2.5             |
|                | 200                          | 800   | 134.0                  | 134.1               | 0.1                 | ±1.0                   |
| Slow           | 2                            | 8     | 108.0                  | 108.0               | 0.0                 | 1.5 ; -5.0             |
|                | 200                          | 800   | 127.6                  | 127.6               | 0.0                 | ±1.0                   |
|                | 0.25                         | 1     | 99.0                   | 98.9                | -0.1                | 1.5 ; -5.0             |
| SEL            | 2                            | 8     | 108.0                  | 108.0               | 0.0                 | 1.0 ; -2.5             |
|                | 200                          | 800   | 128.0                  | 128.1               | 0.1                 | ±1.0                   |

## 10. Peak C sound level

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value, L <sub>peak</sub> (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------|------------------------|--|---------------------|------------------------|
| Continuous                     | 133.0                  | 133.0                                  | 0.0                 | -                      |
| One                            | 136.4                  | 135.7                                  | -0.7                | ±3.0                   |

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------|------------------------|---------------------|---------------------|------------------------|
| Continuous                     | 133.0                  | 133.0               | 0.0                 | -                      |
| Positive half cycle            | 135.4                  | 135.2               | -0.2                | ±2.0                   |
| Negative half cycle            | 135.4                  | 135.2               | -0.2                | ±2.0                   |

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T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL22253  
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## 11. Overload indication

| Measured value (dB)     |                         | Deviated Value (dB) | Acceptance Limits (dB) |
|-------------------------|-------------------------|---------------------|------------------------|
| Positive one-half cycle | Negative one-half cycle | (dB)                | (dB)                   |
| 89.6                    | 89.7                    | 0.1                 | ±1.5                   |

## 12. High level stability

| Frequency Weighting | SLM Display at initial (dB) | SLM Display at final (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|---------------------|-----------------------------|---------------------------|---------------------|------------------------|
| A - weight          | 137.0                       | 137.0                     | 0.0                 | ±0.3                   |

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY451-451/1 Sirinthorn Rd., Bangbunmu, Bangplud Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comNSC-TS1-TS 17025  
CALIBRATION 0394Cert. No. : ACL22287  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00658240 / 157780 / 48095  
ID No.: BKK\_FS0097

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD,  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location : -  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 30 NOVEMBER 2022  
Calibration Date : 13-16 DECEMBER 2022  
Date of Issue : 19 DECEMBER 2022

Calibrated by : Nadiakorn Pisutpaisan

Approved by :

T. Petchur  
( Thanakul Petchurai )

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QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL22287  
Job No. : VC66AC0015  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM). The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

| Instrument              | Model    | Serial No. | Cert. No.      | Due Date  |
|-------------------------|----------|------------|----------------|-----------|
| Waveform Generator      | 33210A   | MY48017076 | EF-0007-22     | 04-Feb-23 |
| Waveform Generator      | 33511B   | MY52302742 | EF-0008-22     | 04-Feb-23 |
| Digital Multimeter      | 33461A   | MY53220104 | EEL-BP_04/0265 | 09-Feb-23 |
| Digital Multimeter      | 33461A   | MY53220076 | EEL-BP_03/0265 | 09-Feb-23 |
| Digital Multimeter      | 34461A   | MY60024273 | EEL-BP_05/0265 | 09-Feb-23 |
| Programmable Attenuator | MAT-1070 | 62100114   | EF-0009-22     | 07-Feb-23 |
| Condenser Microphone    | 4180     | 2977900    | AA-1013-22     | 24-Feb-23 |
| Measuring Amplifier     | NA-42KAI | 34560495   | AA-3005-22     | 22-Feb-23 |

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

T. Petchur



## Continuation of Calibration Certificate

Cert. No. : ACL22287  
Job No. : VC66AC0015  
Pages : 3 of 8

## Summary of Measurement Result :

| Parameter  | Pass | Fail | Uncertainty (dB) | Maximum-permitted uncertainty of measurement (dB) |
|--|------|------|------------------|---|
| 1. Absolute sensitivity                              | ✓    | -    | 0.2              | N/A   |
| 2. Self-generated noise                              | ✓    | -    | 0.2              | N/A   |
| 3. Acoustical signal tests of frequency weightings   |      |      |                  |   |
| 125 Hz   | ✓    | -    | 0.3              | 0.6   |
| 1000 Hz  | ✓    | -    | 0.3              | 0.6   |
| 8000 Hz  | ✓    | -    | 0.3              | 0.7   |
| 4. Electrical signal tests of frequency weightings   |      |      |                  |   |
| For 10 Hz to 4 kHz                                   | ✓    | -    | 0.3              | 0.6   |
| For > 4 kHz to 10 kHz                                | ✓    | -    | 0.3              | 0.7   |
| For > 10 kHz to 20 kHz                               | -    | -    | -                | 1.0   |
| 5. Frequency and time weightings at 1 kHz            | ✓    | -    | 0.2              | 0.2   |
| 6. Long - term stability                             | ✓    | -    | 0.1              | 0.1   |
| 7. Level linearity on the reference level range      | ✓    | -    | 0.2              | 0.3   |
| 8. Level linearity including the level range control | ✓    | -    | 0.2              | 0.3   |
| 9. Tone burst response                               | ✓    | -    | 0.2              | 0.3   |
| 10. Peak C sound level                               | ✓    | -    | 0.2              | 0.35  |
| 11. Overload indication                              | ✓    | -    | 0.2              | 0.25  |
| 12. High level stability                             | ✓    | -    | 0.1              | 0.1   |

QF-TS12-04-04-020664

T. R. L.

## Continuation of Calibration Certificate

Cert. No. : ACL22287  
Job No. : VC66AC0015  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|--------------------------------|---------------------|----------------|-----------------------|
| 93.9 (93.95)                   | 93.9                | 0.0            | ±0.3                  |

## 2. Self-generated noise

## 2.1 Normal test

| Measured Value (dB) |
|---------------------|
| 16.9                |

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

| Frequency Weighting | Measured value (dB) |
|---------------------|---------------------|
| A - weight          | 12.6                |
| C - weight          | 18.4                |
| Flat                | 24.4                |

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) |          |          |                   |
|----------------|--|----------|----------|-------------------|
|                | Flat   | C-weight | A-weight | Acceptance Limits |
| 125            | 0.1  | 0.2      | 0.2      | ± 1.5             |
| 1000           | -0.1   | -0.1     | -0.1     | ± 1.0             |
| 8000           | -1.0   | -1.0     | -1.0     | ±5.0              |

QF-TS12-04-04-020664

T. R. L.

## Continuation of Calibration Certificate

Cert. No. : ACL22287  
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Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) |          |          |                   |
|----------------|--|----------|----------|-------------------|
|                | Flat   | C-weight | A-weight | Acceptance Limits |
| 63             | 0.0  | 0.0      | 0.0      | ±2.0              |
| 125            | 0.0  | 0.1      | 0.0      | ±1.5              |
| 250            | 0.0  | 0.0      | 0.0      | ±1.5              |
| 500            | 0.0  | 0.1      | 0.0      | ±1.5              |
| 1000           | 0.0  | 0.0      | 0.0      | ±1.0              |
| 2000           | 0.0  | 0.1      | 0.0      | ±2.0              |
| 4000           | 0.0  | 0.0      | 0.0      | ±3.0              |
| 8000           | 0.0  | 0.1      | 0.1      | ±5.0              |

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

| Frequency Weighting | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|---------------------|---------------------|---------------------|------------------------|
| A - weight          | 94.0                | 0.0                 | -                      |
| C - weight          | 94.0                | 0.0                 | ± 0.2                  |
| Flat                | 94.0                | 0.0                 | ± 0.2                  |

## 5.2 Time weighting at 1 kHz

| Frequency Weighting | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|---------------------|---------------------|---------------------|------------------------|
| Fast                | 94.0                | 0.0                 | -                      |
| Slow                | 94.0                | 0.0                 | ± 0.1                  |
| Leq                 | 94.0                | 0.0                 | ± 0.1                  |

## 6. Long - term stability

| Frequency Weighting | SLM Display at initial (dB) | SLM Display at final (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|---------------------|-----------------------------|---------------------------|---------------------|------------------------|
| A - weight          | 94.0                        | 94.1                      | 0.1                 | ± 0.3                  |

QF-TS12-04-04-020664

T. R. L.

## Continuation of Calibration Certificate

Cert. No. : ACL22287  
Job No. : VC66AC0015  
Pages : 6 of 8

## 7. Level linearity on the reference level range

| Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|---------------------|---------------------|------------------------|
| 137.0                  | 137.0               | 0.0                 | ± 1.1                  |
| 136.0                  | 136.0               | 0.0                 | ± 1.1                  |
| 135.0                  | 135.0               | 0.0                 | ± 1.1                  |
| 134.0                  | 134.0               | 0.0                 | ± 1.1                  |
| 133.0                  | 133.0               | 0.0                 | ± 1.1                  |
| 132.0                  | 132.0               | 0.0                 | ± 1.1                  |
| 131.0                  | 131.0               | 0.0                 | ± 1.1                  |
| 129.0                  | 129.0               | 0.0                 | ± 1.1                  |
| 124.0                  | 124.0               | 0.0                 | ± 1.1                  |
| 119.0                  | 119.0               | 0.0                 | ± 1.1                  |
| 114.0                  | 114.0               | 0.0                 | ± 1.1                  |
| 109.0                  | 109.0               | 0.0                 | ± 1.1                  |
| 104.0                  | 104.0               | 0.0                 | ± 1.1                  |
| 99.0                   | 99.0                | 0.0                 | ± 1.1                  |
| 94.0                   | 94.0                | 0.0                 | ± 1.1                  |
| 89.0                   | 89.0                | 0.0                 | ± 1.1                  |
| 84.0                   | 84.0                | 0.0                 | ± 1.1                  |
| 79.0                   | 79.0                | 0.0                 | ± 1.1                  |
| 74.0                   | 74.0                | 0.0                 | ± 1.1                  |
| 69.0                   | 69.0                | 0.0                 | ± 1.1                  |
| 64.0                   | 64.0                | 0.0                 | ± 1.1                  |
| 59.0                   | 59.0                | 0.0                 | ± 1.1                  |
| 54.0                   | 54.0                | 0.0                 | ± 1.1                  |
| 49.0                   | 49.0                | 0.0                 | ± 1.1                  |
| 44.0                   | 44.0                | 0.0                 | ± 1.1                  |
| 39.0                   | 39.0                | 0.0                 | ± 1.1                  |
| 34.0                   | 34.0                | 0.0                 | ± 1.1                  |
| 30.0                   | 29.9                | -0.1                | ± 1.1                  |
| 29.0                   | 28.9                | -0.1                | ± 1.1                  |
| 28.0                   | 27.9                | -0.1                | ± 1.1                  |
| 27.0                   | 26.9                | -0.1                | ± 1.1                  |
| 26.0                   | 25.9                | -0.1                | ± 1.1                  |
| 25.0                   | 24.9                | -0.1                | ± 1.1                  |

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T. R. L.



## Continuation of Calibration Certificate

Cert. No. : ACL22287  
Job No. : VC66AC0015  
Pages : 7 of 8

## 8. Level linearity including the level range control

| Range | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------|------------------------|---------------------|---------------------|------------------------|
| Auto  | 94.0                   | 94.0                | 0.0                 | ±1.1                   |

## 9. Tone burst response

| Time Weighting | Tone burst duration, Tb (ms) | Cycle | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|----------------|------------------------------|-------|------------------------|---------------------|---------------------|------------------------|
| Fast           | 0.25                         | 1     | 108.0                  | 108.0               | 0.0                 | 1.5 ; -5.0             |
|                | 2                            | 8     | 117.0                  | 117.0               | 0.0                 | 1.0 ; -2.5             |
|                | 200                          | 800   | 134.0                  | 134.1               | 0.1                 | ±1.0                   |
| Slow           | 2                            | 8     | 108.0                  | 108.0               | 0.0                 | 1.5 ; -5.0             |
|                | 200                          | 800   | 127.6                  | 127.6               | 0.0                 | ±1.0                   |
| SEL            | 0.25                         | 1     | 99.0                   | 98.9                | -0.1                | 1.5 ; -5.0             |
|                | 2                            | 8     | 108.0                  | 108.0               | 0.0                 | 1.0 ; -2.5             |
|                | 200                          | 800   | 128.0                  | 128.1               | 0.1                 | ±1.0                   |

## 10. Peak C sound level

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value, L <sub>peak</sub> (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------|------------------------|--|---------------------|------------------------|
| Continuous                     | 133.0                  | 133.0                                  | 0.0                 | -                      |
| One                            | 136.4                  | 136.2                                  | -0.2                | ±3.0                   |

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------|------------------------|---------------------|---------------------|------------------------|
| Continuous                     | 133.0                  | 133.0               | 0.0                 | -                      |
| Positive half cycle            | 135.4                  | 135.2               | -0.2                | ±2.0                   |
| Negative half cycle            | 135.4                  | 135.2               | -0.2                | ±2.0                   |

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## Continuation of Calibration Certificate

Cert. No. : ACL22287  
Job No. : VC66AC0015  
Pages : 8 of 8

## 11. Overload Indication

| Measured value (dB)     |                         | Deviated Value (dB) | Acceptance Limits (dB) |
|-------------------------|-------------------------|---------------------|------------------------|
| Positive one-half cycle | Negative one-half cycle |                     |                        |
| 89.6                    | 89.7                    | 0.1                 | ±1.5                   |

## 12. High level stability

| Frequency Weighting | SLM Display at initial (dB) | SLM Display at final (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|---------------------|-----------------------------|---------------------------|---------------------|------------------------|
| A-weight            | 137.0                       | 137.0                     | 0.0                 | ±0.3                   |

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

End of Calibration Certificate

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACC23038  
Pages : 1 of 3

## Calibration Certificate

Equipment : SOUND CALIBRATOR  
Manufacturer : RION  
Model : NC-74  
Serial No.: 34425566  
ID No.: BKK\_FS0617

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 22 SEPTEMBER 2023  
Calibration Date : 19 OCTOBER 2023  
Date of Issue : 19 OCTOBER 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACC23038  
Job No. : VC66AC0101  
Pages : 2 of 3

Calibration Procedure : CP-AC-03

## Calibration Method :

This equipment was calibrated by based on IEC-60942-2003 Standard.  
The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

| Instrument              | Model     | Serial No. | Cert. No.      | Due Date  |
|-------------------------|-----------|------------|----------------|-----------|
| Waveform Generator      | 33511B    | MY52302742 | EF-0010-23     | 07-FEB-24 |
| Digital Multimeter      | 33461A    | MY53220104 | EEL-BP 30/0266 | 13-FEB-24 |
| Digital Multimeter      | 33461A    | MY53220076 | EEL-BP 30/0267 | 13-FEB-24 |
| Digital Multimeter      | 33461A    | MY60024273 | EEL-BP 31/0266 | 14-FEB-24 |
| Programmable Attenuator | MAT-1070  | 62100114   | EF-0011-23     | 08-FEB-24 |
| Condenser Microphone    | 4180      | 2977900    | AA-1001-23     | 14-FEB-24 |
| Measuring Amplifier     | NA-42KA1  | 34560495   | AA-3002-23     | 14-FEB-24 |
| Audio Analyzer          | AVR-3360A | V744B6069  | EF-0012-23     | 10-FEB-24 |

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664



Cert. No. : ACC23038  
Job No. : VC66AC0101  
Pages : 3 of 3

**Result of calibration :**

**1. Sound pressure level**

| Specified sound pressure level (dB) | Measured value (dB) | Deviated value (dB) | Uncertainty (dB) | Acceptance limit (dB) |
|-------------------------------------|---------------------|---------------------|------------------|-----------------------|
| 94                                  | 94,17               | 0,17                | 0,14             | 0,40                  |

**2. Frequency**

| Specified Frequency (Hz) | Measured value (Hz) | Deviated value (%) | Uncertainty (%) | Acceptance limit (%) |
|--------------------------|---------------------|--------------------|-----------------|----------------------|
| 1000                     | 1001,9              | 0,2                | 0,1             | 1,0                  |

**3. Total distortion**

| Measured value (%) | Uncertainty (%) | Acceptance limit (%) |
|--------------------|-----------------|----------------------|
| 1,21               | 0,10            | 3,0                  |

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

End of Calibration Certificate

QF-TS12-04-04-020664

*T. Petchurai*

451-451/1 Sirinthon Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com

Cert. No. : ACL23056  
Pages : 1 of 8

**Calibration Certificate**

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00858518 / 158769 / 58770  
**ID No.:** BKK\_FS0108

**Condition As Found :** GOOD

**Customer :** ALS LABORATORY GROUP (THAILAND) CO., LTD,  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

**Location :** -  
**Ambient Temperature :** ( 23,0 ± 3 ) °C  
**Pressure :** ( 101,3 ± 3 ) kPa  
**Relative Humidity :** ( 50,0 ± 20 ) %

**Received Date :** 17 JANUARY 2023  
**Calibration Date :** 19-20 JANUARY 2023  
**Date of Issue :** 23 JANUARY 2023

**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

*T. Petchurai*  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

Cert. No. : ACL23056  
Job No. : VC66AC0026  
Pages : 2 of 8

**Calibration Procedure :** CP-AC-01

**Calibration Method :**

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

**Condition of this result of calibration :**

**1. Reference Standard Instruments :**

| Instrument              | Model    | Serial No. | Cert. No.      | Due Date  |
|-------------------------|----------|------------|----------------|-----------|
| Waveform Generator      | 33210A   | MY48017076 | EF-0007-22     | 04-Feb-23 |
| Waveform Generator      | 33511B   | MY52302742 | EF-0008-22     | 04-Feb-23 |
| Digital Multimeter      | 33461A   | MY53220104 | EEL-BP_04/0265 | 09-Feb-23 |
| Digital Multimeter      | 33461A   | MY53220076 | EEL-BP_03/0265 | 09-Feb-23 |
| Digital Multimeter      | 34461A   | MY60024273 | EEL-BP_05/0265 | 09-Feb-23 |
| Programmable Attenuator | MAT-1070 | 62100114   | EF-0009-22     | 07-Feb-23 |
| Condenser Microphone    | 4180     | 2977900    | AA-1013-22     | 24-Feb-23 |
| Measuring Amplifier     | NA-42KA1 | 34560495   | AA-3005-22     | 22-Feb-23 |

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Cert. No. : ACL23056  
Job No. : VC66AC0026  
Pages : 3 of 8

**Summary of Measurement Result :**

| Parameter  | Pass | Fail | Uncertainty (dB) | Maximum-permitted uncertainty of measurement (dB) |
|--|------|------|------------------|---|
| 1. Absolute sensitivity                              | ✓    | -    | 0,2              | N/A   |
| 2. Self-generated noise                              | ✓    | -    | 0,2              | N/A   |
| 3. Acoustical signal tests of frequency weightings   |      |      |                  |   |
| 125 Hz   | ✓    | -    | 0,3              | 0,6   |
| 1000 Hz  | ✓    | -    | 0,3              | 0,6   |
| 8000 Hz  | ✓    | -    | 0,3              | 0,7   |
| 4. Electrical signal tests of frequency weightings   |      |      |                  |   |
| For 10 Hz to 4 kHz                                   | ✓    | -    | 0,3              | 0,6   |
| For > 4 kHz to 10 kHz                                | ✓    | -    | 0,3              | 0,7   |
| For > 10 kHz to 20 kHz                               | -    | -    | -                | 1,0   |
| 5. Frequency and time weightings at 1 kHz            | ✓    | -    | 0,2              | 0,2   |
| 6. Long - term stability                             | ✓    | -    | 0,1              | 0,1   |
| 7. Level linearity on the reference level range      | ✓    | -    | 0,2              | 0,3   |
| 8. Level linearity including the level range control | ✓    | -    | 0,2              | 0,3   |
| 9. Tone burst response                               | ✓    | -    | 0,2              | 0,3   |
| 10. Peak C sound level                               | ✓    | -    | 0,2              | 0,35  |
| 11. Overload indication                              | ✓    | -    | 0,2              | 0,25  |
| 12. High level stability                             | ✓    | -    | 0,1              | 0,1   |

QF-TS12-04-04-020664

*T. Petchurai*

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*T. Petchurai*



## Continuation of Calibration Certificate

Cert. No. : ACL23056  
Job No. : VC66AC0026  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

| Reference<br>Acoustic Signal<br>( dB ) | Measured<br>Value<br>( dB ) | Deviation<br>( dB ) | Acceptance<br>Limit<br>( dB ) |
|--|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.95)                           | 93.9                        | 0.0                 | ±0.3                          |

## 2. Self-generated noise

## 2.1 Normal test

| Measured Value<br>( dB ) |
|--------------------------|
| 17.2                     |

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

| Frequency<br>Weighting | Measured value<br>( dB ) |
|------------------------|--------------------------|
| A - weight             | 14.8                     |
| C - weight             | 20.8                     |
| Flat                   | 26.6                     |

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

| Frequency<br>( Hz ) | Deviation from various frequency weighting response curve (dB) |          |          |                      |
|---------------------|--|----------|----------|----------------------|
|                     | Flat   | C-weight | A-weight | Acceptance<br>Limits |
| 125                 | 0.2  | 0.3      | 0.3      | ± 1.5                |
| 1000                | 0.0  | 0.0      | 0.0      | ± 1.0                |
| 8000                | -0.8   | -0.7     | -0.7     | ±5.0                 |

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7. Rth

## Continuation of Calibration Certificate

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## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

| Frequency<br>( Hz ) | Deviation from various frequency weighting response curve (dB) |          |          |                      |
|---------------------|--|----------|----------|----------------------|
|                     | Flat   | C-weight | A-weight | Acceptance<br>Limits |
| 63                  | 0.0  | 0.0      | 0.0      | ±2.0                 |
| 125                 | 0.0  | 0.0      | 0.0      | ±1.5                 |
| 250                 | 0.0  | 0.0      | 0.0      | ±1.5                 |
| 500                 | 0.0  | 0.1      | 0.0      | ±1.5                 |
| 1000                | 0.0  | 0.0      | 0.0      | ±1.0                 |
| 2000                | 0.0  | 0.1      | 0.0      | ±2.0                 |
| 4000                | 0.0  | 0.1      | 0.0      | ±3.0                 |
| 8000                | 0.0  | 0.1      | 0.1      | ±5.0                 |

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

| Frequency<br>Weighting | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|------------------------|-----------------------------|-----------------------------|--------------------------------|
| A - weight             | 94.0                        | 0.0                         | -                              |
| C - weight             | 94.0                        | 0.0                         | ± 0.2                          |
| Flat                   | 94.0                        | 0.0                         | ± 0.2                          |

## 5.2 Time weighting at 1 kHz

| Frequency<br>Weighting | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast                   | 94.0                        | 0.0                         | -                              |
| Slow                   | 94.0                        | 0.0                         | ± 0.1                          |
| Leq                    | 94.0                        | 0.0                         | ± 0.1                          |

## 6. Long - term stability

| Frequency<br>Weighting | SLM Display<br>at initial<br>( dB ) | SLM Display<br>at final<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight             | 94.0                                | 94.1                              | 0.1                         | ± 0.3                          |

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## Continuation of Calibration Certificate

Cert. No. : ACL23056  
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## 7. Level linearity on the reference level range

| Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 137.0                          | 137.0                       | 0.0                         | ± 1.1                          |
| 136.0                          | 136.0                       | 0.0                         | ± 1.1                          |
| 135.0                          | 135.0                       | 0.0                         | ± 1.1                          |
| 134.0                          | 134.0                       | 0.0                         | ± 1.1                          |
| 133.0                          | 133.0                       | 0.0                         | ± 1.1                          |
| 132.0                          | 132.0                       | 0.0                         | ± 1.1                          |
| 131.0                          | 131.0                       | 0.0                         | ± 1.1                          |
| 129.0                          | 129.0                       | 0.0                         | ± 1.1                          |
| 124.0                          | 124.0                       | 0.0                         | ± 1.1                          |
| 119.0                          | 119.1                       | 0.1                         | ± 1.1                          |
| 114.0                          | 114.0                       | 0.0                         | ± 1.1                          |
| 109.0                          | 109.0                       | 0.0                         | ± 1.1                          |
| 104.0                          | 104.0                       | 0.0                         | ± 1.1                          |
| 99.0                           | 99.0                        | 0.0                         | ± 1.1                          |
| 94.0                           | 94.0                        | 0.0                         | ± 1.1                          |
| 89.0                           | 89.0                        | 0.0                         | ± 1.1                          |
| 84.0                           | 84.0                        | 0.0                         | ± 1.1                          |
| 79.0                           | 79.0                        | 0.0                         | ± 1.1                          |
| 74.0                           | 74.0                        | 0.0                         | ± 1.1                          |
| 69.0                           | 69.0                        | 0.0                         | ± 1.1                          |
| 64.0                           | 64.0                        | 0.0                         | ± 1.1                          |
| 59.0                           | 59.0                        | 0.0                         | ± 1.1                          |
| 54.0                           | 54.0                        | 0.0                         | ± 1.1                          |
| 49.0                           | 49.0                        | 0.0                         | ± 1.1                          |
| 44.0                           | 44.0                        | 0.0                         | ± 1.1                          |
| 39.0                           | 38.9                        | -0.1                        | ± 1.1                          |
| 34.0                           | 33.9                        | -0.1                        | ± 1.1                          |
| 30.0                           | 29.9                        | -0.1                        | ± 1.1                          |
| 29.0                           | 29.0                        | 0.0                         | ± 1.1                          |
| 28.0                           | 27.9                        | -0.1                        | ± 1.1                          |
| 27.0                           | 26.9                        | -0.1                        | ± 1.1                          |
| 26.0                           | 25.9                        | -0.1                        | ± 1.1                          |
| 25.0                           | 24.8                        | -0.2                        | ± 1.1                          |

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## Continuation of Calibration Certificate

Cert. No. : ACL23056  
Job No. : VC66AC0026  
Pages : 7 of 8

## 8. Level linearity including the level range control

| Range | Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Auto  | 94.0                           | 94.0                        | 0.0                         | ±1.1                           |

## 9. Tone burst response

| Time<br>Weighting | Tone burst<br>duration, Tb<br>( ms ) | Cycle | Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|-------------------|--------------------------------------|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast              | 0.25                                 | 1     | 108.0                          | 108.0                       | 0.0                         | 1.5 ; -5.0                     |
|                   | 2                                    | 8     | 117.0                          | 117.0                       | 0.0                         | 1.0 ; -2.5                     |
|                   | 200                                  | 800   | 134.0                          | 134.1                       | 0.1                         | ±1.0                           |
| Slow              | 2                                    | 8     | 108.0                          | 108.0                       | 0.0                         | 1.5 ; -5.0                     |
|                   | 200                                  | 800   | 127.6                          | 127.6                       | 0.0                         | ±1.0                           |
| SEL               | 0.25                                 | 1     | 99.0                           | 98.9                        | -0.1                        | 1.5 ; -5.0                     |
|                   | 2                                    | 8     | 108.0                          | 108.0                       | 0.0                         | 1.0 ; -2.5                     |
|                   | 200                                  | 800   | 128.0                          | 128.1                       | 0.1                         | ±1.0                           |

## 10. Peak C sound level

| Number of cycle<br>in<br>test signal | Anticipated<br>Value<br>( dB ) | Measured<br>Value, L <sub>peak</sub><br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|--------------------------------------|--------------------------------|--|-----------------------------|--------------------------------|
| Continuous                           | 133.0                          | 133.0  | 0.0                         | -                              |
| One                                  | 136.4                          | 136.2  | -0.2                        | ±3.0                           |

| Number of cycle<br>in<br>test signal | Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|--------------------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Continuous                           | 133.0                          | 132.9                       | -0.1                        | -                              |
| Positive half cycle                  | 135.4                          | 135.1                       | -0.3                        | ±2.0                           |
| Negative half cycle                  | 135.4                          | 135.1                       | -0.3                        | ±2.0                           |

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7. Rth



## Continuation of Calibration Certificate

Cert. No. : ACL23056  
Job No. : VC66AC0026  
Pages : 8 of 8

## 11. Overload indication

| Measured value ( dB )      |                            | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|----------------------------|----------------------------|-----------------------------|--------------------------------|
| Positive<br>one-half cycle | Negative<br>one-half cycle |                             |                                |
| 89.7                       | 89.5                       | -0.2                        | ±1.5                           |

## 12. High level stability

| Frequency<br>Weighting | SLM Display<br>at initial<br>( dB ) | SLM Display<br>at final<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight             | 137.0                               | 137.0                             | 0.0                         | ±0.3                           |

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

End of Calibration Certificate

QF-TS12-04-04-020664

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Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.comCert. No. : ACL23005  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00858525 / 170383 / 72889  
ID No.: BKK\_FS0115

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location : -  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %  
Received Date : 14 DECEMBER 2022  
Calibration Date : 03-05 JANUARY 2023  
Date of Issue : 06 JANUARY 2023



Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai  
( Thanakul Petchurai )

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other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23005  
Job No. : VC66AC0021  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference  
Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

| Instrument              | Model    | Serial No. | Cert. No.      | Due Date  |
|-------------------------|----------|------------|----------------|-----------|
| Waveform Generator      | 33210A   | MY48017076 | EF-0007-22     | 04-Feb-23 |
| Waveform Generator      | 33511B   | MY52302742 | EF-0008-22     | 04-Feb-23 |
| Digital Multimeter      | 33461A   | MY53220104 | EEL-BP_04/0265 | 09-Feb-23 |
| Digital Multimeter      | 33461A   | MY53220076 | EEL-BP_03/0265 | 09-Feb-23 |
| Digital Multimeter      | 34461A   | MY60024273 | EEL-BP_05/0265 | 09-Feb-23 |
| Programmable Attenuator | MAT-1070 | 62100114   | EF-0009-22     | 07-Feb-23 |
| Condenser Microphone    | 4180     | 2977900    | AA-1013-22     | 24-Feb-23 |
| Measuring Amplifier     | NA-42KAI | 34560495   | AA-3005-22     | 22-Feb-23 |

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

## Continuation of Calibration Certificate

Cert. No. : ACL23005  
Job No. : VC66AC0021  
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## Summary of Measurement Result :

| Parameter  | Pass | Fail | Uncertainty<br>(dB) | Maximum-permitted<br>uncertainty of<br>measurement (dB) |
|--|------|------|---------------------|---|
| 1. Absolute sensitivity                              | ✓    | -    | 0.2                 | N/A   |
| 2. Self-generated noise                              | ✓    | -    | 0.2                 | N/A   |
| 3. Acoustical signal tests of frequency weightings   |      |      |                     |   |
| 125 Hz   | ✓    | -    | 0.3                 | 0.6   |
| 1000 Hz  | ✓    | -    | 0.3                 | 0.6   |
| 8000 Hz  | ✓    | -    | 0.3                 | 0.7   |
| 4. Electrical signal tests of frequency weightings   |      |      |                     |   |
| For 10 Hz to 4 kHz                                   | ✓    | -    | 0.3                 | 0.6   |
| For > 4 kHz to 10 kHz                                | ✓    | -    | 0.3                 | 0.7   |
| For > 10 kHz to 20 kHz                               | -    | -    | -                   | 1.0   |
| 5. Frequency and time weightings at 1 kHz            | ✓    | -    | 0.2                 | 0.2   |
| 6. Long - term stability                             | ✓    | -    | 0.1                 | 0.1   |
| 7. Level linearity on the reference level range      | ✓    | -    | 0.2                 | 0.3   |
| 8. Level linearity including the level range control | ✓    | -    | 0.2                 | 0.3   |
| 9. Tone burst response                               | ✓    | -    | 0.2                 | 0.3   |
| 10. Peak C sound level                               | ✓    | -    | 0.2                 | 0.35  |
| 11. Overload indication                              | ✓    | -    | 0.2                 | 0.25  |
| 12. High level stability                             | ✓    | -    | 0.1                 | 0.1   |

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## Continuation of Calibration Certificate

Cert. No. : ACL23005  
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## Result of calibration :

## 1. Absolute sensitivity

| Reference<br>Acoustic Signal<br>( dB ) | Measured<br>Value<br>( dB ) | Deviation<br>( dB ) | Acceptance<br>Limit<br>( dB ) |
|--|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.95)                           | 93.9                        | 0.0                 | ±0.3                          |

## 2. Self-generated noise

## 2.1 Normal test

| Measured Value<br>( dB ) |
|--------------------------|
| 15.5                     |

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

| Frequency<br>Weighting | Measured value<br>( dB ) |
|------------------------|--------------------------|
| A - weight             | 14.2                     |
| C - weight             | 20.4                     |
| Flat                   | 25.9                     |

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

| Frequency<br>( Hz ) | Deviation from various frequency weighting response curve (dB) |          |          |                      |
|---------------------|--|----------|----------|----------------------|
|                     | Flat   | C-weight | A-weight | Acceptance<br>Limits |
| 125                 | 0.2  | 0.3      | 0.3      | ± 1.5                |
| 1000                | -0.1   | -0.1     | -0.1     | ± 1.0                |
| 8000                | -1.7   | -1.6     | -1.6     | ±5.0                 |

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## Continuation of Calibration Certificate

Cert. No. : ACL23005  
Job No. : VC66AC0021  
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## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

| Frequency<br>( Hz ) | Deviation from various frequency weighting response curve (dB) |          |          |                      |
|---------------------|--|----------|----------|----------------------|
|                     | Flat   | C-weight | A-weight | Acceptance<br>Limits |
| 63                  | 0.0  | -0.1     | 0.0      | ±2.0                 |
| 125                 | -0.1   | 0.0      | 0.0      | ±1.5                 |
| 250                 | 0.0  | 0.0      | -0.1     | ±1.5                 |
| 500                 | 0.0  | 0.0      | -0.1     | ±1.5                 |
| 1000                | 0.0  | 0.0      | 0.0      | ±1.0                 |
| 2000                | 0.0  | 0.0      | 0.0      | ±2.0                 |
| 4000                | 0.0  | 0.0      | 0.0      | ±3.0                 |
| 8000                | 0.0  | 0.1      | 0.1      | ±5.0                 |

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

| Frequency<br>Weighting | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|------------------------|-----------------------------|-----------------------------|--------------------------------|
| A - weight             | 94.0                        | 0.0                         | -                              |
| C - weight             | 94.0                        | 0.0                         | ± 0.2                          |
| Flat                   | 94.0                        | 0.0                         | ± 0.2                          |

## 5.2 Time weighting at 1 kHz

| Frequency<br>Weighting | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast                   | 94.0                        | 0.0                         | -                              |
| Slow                   | 94.0                        | 0.0                         | ± 0.1                          |
| Leq                    | 94.0                        | 0.0                         | ± 0.1                          |

## 6. Long - term stability

| Frequency<br>Weighting | SLM Display<br>at initial<br>( dB ) | SLM Display<br>at final<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight             | 94.0                                | 94.0                              | 0.0                         | ± 0.3                          |

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## Continuation of Calibration Certificate

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Job No. : VC66AC0021  
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## 7. Level linearity on the reference level range

| Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 137.0                          | 137.0                       | 0.0                         | ± 1.1                          |
| 136.0                          | 136.0                       | 0.0                         | ± 1.1                          |
| 135.0                          | 135.0                       | 0.0                         | ± 1.1                          |
| 134.0                          | 134.0                       | 0.0                         | ± 1.1                          |
| 133.0                          | 133.0                       | 0.0                         | ± 1.1                          |
| 132.0                          | 132.0                       | 0.0                         | ± 1.1                          |
| 131.0                          | 131.0                       | 0.0                         | ± 1.1                          |
| 129.0                          | 129.0                       | 0.0                         | ± 1.1                          |
| 124.0                          | 124.0                       | 0.0                         | ± 1.1                          |
| 119.0                          | 119.0                       | 0.0                         | ± 1.1                          |
| 114.0                          | 114.0                       | 0.0                         | ± 1.1                          |
| 109.0                          | 109.0                       | 0.0                         | ± 1.1                          |
| 104.0                          | 104.0                       | 0.0                         | ± 1.1                          |
| 99.0                           | 99.0                        | 0.0                         | ± 1.1                          |
| 94.0                           | 94.0                        | 0.0                         | ± 1.1                          |
| 89.0                           | 89.0                        | 0.0                         | ± 1.1                          |
| 84.0                           | 84.1                        | 0.1                         | ± 1.1                          |
| 79.0                           | 79.0                        | 0.0                         | ± 1.1                          |
| 74.0                           | 74.1                        | 0.1                         | ± 1.1                          |
| 69.0                           | 69.0                        | 0.0                         | ± 1.1                          |
| 64.0                           | 64.0                        | 0.0                         | ± 1.1                          |
| 59.0                           | 59.0                        | 0.0                         | ± 1.1                          |
| 54.0                           | 54.0                        | 0.0                         | ± 1.1                          |
| 49.0                           | 49.0                        | 0.0                         | ± 1.1                          |
| 44.0                           | 44.0                        | 0.0                         | ± 1.1                          |
| 39.0                           | 39.0                        | 0.0                         | ± 1.1                          |
| 34.0                           | 34.0                        | 0.0                         | ± 1.1                          |
| 30.0                           | 30.0                        | 0.0                         | ± 1.1                          |
| 29.0                           | 29.0                        | 0.0                         | ± 1.1                          |
| 28.0                           | 28.0                        | 0.0                         | ± 1.1                          |
| 27.0                           | 27.0                        | 0.0                         | ± 1.1                          |
| 26.0                           | 26.0                        | 0.0                         | ± 1.1                          |
| 25.0                           | 25.0                        | 0.0                         | ± 1.1                          |

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## 8. Level linearity including the level range control

| Range | Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Auto  | 94.0                           | 94.0                        | 0.0                         | ±1.1                           |

## 9. Tone burst response

| Time<br>Weighting | Tone burst<br>duration, Tb<br>( ms ) | Cycle | Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|-------------------|--------------------------------------|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast              | 0.25                                 | 1     | 108.0                          | 107.9                       | -0.1                        | 1.5 ; -5.0                     |
|                   | 2                                    | 8     | 117.0                          | 117.0                       | 0.0                         | 1.0 ; -2.5                     |
|                   | 200                                  | 800   | 134.0                          | 134.0                       | 0.0                         | ±1.0                           |
| Slow              | 2                                    | 8     | 108.0                          | 108.0                       | 0.0                         | 1.5 ; -5.0                     |
|                   | 200                                  | 800   | 127.6                          | 127.6                       | 0.0                         | ±1.0                           |
|                   | 0.25                                 | 1     | 99.0                           | 98.9                        | -0.1                        | 1.5 ; -5.0                     |
| SEL               | 2                                    | 8     | 108.0                          | 108.0                       | 0.0                         | 1.0 ; -2.5                     |
|                   | 200                                  | 800   | 128.0                          | 128.0                       | 0.0                         | ±1.0                           |

## 10. Peak C sound level

| Number of cycle<br>in<br>test signal | Anticipated<br>Value<br>( dB ) | Measured<br>Value, Lcpeak<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|--------------------------------------|--------------------------------|-------------------------------------|-----------------------------|--------------------------------|
| Continuous                           | 133.0                          | 133.0                               | 0.0                         | -                              |
| One                                  | 136.4                          | 136.4                               | 0.0                         | ±3.0                           |

| Number of cycle<br>in<br>test signal | Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|--------------------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Continuous                           | 133.0                          | 133.0                       | 0.0                         | -                              |
| Positive half cycle                  | 135.4                          | 135.1                       | -0.3                        | ±2.0                           |
| Negative half cycle                  | 135.4                          | 135.1                       | -0.3                        | ±2.0                           |

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7. Petch



Continuation of Calibration Certificate

Cert. No. : ACL23005  
Job No. : VC66AC0021  
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11. Overload indication

| Measured value ( dB )   |                         | Deviated Value ( dB ) | Acceptance Limits ( dB ) |
|-------------------------|-------------------------|-----------------------|--------------------------|
| Positive one-half cycle | Negative one-half cycle |                       |                          |
| 89.5                    | 89.5                    | 0.0                   | ±1.5                     |

12. High level stability

| Frequency Weighting | SLM Display at initial ( dB ) | SLM Display at final ( dB ) | Deviated Value ( dB ) | Acceptance Limits ( dB ) |
|---------------------|-------------------------------|-----------------------------|-----------------------|--------------------------|
| A - weight          | 137.0                         | 137.0                       | 0.0                   | ±0.3                     |

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

End of Calibration Certificate

QF-TS12-04-04-020664



451-451/1 Sirinthorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com

Cert. No. : ACL23052  
Pages : 1 of 8

Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00296514 / 179116 / 87523  
**ID No.:** BKK\_FS0971

**Condition As Found :** GOOD

**Customer :** ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

**Location :**  
**Ambient Temperature :** ( 23.0 ± 3 ) °C  
**Pressure :** ( 101.3 ± 3 ) kPa  
**Relative Humidity :** ( 50.0 ± 20 ) %

**Received Date :** 17 JANUARY 2023  
**Calibration Date :** 19-20 JANUARY 2023  
**Date of Issue :** 23 JANUARY 2023



**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

*T. Petchur*  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

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Continuation of Calibration Certificate

Cert. No. : ACL23052  
Job No. : VC66AC0026  
Pages : 2 of 8

**Calibration Procedure :** CP-AC-01

**Calibration Method :**

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

**Condition of this result of calibration :**

1. Reference Standard Instruments :

| Instrument              | Model    | Serial No. | Cert. No.      | Due Date  |
|-------------------------|----------|------------|----------------|-----------|
| Waveform Generator      | 33210A   | MY48017076 | EF-0007-22     | 04-Feb-23 |
| Waveform Generator      | 33511B   | MY52302742 | EF-0008-22     | 04-Feb-23 |
| Digital Multimeter      | 33461A   | MY53220104 | EEL_BP_04/0265 | 09-Feb-23 |
| Digital Multimeter      | 33461A   | MY53220076 | EEL_BP_03/0265 | 09-Feb-23 |
| Digital Multimeter      | 34461A   | MY60024273 | EEL_BP_05/0265 | 09-Feb-23 |
| Programmable Attenuator | MAT-1070 | 62100114   | EF-0009-22     | 07-Feb-23 |
| Condenser Microphone    | 4180     | 2977900    | AA-1013-22     | 24-Feb-23 |
| Measuring Amplifier     | NA-42KAI | 34560495   | AA-3005-22     | 22-Feb-23 |

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Continuation of Calibration Certificate

Cert. No. : ACL23052  
Job No. : VC66AC0026  
Pages : 3 of 8

**Summary of Measurement Result :**

| Parameter  | Pass | Fail | Uncertainty (dB) | Maximum-permitted uncertainty of measurement (dB) |
|--|------|------|------------------|---|
| 1. Absolute sensitivity                              | ✓    | -    | 0.2              | N/A   |
| 2. Self-generated noise                              | ✓    | -    | 0.2              | N/A   |
| 3. Acoustical signal tests of frequency weightings   |      |      |                  |   |
| 125 Hz   | ✓    | -    | 0.3              | 0.6   |
| 1000 Hz  | ✓    | -    | 0.3              | 0.6   |
| 8000 Hz  | ✓    | -    | 0.3              | 0.7   |
| 4. Electrical signal tests of frequency weightings   |      |      |                  |   |
| For 10 Hz to 4 kHz                                   | ✓    | -    | 0.3              | 0.6   |
| For > 4 kHz to 10 kHz                                | ✓    | -    | 0.3              | 0.7   |
| For > 10 kHz to 20 kHz                               | -    | -    | -                | 1.0   |
| 5. Frequency and time weightings at 1 kHz            | ✓    | -    | 0.2              | 0.2   |
| 6. Long - term stability                             | ✓    | -    | 0.1              | 0.1   |
| 7. Level linearity on the reference level range      | ✓    | -    | 0.2              | 0.3   |
| 8. Level linearity including the level range control | ✓    | -    | 0.2              | 0.3   |
| 9. Tone burst response                               | ✓    | -    | 0.2              | 0.3   |
| 10. Peak C sound level                               | ✓    | -    | 0.2              | 0.35  |
| 11. Overload indication                              | ✓    | -    | 0.2              | 0.25  |
| 12. High level stability                             | ✓    | -    | 0.1              | 0.1   |

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## Continuation of Calibration Certificate

Cert. No. : ACL23052  
Job No. : VC66AC0026  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

| Reference<br>Acoustic Signal<br>( dB ) | Measured<br>Value<br>( dB ) | Deviation<br>( dB ) | Acceptance<br>Limit<br>( dB ) |
|--|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.95)                           | 93.9                        | 0.0                 | ±0.3                          |

## 2. Self-generated noise

## 2.1 Normal test

| Measured Value<br>( dB ) |
|--------------------------|
| 13.8                     |

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

| Frequency<br>Weighting | Measured value<br>( dB ) |
|------------------------|--------------------------|
| A - weight             | 10.8                     |
| C - weight             | 16.7                     |
| Flat                   | 22.5                     |

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

| Frequency<br>( Hz ) | Deviation from various frequency weighting response curve (dB) |          |          |                      |
|---------------------|--|----------|----------|----------------------|
|                     | Flat   | C-weight | A-weight | Acceptance<br>Limits |
| 125                 | 0.3  | 0.4      | 0.4      | ± 1.5                |
| 1000                | -0.1   | -0.1     | -0.1     | ± 1.0                |
| 8000                | -0.9   | -0.9     | -0.9     | ±5.0                 |

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7. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23052  
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## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

| Frequency<br>( Hz ) | Deviation from various frequency weighting response curve (dB) |          |          |                      |
|---------------------|--|----------|----------|----------------------|
|                     | Flat   | C-weight | A-weight | Acceptance<br>Limits |
| 63                  | -0.1   | 0.0      | 0.0      | ±2.0                 |
| 125                 | 0.0  | 0.0      | 0.0      | ±1.5                 |
| 250                 | 0.0  | 0.0      | -0.1     | ±1.5                 |
| 500                 | 0.0  | 0.0      | -0.1     | ±1.5                 |
| 1000                | 0.0  | 0.0      | 0.0      | ±1.0                 |
| 2000                | 0.0  | 0.0      | 0.0      | ±2.0                 |
| 4000                | 0.0  | 0.0      | 0.0      | ±3.0                 |
| 8000                | 0.0  | 0.1      | 0.1      | ±5.0                 |

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

| Frequency<br>Weighting | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|------------------------|-----------------------------|-----------------------------|--------------------------------|
| A - weight             | 94.0                        | 0.0                         | -                              |
| C - weight             | 94.0                        | 0.0                         | ± 0.2                          |
| Flat                   | 94.0                        | 0.0                         | ± 0.2                          |

## 5.2 Time weighting at 1 kHz

| Frequency<br>Weighting | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast                   | 94.0                        | 0.0                         | -                              |
| Slow                   | 94.0                        | 0.0                         | ± 0.1                          |
| Leq                    | 94.0                        | 0.0                         | ± 0.1                          |

## 6. Long - term stability

| Frequency<br>Weighting | SLM Display<br>at initial<br>( dB ) | SLM Display<br>at final<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A -weight              | 94.0                                | 94.0                              | 0.0                         | ± 0.3                          |

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7. Petch

## Continuation of Calibration Certificate

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## 7. Level linearity on the reference level range

| Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 137.0                          | 137.0                       | 0.0                         | ± 1.1                          |
| 136.0                          | 136.0                       | 0.0                         | ± 1.1                          |
| 135.0                          | 135.0                       | 0.0                         | ± 1.1                          |
| 134.0                          | 134.0                       | 0.0                         | ± 1.1                          |
| 133.0                          | 133.0                       | 0.0                         | ± 1.1                          |
| 132.0                          | 131.9                       | -0.1                        | ± 1.1                          |
| 131.0                          | 130.9                       | -0.1                        | ± 1.1                          |
| 129.0                          | 129.0                       | 0.0                         | ± 1.1                          |
| 124.0                          | 124.0                       | 0.0                         | ± 1.1                          |
| 119.0                          | 119.0                       | 0.0                         | ± 1.1                          |
| 114.0                          | 114.0                       | 0.0                         | ± 1.1                          |
| 109.0                          | 109.0                       | 0.0                         | ± 1.1                          |
| 104.0                          | 104.0                       | 0.0                         | ± 1.1                          |
| 99.0                           | 99.0                        | 0.0                         | ± 1.1                          |
| 94.0                           | 94.0                        | 0.0                         | ± 1.1                          |
| 89.0                           | 89.0                        | 0.0                         | ± 1.1                          |
| 84.0                           | 84.0                        | 0.0                         | ± 1.1                          |
| 79.0                           | 79.0                        | 0.0                         | ± 1.1                          |
| 74.0                           | 74.0                        | 0.0                         | ± 1.1                          |
| 69.0                           | 69.0                        | 0.0                         | ± 1.1                          |
| 64.0                           | 64.0                        | 0.0                         | ± 1.1                          |
| 59.0                           | 59.0                        | 0.0                         | ± 1.1                          |
| 54.0                           | 54.0                        | 0.0                         | ± 1.1                          |
| 49.0                           | 49.0                        | 0.0                         | ± 1.1                          |
| 44.0                           | 44.0                        | 0.0                         | ± 1.1                          |
| 39.0                           | 39.0                        | 0.0                         | ± 1.1                          |
| 34.0                           | 34.0                        | 0.0                         | ± 1.1                          |
| 30.0                           | 30.1                        | 0.1                         | ± 1.1                          |
| 29.0                           | 29.0                        | 0.0                         | ± 1.1                          |
| 28.0                           | 28.0                        | 0.0                         | ± 1.1                          |
| 27.0                           | 27.0                        | 0.0                         | ± 1.1                          |
| 26.0                           | 26.0                        | 0.0                         | ± 1.1                          |
| 25.0                           | 25.1                        | 0.1                         | ± 1.1                          |

QF-TS12-04-04-020664

7. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23052  
Job No. : VC66AC0026  
Pages : 7 of 8

## 8. Level linearity including the level range control

| Range | Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Auto  | 94.0                           | 94.0                        | 0.0                         | ±1.1                           |

## 9. Tone burst response

| Time<br>Weighting | Tone burst<br>duration, Tb<br>( ms ) | Cycle | Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|-------------------|--------------------------------------|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast              | 0.25                                 | 1     | 108.0                          | 107.9                       | -0.1                        | 1.5 ; -5.0                     |
|                   | 2                                    | 8     | 117.0                          | 117.0                       | 0.0                         | 1.0 ; -2.5                     |
|                   | 200                                  | 800   | 134.0                          | 134.0                       | 0.0                         | ±1.0                           |
| Slow              | 2                                    | 8     | 108.0                          | 108.0                       | 0.0                         | 1.5 ; -5.0                     |
|                   | 200                                  | 800   | 127.6                          | 127.6                       | 0.0                         | ±1.0                           |
| SEL               | 0.25                                 | 1     | 99.0                           | 98.9                        | -0.1                        | 1.5 ; -5.0                     |
|                   | 2                                    | 8     | 108.0                          | 108.0                       | 0.0                         | 1.0 ; -2.5                     |
|                   | 200                                  | 800   | 128.0                          | 128.0                       | 0.0                         | ±1.0                           |

## 10. Peak C sound level

| Number of cycle<br>in<br>test signal | Anticipated<br>Value<br>( dB ) | Measured<br>Value, L <sub>peak</sub><br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|--------------------------------------|--------------------------------|--|-----------------------------|--------------------------------|
| Continuous                           | 133.0                          | 133.0  | 0.0                         | -                              |
| One                                  | 136.4                          | 135.7  | -0.7                        | ±3.0                           |

| Number of cycle<br>in<br>test signal | Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|--------------------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Continuous                           | 133.0                          | 133.0                       | 0.0                         | -                              |
| Positive half cycle                  | 135.4                          | 135.1                       | -0.3                        | ±2.0                           |
| Negative half cycle                  | 135.4                          | 135.2                       | -0.2                        | ±2.0                           |

QF-TS12-04-04-020664

7. Petch



Continuation of Calibration Certificate

Cert. No. : ACL23052  
Job No. : VC66AC0026  
Pages : 8 of 8

11. Overload indication

| Measured value ( dB )   |                         | Deviated Value ( dB ) | Acceptance Limits ( dB ) |
|-------------------------|-------------------------|-----------------------|--------------------------|
| Positive one-half cycle | Negative one-half cycle |                       |                          |
| 89.6                    | 89.5                    | -0.1                  | ±1.5                     |

12. High level stability

| Frequency Weighting | SLM Display at initial ( dB ) | SLM Display at final ( dB ) | Deviated Value ( dB ) | Acceptance Limits ( dB ) |
|---------------------|-------------------------------|-----------------------------|-----------------------|--------------------------|
| A - weight          | 137.0                         | 137.0                       | 0.0                   | ±0.3                     |

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

End of Calibration Certificate

QF-TS12-04-04-020664



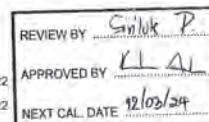
TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
1344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-21 FAX. 0-2719-0484



Cert.No.: 22CH1222  
Page.: 1 of 2

Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : Seven Compact S220  
Serial No. : B520948426  
ID No. : BKK\_EN0072  
Condition As-Received : Used Item  
Received Date : 09 September 2022  
Calibration Date : 12 September 2022  
Reference : 2209-0312DSC-1  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwang Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand  
Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In-house method :  
- CP-CH5 by direct measurement with standard  
voltage calibrator and direct measurement  
with certified reference material (CRM)



Calibrated by : Warakorn Lemgagrakul

Approved by : Approved Signatory

( / ) Malee Butkruea  
( ) Sathip Meangmai  
( ) Warakorn Lemgagrakul

Issue Date : 15 September 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services, Engineering Calibration and Testing Services.



Cert. No.: 22CH1222  
Page.: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument

Instrument Serial No. ID No. Cert. No. Due Date  
1) Document Process Calibrator 54030049 130RC116 22E2769 24 Aug 2023

This certification is traceable to the International System of Unit maintained at:  
- Traceable to National Institute of Metrology (Thailand), NIMT

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

| Buffer Solution | Manufacturer | Lot No. | Exp. date    |
|-----------------|--------------|---------|--------------|
| pH 4.008        | CPA chem     | 823320  | 20 June 2024 |
| pH 6.985        | CPA chem     | 794122  | 14 Feb 2023  |
| pH 10.008       | CPA chem     | 823323  | 20 June 2023 |

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

Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4,7,10)

| Unit Under Calibration       | Nominal Value | Standard Voltage Input | Actual Reading |        | Uncertainty of Measurement ( ±mV ) | Coverage factor k |
|------------------------------|---------------|------------------------|----------------|--------|------------------------------------|-------------------|
|                              | pH            | mV                     | mV             | pH     |                                    |                   |
| pH Meter<br>S/N : B520948426 | 4.000         | 177.48                 | 177.4          | 4.000  | 0.058                              | 2.00              |
|                              | 7.000         | 0.00                   | 0.0            | 7.000  | 0.058                              | 2.00              |
|                              | 10.000        | -177.48                | -177.5         | 10.000 | 0.058                              | 2.00              |

Function : pH Measurement

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

| Unit Under Calibration              | Standard pH Buffer Solution | Actual pH Reading | Actual mV Reading ( mV ) | Uncertainty of pH measurement ( ± ) | Coverage factor k |
|-------------------------------------|-----------------------------|-------------------|--------------------------|-------------------------------------|-------------------|
| pH Electrode<br>S/N : PCE-88-EX1001 | 4.008                       | 3.999             | 153.9                    | 0.0055                              | 2.09              |
|                                     | 6.985                       | 7.017             | -13.7                    | 0.0084                              | 2.00              |
|                                     | 10.008                      | 9.985             | -179.0                   | 0.0078                              | 2.06              |

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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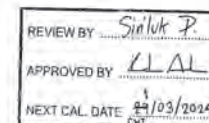
TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
1344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-21 FAX. 0-2719-0484



Cert.No.: 22CG3154  
Page.: 1 of 2

Certificate of Calibration

Equipment : Burette  
Capacity : 50 mL  
Serial No. :  
ID No. : BKK\_EN0171  
Manufacturer : Witeg  
Made in : Germany  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.  
Khwang Phatthanakan, Khet Suan Luang  
Bangkok 10250 Thailand  
Ambient Temperature : (20 ± 2.5) °C  
Relative Humidity : (50 ± 10) %  
Barometric Pressure : 759 mmHg  
Calibration Procedure : ASTM E 542 - 01



Calibrated by : Panward Pramklam

Approved by : Approved Signatory

( ) Pornthipha Tameyakul  
( ) Malee Butkruea  
( / ) Ponpan Palpim  
( ) Srisuda Khamthia

Issue Date : 31 August 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services, Engineering Calibration and Testing Services.

A 0044607



Equipment : Burette  
 Received Date : 28 August 2022  
 Condition As-Received : Used Item  
 Calibration Date : 30 August 2022  
 Reference : 2208-0818DSC-2

Cert.No.: 22CG3154  
 Page: 2 of 2

#### Condition of this result of calibration

#### 1. Reference Standard Instruments :

| Instruments          | Model   | Serial No. | ID No.   | Certificate No. | Traceability | Due date     |
|----------------------|---------|------------|----------|-----------------|--------------|--------------|
| 1) Balance           | AE200S  | N03679     | 140RC091 | 21MM429         | NIMT         | 22 Sep 2022  |
| 2) Thermo-Hygrograph | THDX-CE | 00016540   | 140EC001 | 22H1243         | NIST, NIMT   | 09 June 2023 |
| 3) Thermometer       | -       | 1584592    | 140EC010 | 221181          | NIMT         | 10 Feb 2023  |

This certification is traceable to SI Unit

- The certificate is valid only to the item calibrated on date and place of calibration.
- True value is converted to true volume at the standard temperature of 20 °C

#### Calibration result :

| Nominal capacity<br>( mL ) | Reading<br>( mL ) | Uncertainty<br>( ± mL ) | k<br>Factor |
|----------------------------|-------------------|-------------------------|-------------|
| 50                         | 48.9859           | 0.010                   | 2.00        |

Remark : mL = cm<sup>3</sup>

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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## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhroi, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th



Certificate No. T221644

Page 1 of 4

## Certificate of Calibration

Equipment : Chamber ( Cold Room )

Manufacturer : KOLDTECH

Model : KM 320

Serial No. : TBN-1012061/05

Customer Code : BKK\_EN0167

ID No. : T2463A3

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Environmental Laboratory

Date of Receipt : 27 June 2022

Calibrated By : Sujjar Nakhakred ( Site Calibration Manager )

Approved By : / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 6 JUL 2022

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 standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L13 11/7/01-02-04



## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhroi, Saraburi 18110, Thailand.



Certificate No. T221644

Page 2 of 4

## Calibration Report

Equipment : Chamber ( Cold Room )  
 Date of Calibration : 30 June - 1 July 2022  
 Environment : Temperature : 18.9-23.7 °C  
 Line Voltage : 222.9-226.5 V  
 Relative Humidity : 55 - 65 %RH

#### Condition of this results of calibration :

- This equipment was calibrated by insert nine standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 ( based on ASTM E145-94 ( Reapproved 2001 ) and AS2853-1986 ).

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

#### 2. Reference Standard Instrument :

| Instrument  | Model  | Instrument No. | Certificate No. | Due Date     |
|-------------|--------|----------------|-----------------|--------------|
| TC          | TYPE T | TN161-TN170    | T210009         | 30 July 2022 |
| TC          | TYPE T | TN171-TN180    | T210009         | 30 July 2022 |
| DATA LOGGER | 34970A | T149           | T210009         | 30 July 2022 |

#### 3. This certificate is traceable to :

National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244 )

#### 4. Condition of calibrated item : good

Equipment Description :

Time Constant 3 Hour - Minute At 3 °C

Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max

☐ Close

☒ Not Available

#### 5. Adjustment :

( ) without adjustment

( X ) after adjustment

Approved By:

FM-L13 11/7/01-03-03



## Metrological Center

SCI ECO Services Company Limited

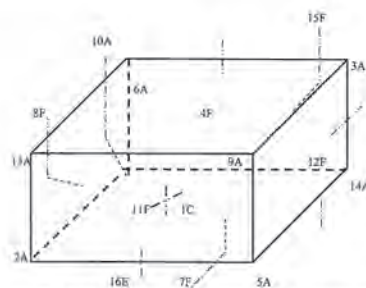
33/2 Moo 3, T.Banpa, A.Kaengkhroi, Saraburi 18110, Thailand.



Certificate No. T221644

Page 3 of 4

## Calibration Report



C = Centre, F = Centre of Face, A = Corner, E = Centre of Edge.

|       |       |
|-------|-------|
| 1C =  | TN161 |
| 2A =  | TN162 |
| 3A =  | TN163 |
| 4F =  | TN164 |
| 5A =  | TN165 |
| 6A =  | TN166 |
| 7F =  | TN167 |
| 8F =  | TN168 |
| 9A =  | TN169 |
| 10A = | TN170 |

|       |       |
|-------|-------|
| 11F = | TN171 |
| 12F = | TN172 |
| 13A = | TN173 |
| 14A = | TN174 |
| 15F = | TN175 |
| 16E = | TN176 |

Approved By:

FM-L13 11/7/01-03-03



## Calibration Report

### Measurement Results:

| Calibration Point | Average Standard Reading at each position (°C) |       |       |       |       |       |       |       |       |       |
|-------------------|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|                   | TN161  | TN162 | TN163 | TN164 | TN165 | TN166 | TN167 | TN168 | TN169 | TN170 |
| 3                 | 2.71   | 2.82  | 2.75  | 2.89  | 2.95  | 3.08  | 3.02  | 2.96  | 3.03  | 2.85  |
|                   | TN171  | TN172 | TN173 | TN174 | TN175 | TN176 |       |       |       |       |
|                   | 2.97   | 3.02  | 2.89  | 3.04  | 2.97  | 3.33  |       |       |       |       |

| Chamber ( Cold Room ) |              |         | Temperature Distribution |                  |                 |                    |                   |
|-----------------------|--------------|---------|--------------------------|------------------|-----------------|--------------------|-------------------|
| Setting (°C)          | Reading (°C) |         | Average (°C)             | Stability (± °C) | Uniformity (°C) | Uncertainty (± °C) | Coverage Factor k |
|                       | Min , Max    | Average |                          |                  |                 |                    |                   |
| 3.0                   | 2.9 , 4.0    | 3.2     | 2.99                     | 1.05             | 1.30            | 1.66               | 2.00              |

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate at shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k, which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By:

TM-L15117/15-05-03

001-EN0069

REVIEW BY: Aucharawan S.  
APPROVED BY: Sirarat M.  
NEXT CAL DATE: 12.3.2024



## Certificate of Calibration

ICS-2100: Anion (ID#659)

This certificate is to verify that instrument below are calibrated

by Archimica Lab Co., Ltd.

ICS-2100 S/N: 15010977

AS-HV S/N: 5450A36659

For

ALS Laboratory Group (Thailand) Co., Ltd.

Operator Signature: Nutdanai

Date: Jan 12, 2023

(Mr.Nutdanai Laekhwan)

Application Chemist

**Sartorius (Thailand) Co., Ltd.**  
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
Tel : +66 2043 8361-6 Fax : +66 2043 8367, e-mail: service.thailand@sartorius.com



**SARTORIUS**

## Certificate of Calibration

Model Number : MSE224S-100-DU  
Description : Analytical Balance  
Serial Number : 26207042  
ID No. : BKK\_EN0002  
Manufacturer : Sartorius

Certificate No. : 23BC10072  
Issued Date : Monday, February 13, 2023  
Reference No. : 203245  
Page No. : 1 of 2

Customer Name : ALS Laboratory Group (Thailand) Co., Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250.

Calibrated Place : Balance Room

Calibrated By : Mr. Chonchai Inthana  
Calibration Date : Wednesday, February 08, 2023

Calibration Procedure No. : This calibration was conducted by Using in-house calibration procedure number (WI-003) Based on UKAS LAB 14 : 2019

### Metrological data :

Capacity : 220 g Readability : 0.0001 g

### Ambient Conditions:

Temperature : 23.2 °C ± 5.0 °C  
Humidity : 60.0 % RH ± 10.0 % RH  
Pressure : ±

### Reasons for calibration

☐ New Installation ☐ Service / Repair ☒ Re-calibration / Maintenance

### Equipment Condition:

☒ Good Operate ☐ Fair

### Measurement Method UKAS Publication Ref : Lab 14

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to the Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

### Traceability:

| Model Number  | Description                                       | Traceability | Certificate No. | Due Date    |
|---------------|---|--------------|-----------------|-------------|
| YC5011-522-00 | Sartorius weight set 1mg - 5000g E2 YC5011-522-00 | SPC-RT       | C02212566       | 14-Sep-2023 |
| MHB-382SD     | Humidity/Balance/Temp. Lution MHB-382SD           | DKSH         | C18220444       | 5-Sep-2023  |

This certificate relate and apply this equipment only.  
This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division  
Sartorius (Thailand) Co., Ltd.

Mr. Chonchai Inthana (Technical Manager)



**Sartorius (Thailand) Co., Ltd.**  
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
Tel : +66 2043 8361-6 Fax : +66 2043 8367, e-mail: service.thailand@sartorius.com

**SARTORIUS**

## Certificate of Calibration

Model Number : MSE224S-100-DU  
Description : Analytical Balance  
Serial Number : 26207042  
ID No. : BKK\_EN0002  
Manufacturer : Sartorius

Certificate No. : 23BC10072  
Issued Date : Monday, February 13, 2023  
Reference No. : 203245  
Page No. : 2 of 2

### Calibration Results : Without Adjustment

| Repeatability   |          |          | Eccentricity (Off-center loading error)  |        |   |
|---|----------|----------|--|--------|---|
| The repeatability is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively. |          |          | The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R110) |        |   |
| Nominal Value : (Low Load)  | 20.0000  | 200.0000 | Nominal value :  | 50     | g |
| 20 g  | 20.0000  | 199.9999 | Tolerance  | 0.0004 | g |
| Tolerance   | 0.0001 g | 0.0000   | Difference   |        |   |
|   | 20.0000  | 199.9999 |  |        |   |
|   | 20.0001  | 200.0000 |  |        |   |
| Nominal Value : (High Load)   | 200.0000 | 200.0000 |  |        |   |
| 200 g   | 200.0000 | 199.9999 |  |        |   |
| Tolerance   | 0.0001 g | 0.0000   |  |        |   |
|   | 20.0000  | 199.9999 |  |        |   |
|   | 20.0000  | 200.0000 |  |        |   |
|   | 20.0001  | 199.9999 |  |        |   |
| Standard Deviation  |          | 0.0000%  |  |        |   |

### Linearity

The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.

Tolerance 0.0002 g

| Nominal Value (g) | Conventional Mass Value (g) | Displayed Value (g) | Deviation (g) | Uncertainty (g) |
|-------------------|-----------------------------|---------------------|---------------|-----------------|
| 0.01              | 0.0100                      | 0.0100              | 0.0000        | 0.00014         |
| 0.1               | 0.1000                      | 0.1000              | 0.0000        | 0.00014         |
| 1                 | 1.0000                      | 1.0000              | 0.0000        | 0.00014         |
| 2                 | 2.0000                      | 2.0000              | 0.0000        | 0.00014         |
| 5                 | 5.0000                      | 5.0000              | 0.0000        | 0.00014         |
| 10                | 10.0000                     | 10.0000             | 0.0000        | 0.00014         |
| 20                | 20.0000                     | 20.0000             | 0.0000        | 0.00014         |
| 50                | 50.0000                     | 50.0000             | 0.0000        | 0.00015         |
| 100               | 100.0000                    | 100.0000            | 0.0000        | 0.00019         |
| 200               | 200.0000                    | 199.9999            | -0.0001       | 0.00010         |

End of Report.



Certificate No. T222502

Page 1 of 4

## Certificate of Calibration

**Equipment** : Chamber ( Oven )

**Manufacturer** : Memmert

**Model** : UF 450

**Serial No.** : B7170531

**Customer Code** : BKK\_EN0273

**ID No.** : T8042A4

**Customer** : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250

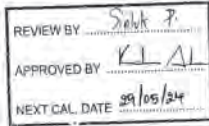
**Customer Location** : Oven Room

**Date of Receipt** : 23 November 2022

**Calibrated By** : Sujjar Naknakred ( Site Calibration Manager )

**Approved By** : /Boonchai Suriyawong (Site Calibration Manager)

**Date of Issue** : 09 DEC 2022



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 standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L15117/15-05-63

Certificate No. T222502

Page 2 of 4

## Calibration Report

**Equipment** : Chamber ( Oven )

**Date of Calibration** : 29 November 2022

**Environment** : Temperature : 29.1-29.6 °C  
Line Voltage : 221.3-223.2 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert nine resistance thermometer detectors and nine standard thermocouples type T into its chamber , the other one resistance thermometer detector use for ambient temperature measurement .  
The calibration was done in according to WI-T20 ( based on ASTM E145-94 ( Reapproved 2001 ) and AS2853-1986 ) .  
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

### 2. Reference Standard Instrument :

| Instrument  | Model   | Instrument No. | Certificate No. | Due Date         |
|-------------|---------|----------------|-----------------|------------------|
| RTD         | 100 ohm | 27-CH1-10      | T210004         | 30 December 2022 |
| TC          | TYPE T  | TN261-TN270    | T210010         | 30 December 2022 |
| DATA LOGGER | 34970A  | T149           | T210004         | 30 December 2022 |

### 3. This certificate is traceable to :

National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244 )

### 4. Condition of calibrated item : good

#### Equipment Description :

Time Constant : 1 Hour 49 Minute At 104 °C

Fresh Air Damper : ☒ Open ☐ Min ☐ Medium ☒ Max  
☐ Close  
☐ Not Available

### 5. Adjustment :

( ) without adjustment ( X ) after adjustment

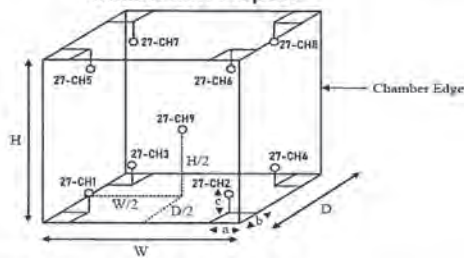
Approved By:

FM-L15117/15-05-63

Certificate No. T222502

Page 3 of 4

## Calibration Report



### Remark :

Internal Dimensions of Chamber : W (Width) = 104 cm., H (Height) = 72 cm. and D (Depth) = 60 cm.  
Size of Installed Standard sensor number 27-CH1 to number 27-CH9 : a = 5 cm., b = 5 cm. and c = 5 cm.  
Size of Installed Standard sensor number 27-CH9 : W/2 = 104 cm./2 , H/2 = 72 cm./2 and D/2 = 60cm./2

### Measurement Results

| Average Standard Reading at each position ( °C ) |        |        |        |        |        |        |        |        |
|--|--------|--------|--------|--------|--------|--------|--------|--------|
| Calibration Point                                | 27-CH1 | 27-CH2 | 27-CH3 | 27-CH4 | 27-CH5 | 27-CH6 | 27-CH7 | 27-CH8 |
| 104  | 101.07 | 103.80 | 103.45 | 104.62 | 104.47 | 103.57 | 104.39 | 101.75 |

| Chamber ( Oven ) |                | Temperature Distribution |                |                    |                   |                      |
|------------------|----------------|--------------------------|----------------|--------------------|-------------------|----------------------|
| Setting ( °C )   | Reading ( °C ) |                          | Average ( °C ) | Stability ( ± °C ) | Uniformity ( °C ) | Uncertainty ( ± °C ) |
|                  | Min , Max      | Average                  |                |                    |                   |                      |
| 104.0            | -              | 104.0                    | 101.97         | 0.07               | 0.70              | 0.42                 |

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing

a level of confidence of approximately 95 % .

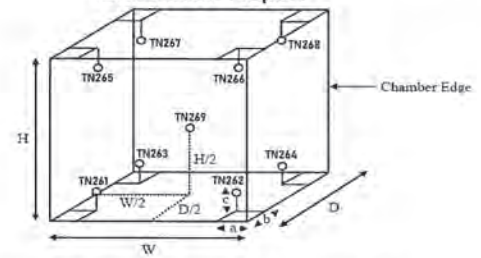
Approved By:

FM-L15117/15-05-63

Certificate No. T222502

Page 4 of 4

## Calibration Report



### Remark :

Internal Dimensions of Chamber : W (Width) = 104 cm., H (Height) = 72 cm. and D (Depth) = 60 cm.  
Size of Installed Standard sensor number TN261 to number TN269 : a = 5 cm., b = 5 cm. and c = 5 cm.  
Size of Installed Standard sensor number TN269 : W/2 = 104 cm./2 , H/2 = 72 cm./2 and D/2 = 60cm./2

### Measurement Results

| Average Standard Reading at each position ( °C ) |        |        |        |        |        |        |        |        |
|--|--------|--------|--------|--------|--------|--------|--------|--------|
| Calibration Point                                | TN261  | TN262  | TN263  | TN264  | TN265  | TN266  | TN267  | TN268  |
| 180  | 179.14 | 179.17 | 179.65 | 179.26 | 180.41 | 179.64 | 181.18 | 180.99 |

| Chamber ( Oven ) |                | Temperature Distribution |                |                    |                   |                      |
|------------------|----------------|--------------------------|----------------|--------------------|-------------------|----------------------|
| Setting ( °C )   | Reading ( °C ) |                          | Average ( °C ) | Stability ( ± °C ) | Uniformity ( °C ) | Uncertainty ( ± °C ) |
|                  | Min , Max      | Average                  |                |                    |                   |                      |
| 180.0            | -              | 180.0                    | 179.98         | 0.38               | 1.78              | 1.10                 |

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing

a level of confidence of approximately 95 % .

Approved By:

FM-L15117/15-05-63





## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110


Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T230902

Page 1 of 5

### Certificate of Calibration

Equipment : Digestion Unit  
Manufacturer : SCP Science  
Model : DigiPRER HT  
Serial No. : HTC1120480658  
Customer Code : BKK\_EN0366  
ID No. : T2635A5  
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250  
Customer Location : Wet Chemistry Lab 1  
Date of Receipt : 10 May 2023  
Calibrated By : Sujjar Naknakred ( Site Calibration Manager )  
Approved By :  / Boonchai Suriyawong ( Site Calibration Manager )  
Date of Issue : 29 MAY 2023

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 standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L12 108/30-05-57



## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T230902

Page 2 of 5

### Calibration Report


Equipment : Digestion Unit  
Date of Calibration : 17 May 2023  
Environment : Temperature : 23.9 - 26.3 °C  
Line Voltage : 221.8 - 225.9 V  
Relative Humidity : 55 - 65 %RH

#### Condition of this results of calibration :

- This equipment was calibrated by insert four standard thermocouples type S into its chamber, the other one thermocouple type T use for ambient temperature measurement. The calibration was done in according to WI-T10.
- Reference Standard Instrument :

| Instrument  | Model  | Instrument No.    | Certificate No. | Due Date      |
|-------------|--------|-------------------|-----------------|---------------|
| TC          | Type S | M20A1-(CH17-CH20) | T230547         | 18 April 2024 |
| DATA LOGGER | 34970A | T149              | T230547         | 18 April 2024 |
- This certificate is traceable to :  
National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244J ).
- Condition of calibrated item : good  
Equipment Description :

| Time Constant    | 1 Hour  | 54 Minute | At 380 °C |
|------------------|---|-----------|-----------|
| Fresh Air Damper | <input type="checkbox"/> Open <input type="checkbox"/> Min <input type="checkbox"/> Medium <input type="checkbox"/> Max |           |           |
|                  | <input type="checkbox"/> Close  |           |           |
|                  | <input checked="" type="checkbox"/> Not Available   |           |           |
- Adjustment :  
( X ) without adjustment ( ) after adjustment

Approved By : 

FM-L13 108/30-05-57



## Metrological Center

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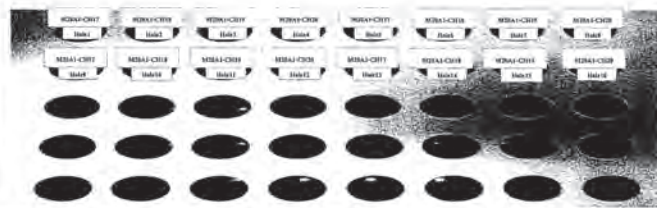
Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T230902

Page 3 of 5

### Calibration Report




FRONT

#### Measurement Results

| Cal. Point | Setting | Reading       | STD.           | Position of Standards at Block |       |       |       |       |       |       |       |
|------------|---------|---------------|----------------|--------------------------------|-------|-------|-------|-------|-------|-------|-------|
| °C         | °C      | °C            | Reading        | Hole1                          | Hole2 | Hole3 | Hole4 | Hole5 | Hole6 | Hole7 | Hole8 |
| 380.0      | 380.0   | 379.4 - 380.7 | Max °C         | 377.3                          | 379.0 | 379.2 | 380.2 | 377.5 | 379.5 | 380.7 | 380.1 |
|            |         |               | Min °C         | 376.8                          | 378.6 | 378.9 | 379.9 | 377.0 | 379.0 | 380.2 | 379.6 |
|            |         |               | Average °C     | 377.6                          | 378.8 | 379.1 | 380.0 | 377.5 | 379.2 | 380.4 | 379.9 |
|            |         |               | Stability ± °C | 0.2                            | 0.2   | 0.2   | 0.2   | 0.3   | 0.3   | 0.2   | 0.2   |
|            |         |               |                |                                |       |       |       |       |       |       |       |

| Cal. Point | Setting | Reading       | STD.           | Position of Standards at Block |        |        |        |        |        |        |        |
|------------|---------|---------------|----------------|--------------------------------|--------|--------|--------|--------|--------|--------|--------|
| °C         | °C      | °C            | Reading        | Hole9                          | Hole10 | Hole11 | Hole12 | Hole13 | Hole14 | Hole15 | Hole16 |
| 380.0      | 380.0   | 379.4 - 380.7 | Max °C         | 377.1                          | 378.9  | 379.7  | 379.9  | 379.3  | 379.6  | 379.5  | 377.8  |
|            |         |               | Min °C         | 376.7                          | 378.3  | 379.3  | 379.5  | 378.9  | 379.1  | 379.9  | 377.0  |
|            |         |               | Average °C     | 376.9                          | 378.7  | 379.5  | 379.7  | 379.1  | 379.4  | 379.3  | 377.2  |
|            |         |               | Stability ± °C | 0.2                            | 0.2    | 0.2    | 0.2    | 0.2    | 0.3    | 0.3    | 0.2    |
|            |         |               |                |                                |        |        |        |        |        |        |        |

Approved By : 

FM-L13 108/30-05-57



## Metrological Center

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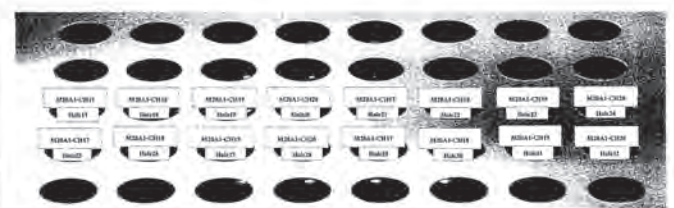
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Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T230902

Page 4 of 5

### Calibration Report




FRONT

#### Measurement Results

| Cal. Point | Setting | Reading       | STD.           | Position of Standards at Block |        |        |        |        |        |        |        |
|------------|---------|---------------|----------------|--------------------------------|--------|--------|--------|--------|--------|--------|--------|
| °C         | °C      | °C            | Reading        | Hole17                         | Hole18 | Hole19 | Hole20 | Hole21 | Hole22 | Hole23 | Hole24 |
| 380.0      | 380.0   | 379.4 - 380.7 | Max °C         | 378.4                          | 380.1  | 380.1  | 380.0  | 379.1  | 379.8  | 379.6  | 377.8  |
|            |         |               | Min °C         | 377.8                          | 379.6  | 379.7  | 379.3  | 378.6  | 379.2  | 379.2  | 377.3  |
|            |         |               | Average °C     | 378.1                          | 379.9  | 379.9  | 379.7  | 378.9  | 379.5  | 379.4  | 377.5  |
|            |         |               | Stability ± °C | 0.3                            | 0.3    | 0.2    | 0.3    | 0.3    | 0.3    | 0.2    | 0.2    |
|            |         |               |                |                                |        |        |        |        |        |        |        |

| Cal. Point | Setting | Reading       | STD.           | Position of Standards at Block |        |        |        |        |        |        |        |
|------------|---------|---------------|----------------|--------------------------------|--------|--------|--------|--------|--------|--------|--------|
| °C         | °C      | °C            | Reading        | Hole25                         | Hole26 | Hole27 | Hole28 | Hole29 | Hole30 | Hole31 | Hole32 |
| 380.0      | 380.0   | 379.4 - 380.7 | Max °C         | 377.9                          | 379.4  | 380.1  | 380.1  | 379.3  | 379.6  | 378.9  | 377.3  |
|            |         |               | Min °C         | 377.4                          | 378.9  | 379.7  | 379.7  | 378.8  | 378.9  | 378.4  | 376.7  |
|            |         |               | Average °C     | 377.7                          | 379.2  | 379.9  | 379.9  | 379.0  | 379.3  | 378.6  | 377.0  |
|            |         |               | Stability ± °C | 0.3                            | 0.3    | 0.2    | 0.2    | 0.3    | 0.4    | 0.3    | 0.3    |
|            |         |               |                |                                |        |        |        |        |        |        |        |

Approved By : 

FM-L13 108/30-05-57



## Metrological Center

SCI ECO Services Company Limited

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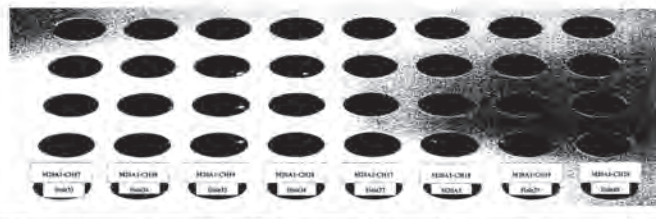
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Certificate No. T230902

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### Calibration Report



FRONT

#### Measurement Results

| Cal. Point         | Setting            | Reading            | STD                          | Position of Standards of Block |          |          |          |          |          |          |          |
|--------------------|--------------------|--------------------|------------------------------|--------------------------------|----------|----------|----------|----------|----------|----------|----------|
| $^{\circ}\text{C}$ | $^{\circ}\text{C}$ | $^{\circ}\text{C}$ | Reading                      | Hole33                         | Hole34   | Hole35   | Hole36   | Hole37   | Hole38   | Hole39   | Hole40   |
|                    |                    |                    |                              | NDA1-CUT                       | NDA1-CUR | NDA1-CHN | NDA1-CHN | NDA1-CHT | NDA1-CHN | NDA1-CHN | NDA1-CHN |
|                    |                    |                    | Max $^{\circ}\text{C}$       | 377.7                          | 378.0    | 378.3    | 379.6    | 378.2    | 378.5    | 377.3    | 377.4    |
|                    |                    |                    | Min $^{\circ}\text{C}$       | 377.3                          | 377.6    | 377.9    | 378.6    | 377.7    | 378.1    | 376.9    | 377.0    |
|                    |                    |                    | Average $^{\circ}\text{C}$   | 377.5                          | 377.8    | 378.1    | 378.8    | 378.0    | 378.3    | 377.1    | 377.2    |
|                    |                    |                    | Stability $^{\circ}\text{C}$ | 0.2                            | 0.2      | 0.2      | 0.2      | 0.2      | 0.2      | 0.2      | 0.2      |

The expanded uncertainty of temperature measurement was  $\pm 1.85^{\circ}\text{C}$

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

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

Approved By

FM-L13 108/30-05-57



บริษัท ดับเบิล เอส ไดแอกโนสติกส์ จำกัด  
DOUBLE S DIAGNOSTICS CO., LTD.

10 หมู่ 11 ต.บ้านใหม่ อ.เมือง จ.นนทบุรี 11000 โทร : 02-512-1451 โทรสาร : 02-512-1452  
10 หมู่ 11 ต.บ้านใหม่ อ.เมือง จ.นนทบุรี 11000 โทร : 02-512-1451 โทรสาร : 02-512-1452

Maintenance Plan YEAR : 2023

| เดือน | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 130   |     |     |     |     |     |     | ✓   | CE  |     |     |     |     |

#### Periodical maintenance check list for Konelab

|   | 6M                                  | 12M                                 | Note |
|---|-------------------------------------|-------------------------------------|------|
| 1.Diluent-wash tubing change                              | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |      |
| 2.ISE tubing change                                       | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | None |
| 3.Syringe check/change                                    |                                     | <input checked="" type="checkbox"/> |      |
| 4.Dispensing check/ change                                |                                     | <input checked="" type="checkbox"/> |      |
| 5.Waste tubing change when necessary                      |                                     | <input checked="" type="checkbox"/> |      |
| 6.Lamp check/change                                       | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |      |
| 7.Mixer paddle/paddle change(not Konelab20)               |                                     | <input checked="" type="checkbox"/> |      |
| 8.ISE needles check/change                                |                                     | <input checked="" type="checkbox"/> | None |
| 9.Pump tubing check/ change                               | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |      |
| 10.Broken/worn out part check /change                     |                                     | <input checked="" type="checkbox"/> |      |
| 11.Peristaltic pump check /cleaning/ lubrication          | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |      |
| 12.Heating check  |                                     | <input checked="" type="checkbox"/> |      |
| 13.Cooling check  |                                     | <input checked="" type="checkbox"/> |      |
| 14.Dispenser mechanic check/adjustment                    | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |      |
| 15.Cuvette transfer mechanic check/adjustment             | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |      |
| 16.Dispenser movement check/adjustment                    | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |      |
| 17.Sample/reagent register check/adjustment               | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |      |
| 18.Dispensing tubing tightness check                      | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |      |
| 19.Photometer and optics cleaning/check/adjustment        | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |      |
| 20.Workstation PC cleaning if necessary                   | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |      |
| 21.Mechanic cleaning/lubrication                          | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |      |
| 22.Instrument cleaning if necessary                       | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |      |
| 23.Complete analyzer testing with waterblank/QC or sample | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |      |
| 24.Test parameters/Adjustment/config. Save to USB key     | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |      |
| 25.UPS Test   | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |      |

Place: AL3 LAB Instrument: K30 Aquakem  
Date/Time: 12/7/66 Serial no: 07981  
Service done by: S. P. S. Install date: 12/12/16  
Signature of customer: 07981 Date/Time: 12/12/16

Accuracy results Aquakem 7.2.AQ2 Page: 1

Laboratory  
Analyzer User

7/12/2023 21:21

Performed 7/12/2023  
Sgt. W166

#### ACCEPTANCE CRITERIA

|                                | Result | Limit        | Warning |
|--------------------------------|--------|--------------|---------|
| Temperature (°C)               | 37.7   | 37.0 +/- 1.0 |         |
| Dispensing ratio               | 16.4   | 14.8 - 17.2  |         |
| CV%                            | 1.17   | <1.7         |         |
| Photometric noise              |        |              |         |
| Max SD L340_2 (nA)             | 0.19   | <2.0         |         |
| Max SD L340_4 (nA)             | 1.06   | <3.0         |         |
| Linearity of photometer        |        |              |         |
| Slope                          | 1.0198 | 0.94 - 1.06  |         |
| Curvature                      | 0.0035 | +/- 0.02     |         |
| Max bias from linear fit (nA)  | 3.2    | <15.0        |         |
| Max delta %                    | -2.0   | +/- 6.0      |         |
| Linearity of sample dispensing |        |              |         |
| Proport. volume XDISP2 (??)    | 2.06   | 1.96 - 2.16  |         |
| Proport. volume XDISP4 (??)    | 4.13   | 3.85 - 4.40  |         |
| XDISP2 CV%                     | 0.58   | <2.0         |         |
| XDISP4 CV%                     | 0.70   | <2.0         |         |
| XDISP10 CV%                    | 0.59   | <2.0         |         |
| Needle 0.71 volume             |        |              |         |
| Average (A)                    | 0.009  | <0.050       |         |
| Standard deviation (A)         | 0.002  | <0.005       |         |
| Volume (??)                    | 0.06   | <0.32        |         |

#### OTHER INFORMATION

| Dispensing ratio | Photom. noise: SD (nA) |
|------------------|------------------------|
| Posit Result (A) | Posit L340_2 L340_4    |
| 1 0.1352         | 1 0.07 0.64            |
| 2 0.1624         | 2 0.09 1.05            |
| 3 0.1631         | 3 0.14 0.50            |
| 4 0.1631         | 4 0.13 0.53            |
| 5 0.1625         | 5 0.19 0.38            |
| 6 0.1650         | 6 0.02 0.64            |

Accuracy results Aquakem 7.2.AQ2 Page: 2

Laboratory  
Analyzer User

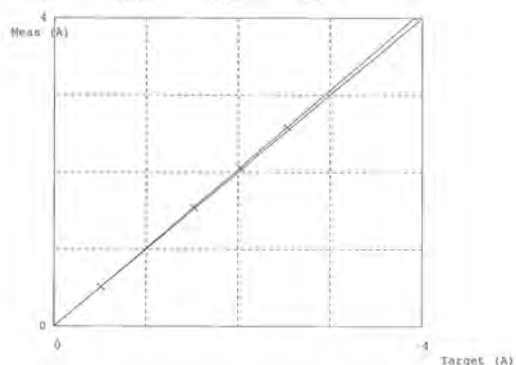
7/12/2023 21:21

#### Linearity of sample dispensing

| Test    | Absorbance (A) |
|---------|----------------|
| XDISP2  | 0.311          |
| XDISP4  | 0.616          |
| XDISP10 | 1.478          |

#### Linearity of photometer

| L340 | Target (A) | Meas (A) | Delta (A) | Delta % |
|------|------------|----------|-----------|---------|
| 1    | 0.001      | 0.005    | -0.004    | -294.7  |
| 2    | 0.512      | 0.519    | -0.007    | -1.3    |
| 3    | 1.523      | 1.550    | -0.027    | -1.8    |
| 4    | 2.027      | 2.066    | -0.039    | -1.9    |
| 5    | 2.532      | 2.582    | -0.050    | -2.0    |







## Certificate of Calibration

Equipment: CONDUCTIVITY METER  
Model: ORION STAR A215  
Serial No. (or ID.): X58031  
Manufacturer: Thermo Scientific  
Electrode Serial No.: YV1-18416  
Condition: In Condition

Certificate No.: C24230001  
Issued Date: 5 January 2023  
Job No.: KSPR2216356  
Page: 1 of 2  
Model: ORION 013005MD  
Brand: Thermo Scientific

Customer: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Soi Pattanakarn 40, Pattanakarn Rd.,  
Suan Luang, Bangkok 10250 Thailand

Environment Condition: Temperature 21.6 °C ± 0.2 °C  
Humidity 58.0 %RH ± 2.0 %RH

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd. ( Wet Chemistry Lab 2 )  
104 Soi Pattanakarn 40, Pattanakarn Rd.,  
Suan Luang, Bangkok 10250 Thailand

Calibration By: Mr. Nattapat Rungueang  
Calibration Date: 3 January 2023  
The Method used: In house method, CAL-WI-49, base on ASTM D 1125-14 and D 5391-14  
Traceability: This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 836317, 838313, 838315

Signature

(Mr. Nattapat Rungueang)  
Person in charge

Signature

(Mr. Nitinun Srihawan)  
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.  
The measurement uncertainty stated in the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

Unit location: 2533 Sukhumvit Road, Bangkok, Thailand 10260  
DKSH Technology Limited  
2533 Sukhumvit Road, Bangkok, Thailand 10260  
Phone: +66 2039 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration

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CAL-FM-C24-09: 12 Sep 2022



Certificate No.: C24230001

Page: 2 of 2

### Calibration Results:

#### Before Adjustment

| Standard Conductivity Solution | Unit Under Calibration Reading | Correction    | Coverage Factor (k) | Uncertainty (±) |
|--------------------------------|--------------------------------|---------------|---------------------|-----------------|
| 84.000 µS/cm                   | 102.4 µS/cm                    | -18.400 µS/cm | 2.00                | 0.68 µS/cm      |
| 1413.0 µS/cm                   | 1689 µS/cm                     | -276.0 µS/cm  | 2.00                | 11 µS/cm        |
| 12.881 mS/cm                   | 15.42 mS/cm                    | -2.5390 mS/cm | 2.00                | 0.098 mS/cm     |

#### After Adjustment ; at 84.0 µS/cm, 1413 µS/cm, 12.88 mS/cm

| Standard Conductivity Solution | Unit Under Calibration Reading | Correction    | Coverage Factor (k) | Uncertainty (±) |
|--------------------------------|--------------------------------|---------------|---------------------|-----------------|
| 84.000 µS/cm                   | 84.08 µS/cm                    | -0.090 µS/cm  | 2.00                | 0.68 µS/cm      |
| 1413.0 µS/cm                   | 1413 µS/cm                     | 0.0 µS/cm     | 2.00                | 11 µS/cm        |
| 12.881 mS/cm                   | 12.88 mS/cm                    | -0.0090 mS/cm | 2.00                | 0.098 mS/cm     |

The End of Certificate

Unit location: 2533 Sukhumvit Road, Bangkok, Thailand 10260  
DKSH Technology Limited  
2533 Sukhumvit Road, Bangkok, Thailand 10260  
Phone: +66 2039 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration

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CAL-FM-C24-09: 12 Sep 2022



## ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR2216356

ชนิดเครื่องวัด: CONDUCTIVITY METER

รุ่น: ORION STAR A215

หมายเลขเครื่อง: X58031

| ตรวจสอบ (รับ)                       |                          | ตรวจสอบ (ส่ง)                       |                          |
|-------------------------------------|--------------------------|-------------------------------------|--------------------------|
| 03 Jan 2023                         |                          | 03 Jan 2023                         |                          |
| ปกติ                                | ไม่ปกติ                  | ปกติ                                | ไม่ปกติ                  |
| รายการตรวจสอบ                       |                          |                                     |                          |
| General                             |                          |                                     |                          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Spectrophotometer                   |                          |                                     |                          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| pH Meter and Conductivity Meter     |                          |                                     |                          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Turbidimeter                        |                          |                                     |                          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Automatic titrator                  |                          |                                     |                          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

ชื่อหน้า:

Mr. Nattapat Rungueang  
Service Engineer

Unit location: 2533 Sukhumvit Road, Bangkok, Thailand 10260  
DKSH Technology Limited  
2533 Sukhumvit Road, Bangkok, Thailand 10260  
Phone: +66 2039 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration

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CAL-FM-R31-03: 20 Jul 2022



## Certificate of Calibration

Equipment: CONDUCTIVITY METER  
Model: ORION STAR A215  
Serial No. (or ID.): X58031  
Manufacturer: Thermo Scientific  
Electrode Serial No.: YV1-18416  
Condition: In Condition

Certificate No.: C24230001  
Issued Date: 5 January 2023  
Job No.: KSPR2216356  
Page: 1 of 2  
Model: ORION 013005MD  
Brand: Thermo Scientific

Customer: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Soi Pattanakarn 40, Pattanakarn Rd.,  
Suan Luang, Bangkok 10250 Thailand

Environment Condition: Temperature 21.6 °C ± 0.2 °C  
Humidity 58.0 %RH ± 2.0 %RH

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd. ( Wet Chemistry Lab 2 )  
104 Soi Pattanakarn 40, Pattanakarn Rd.,  
Suan Luang, Bangkok 10250 Thailand

Calibration By: Mr. Nattapat Rungueang  
Calibration Date: 3 January 2023  
The Method used: In house method, CAL-WI-49, base on ASTM D 1125-14 and D 5391-14

Traceability: This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 836317, 838313, 838315

Signature

(Mr. Nattapat Rungueang)  
Person in charge

REVIEW BY:   
APPROVED BY:   
NEXT CAL. DATE: \_\_\_\_\_

(Mr. Nitinun Srihawan)  
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.  
The measurement uncertainty stated in the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

Unit location: 2533 Sukhumvit Road, Bangkok, Thailand 10260  
DKSH Technology Limited  
2533 Sukhumvit Road, Bangkok, Thailand 10260  
Phone: +66 2039 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration

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CAL-FM-C24-09: 12 Sep 2022

## Calibration Results:

## Before Adjustment

| Standard Conductivity Solution | Unit Under Calibration Reading | Correction               | Coverage Factor (k) | Uncertainty ( $\pm$ ) |
|--------------------------------|--------------------------------|--------------------------|---------------------|-----------------------|
| 84.000 $\mu\text{S/cm}$        | 102.4 $\mu\text{S/cm}$         | -18.400 $\mu\text{S/cm}$ | 2.00                | 0.68 $\mu\text{S/cm}$ |
| 1413.0 $\mu\text{S/cm}$        | 1689 $\mu\text{S/cm}$          | -276.0 $\mu\text{S/cm}$  | 2.00                | 11 $\mu\text{S/cm}$   |
| 12.881 $\text{mS/cm}$          | 15.42 $\text{mS/cm}$           | -2.5390 $\text{mS/cm}$   | 2.00                | 0.098 $\text{mS/cm}$  |

After Adjustment : at 84.0  $\mu\text{S/cm}$ , 1413  $\mu\text{S/cm}$ , 12.88  $\text{mS/cm}$ 

| Standard Conductivity Solution | Unit Under Calibration Reading | Correction              | Coverage Factor (k) | Uncertainty ( $\pm$ ) |
|--------------------------------|--------------------------------|-------------------------|---------------------|-----------------------|
| 84.000 $\mu\text{S/cm}$        | 84.09 $\mu\text{S/cm}$         | -0.090 $\mu\text{S/cm}$ | 2.00                | 0.68 $\mu\text{S/cm}$ |
| 1413.0 $\mu\text{S/cm}$        | 1413 $\mu\text{S/cm}$          | 0.0 $\mu\text{S/cm}$    | 2.00                | 11 $\mu\text{S/cm}$   |
| 12.881 $\text{mS/cm}$          | 12.89 $\text{mS/cm}$           | -0.0090 $\text{mS/cm}$  | 2.00                | 0.098 $\text{mS/cm}$  |

The End of Certificate

Unit: Bangkok m/s/call only  
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250 Sukhumvit Road, Bangkok, Phraechin, Bangkok 10260  
Phone: +66 269 7100 Email: info@dksh.com Website: www.dksh.com/calibration-thailand

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CAL-FM-C24-09: 12 Sep 2022

## ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR2216356

ชนิดเครื่องมือ: CONDUCTIVITY METER

รุ่น: ORION STAR A215

หมายเลขเครื่อง: X58031

| ตรวจสอบ (รับ)                          | 03 Jan 2023              | รายการตรวจสอบ                                      | ตรวจสอบ (ส่ง)                       | 03 Jan 2023              | หมายเหตุ |
|--|--------------------------|--|-------------------------------------|--------------------------|----------|
| ปกติ                                   | ไม่ปกติ                  |  | ปกติ                                | ไม่ปกติ                  |          |
| <b>General</b>                         |                          |  |                                     |                          |          |
| <input checked="" type="checkbox"/>    | <input type="checkbox"/> | 1. ความสมบูรณ์เครื่อง                              | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/>    | <input type="checkbox"/> | 2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)   | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/>    | <input type="checkbox"/> | 3. สวิตช์ ปิด - เปิด เครื่อง (On-Off Switch)       | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/>    | <input type="checkbox"/> | 4. ปุ่มกด (Keypad)                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/>    | <input type="checkbox"/> | 5. หน้าจอ (Display, Screen Contrast)               | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <b>Spectrophotometer</b>               |                          |  |                                     |                          |          |
| <input type="checkbox"/>               | <input type="checkbox"/> | 6. แรงดันไฟฟ้า (Battery Backup) $\geq 2.5$ VDC     | <input type="checkbox"/>            | <input type="checkbox"/> |          |
| <input type="checkbox"/>               | <input type="checkbox"/> | 7. ตัวคูณเลือกความยาวคลื่น (Wavelength Control)    | <input type="checkbox"/>            | <input type="checkbox"/> |          |
| <input type="checkbox"/>               | <input type="checkbox"/> | 8. ความยาวคลื่น (Wavelength Check)                 | <input type="checkbox"/>            | <input type="checkbox"/> |          |
| <input type="checkbox"/>               | <input type="checkbox"/> | 9. แสงยูวี (UV $< 3,000$ hour)                     | <input type="checkbox"/>            | <input type="checkbox"/> |          |
| <input type="checkbox"/>               | <input type="checkbox"/> | 10. แสงที่มองเห็น (Visible $< 5,000$ hour)         | <input type="checkbox"/>            | <input type="checkbox"/> |          |
| <input type="checkbox"/>               | <input type="checkbox"/> | 11. ช่องวัดหลายตัวอย่าง (Carousel Module)          | <input type="checkbox"/>            | <input type="checkbox"/> |          |
| <b>pH Meter and Conductivity Meter</b> |                          |  |                                     |                          |          |
| <input checked="" type="checkbox"/>    | <input type="checkbox"/> | 12. อิเล็กโทรด (Electrode and Connection Cable)    | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input type="checkbox"/>               | <input type="checkbox"/> | 13. ระดับสารละลายใน Electrode (Level KCl)          | <input type="checkbox"/>            | <input type="checkbox"/> |          |
| <input type="checkbox"/>               | <input type="checkbox"/> | 14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)  | <input type="checkbox"/>            | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/>    | <input type="checkbox"/> | 15. ขาจับอิเล็กโทรด (Stand)                        | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <b>Turbidimeter</b>                    |                          |  |                                     |                          |          |
| <input type="checkbox"/>               | <input type="checkbox"/> | 16. ค่าความทึบที่ต่ำสุด (No Sample)                | <input type="checkbox"/>            | <input type="checkbox"/> |          |
| <input type="checkbox"/>               | <input type="checkbox"/> | 17. ระดับการกรองแสงของแสง ( $\geq 2.5$ ไม่นาน 3.0) | <input type="checkbox"/>            | <input type="checkbox"/> |          |
| <b>Automatic titrator</b>              |                          |  |                                     |                          |          |
| <input type="checkbox"/>               | <input type="checkbox"/> | 18. สภาพ Piston Burettes                           | <input type="checkbox"/>            | <input type="checkbox"/> |          |
| <input type="checkbox"/>               | <input type="checkbox"/> | 19. Function Rinsing and Dosing                    | <input type="checkbox"/>            | <input type="checkbox"/> |          |
| <input type="checkbox"/>               | <input type="checkbox"/> | 20. ระบบท่อสายยางและอุปกรณ์ประกอบ                  | <input type="checkbox"/>            | <input type="checkbox"/> |          |

ข้อแนะนำ:

Mr.Nattapat Rungruang

Service Engineer

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DKSH Technology Limited  
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Phone: +66 269 7100 Email: info@dksh.com Website: www.dksh.com/calibration-thailand

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CAL-FM-R31-08: 29 Jul 2022



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

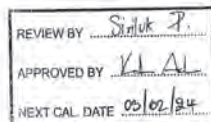
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

TEL: 0-2719-3080 FAX: 0-2719-9484

Cert.No.: 22TW178  
Page: 1 of 2

## Certificate of Testing

Equipment : DO Meter  
Manufacturer : YSI  
Model : 5100  
Serial No. : 15L103204  
ID No. : BKK\_EN0205  
Received Date : 02 August 2022  
Test Date : 03 August 2022  
Reference : 2208-0080DSC-1  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand  
Laboratory Condition : Temperature (  $25 \pm 5$  ) °C  
Humidity (  $50 \pm 20$  ) %  
Test Procedure : In-house method : CP-CH9  
by Comparison Technique with Azide Modification Method  
Tested by : Watalek Sirirhean  
Approved by : Malee Butkjesa  
Malee Butkjesa  
( ) Sathip Meangmai  
( ) Warakorn Lemgatrakul  
Issue Date : 4 August 2022



Cert.No.: 22TW178  
Page: 2 of 2

## Condition of this result of calibration

1. Reference Standard Instruments :  
This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

| Instruments | Serial No. | ID No.   | Certificate No. | Due Date    |
|-------------|------------|----------|-----------------|-------------|
| 1) Burette  | -          | 130BU10  | 21CG1389        | 25 Mar 2023 |
| 2) Balance  | 1126143764 | 140RC004 | 21MM430         | 21 Sep 2022 |

## 2. Standard Material :-

| Material                        | Manufacturer | Lot.No.   | Assay  |
|---------------------------------|--------------|-----------|--------|
| Sodium Thiosulfate pentahydrate | Merck        | AM1763316 | 100.2% |

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 17A100064

| Titration Method<br>(Azide Modification Method)<br>(mg/L) | DO Meter<br>Reading<br>(mg/L) | Standard Deviation<br>(mg/L) |
|---|-------------------------------|------------------------------|
| 8.06  | 8.07                          | 0.0045                       |

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency, The environmental impact control and present to organization. It may concern intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory.

-000-

Malee

a 1119718

0293758





Cert. No.: 22LM107  
Page.: 1 of 2

## Certificate of Calibration

Equipment : DO Meter with Sensor  
Manufacturer : VSI  
Model : 5100  
Serial No. : 15L103204  
ID No. : BKK\_EN0205  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand  
Location : TPA On Site Calibration Laboratory  
Received Order : 2 August 2022  
Calibrated Date : 4 August 2022  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
AC Line Voltage : ( 220 ± 22 ) V  
Calibrated by : Man Pattanapongpalboon

Approved by :   
Approved Signatory

( ) Pornthippa Tameyakul  
( ) Malee Butkrua  
( ) Suwit Imjai

Issue Date : 9 August 2022

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

This certificate may not be reproduced after date of full scope with the prior written approval of the head of Corporate Services ( ) Equipment Calibration and Testing Services.

A 0044131



Equipment : DO Meter with Sensor  
Condition As-Received : Used Item  
Reference : 2208-0060DSC-2  
Procedure Used :-

Cert. No.: 22LM107  
Page.: 2 of 2

Calibration was conducted using in-house calibration procedure CP-0101 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-

| Instrument             | Model | Serial No. | Cert. No. | Due Date    |
|------------------------|-------|------------|-----------|-------------|
| 1) Digital Thermometer | 1502A | A52847     | 2111144   | 20 Oct 2022 |

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.

Result of Calibration :- ( \* ) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 18C100772

| Calibration Point (°C) | Immersion Depth (mm) | Standard Temperature (°C) | UUC* Reading (°C) | Error (°C) | Uncertainty (± °C) | Coverage Factor k |
|------------------------|----------------------|---------------------------|-------------------|------------|--------------------|-------------------|
| 20.00                  | 60                   | 20.002                    | 19.93             | -0.072     | 0.15               | 2.00              |

UUC\* : Unit Under Calibration

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

-000-

a 1120698



## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T. Banpa, A. Kaengkhoh, Saraburi 18110, Thailand.  
Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100  
Bangkok Tel : +668 9205 6851, +669 8247 2360  
Website : www.scieco.co.th E-Mail : calibrate@scg.com

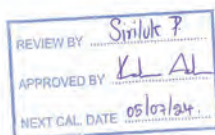


Certificate No. T231342

Page 1 of 4

## Certificate of Calibration

Equipment : Chamber ( Incubator )  
Manufacturer : MEMMERT  
Model : ICP 750  
Serial No. : F818.0033  
Customer Code : BKK\_EN0272  
ID No. : T8041A4  
Customer : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250  
Customer Location : Wet Chemistry Lab 2  
Date of Receipt : 3 July 2023  
Calibrated By : Sujjar Naknakred ( Site Calibration Manager )  
Approved By : / Boonchai Suriyawong ( Assistant Calibration Manager )  
Date of Issue : 11 JUL 2023



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 standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L14118/31-08-64



## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T. Banpa, A. Kaengkhoh, Saraburi 18110, Thailand.



Certificate No. T231342

Page 2 of 4

## Calibration Report

Equipment : Chamber ( Incubator )  
Date of Calibration : 5-6 July 2023 ( Finished Time 4:30 PM )  
Environment : Temperature 26.9-30.3 °C  
Line Voltage 221.7-225.5 V

### Condition of this results of test. :

1. This instrument was calibrated by insert 12 standard resistance thermometer into its chamber and test according to WI-T20 ( based on ASTM E145-94 ( Reapproved 2001 ) and AS2853-1986. )

All data show below were final values and the initial data may be obtained upon request.

The temperature scale used was based on ITS - 90.

2. Reference Standard Instrument :

| Instrument  | Model   | Instrument No. | Certificate No. | Due Date      |
|-------------|---------|----------------|-----------------|---------------|
| RTD         | 100 ohm | 27-(CH1)-10    | T230543         | 10 April 2024 |
| RTD         | 100 ohm | 28-(CH1)-10    | T230543         | 10 April 2024 |
| DATA LOGGER | 34970A  | T149           | T230543         | 10 April 2024 |

3. This certificate is traceable to :

National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 9244. )

4. Condition of calibrated item : good

UUC Description :

Time Constant 6 Hour 35 Minute At 20 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

5. Result of test :

( ) without adjustment ( X ) after adjustment

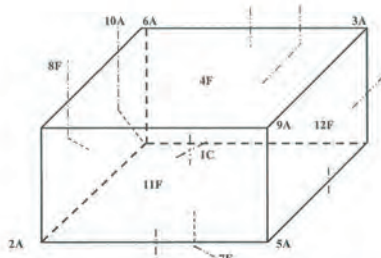
Approved By:

FM-L15117/15-05-63

Certificate No T231342

## Calibration Report

Page 3 of 4



C = Centre, F = Centre of Face, A = Corner, E = Centre of Edge

|               |              |
|---------------|--------------|
| 1C = 27-CH1   | 11F = 28-CH1 |
| 2A = 27-CH2   | 12F = 28-CH2 |
| 3A = 27-CH3   |              |
| 4F = 27-CH4   |              |
| 5A = 27-CH5   |              |
| 6A = 27-CH6   |              |
| 7F = 27-CH7   |              |
| 8F = 27-CH8   |              |
| 9A = 27-CH9   |              |
| 10A = 27-CH10 |              |

Approved By:

FM-L13 11/7/15-05-63

Certificate No. T231342

## Calibration Report

Page 4 of 4

## Measurement Results

| Calibration Point | Average Standard Reading at each position (°C) |        |        |        |        |        |        |        |        |         |
|-------------------|--|--------|--------|--------|--------|--------|--------|--------|--------|---------|
|                   | 27-CH1   | 27-CH2 | 27-CH3 | 27-CH4 | 27-CH5 | 27-CH6 | 27-CH7 | 27-CH8 | 27-CH9 | 27-CH10 |
| 20.0              | 19.82  | 19.80  | 20.32  | 19.78  | 19.77  | 19.65  | 20.11  | 19.69  | 19.78  | 20.18   |
|                   | 28-CH1   | 28-CH2 |        |        |        |        |        |        |        |         |
|                   | 20.02  | 19.81  |        |        |        |        |        |        |        |         |

| Chamber ( Incubator ) |              | Temperature Distribution |              |                 |                 |                   |                      |
|-----------------------|--------------|--------------------------|--------------|-----------------|-----------------|-------------------|----------------------|
| Setting (°C)          | Reading (°C) |                          | Average (°C) | Stability (±°C) | Uniformity (°C) | Uncertainty (±°C) | Coverage<br>Factor k |
|                       | Min, Max     | Average                  |              |                 |                 |                   |                      |
| 20.0                  | 19.9, 20.1   | 20.0                     | 19.98        | 0.06            | 0.61            | 0.38              | 2.00                 |

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By:

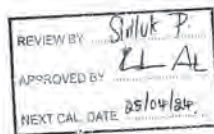
FM-L13 11/7/15-05-63

Certificate No. T230760

Page 1 of 5

## Certificate of Calibration

Equipment : HOT BLOCK  
Manufacturer : Environmental Express  
Model : B3000-240  
Serial No. : 2017CODW116  
Customer Code : BKK\_EN0222  
ID No. : T6769A4  
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250  
Customer Location : Wet Chemistry Lab2  
Date of Receipt : 21 April 2023  
Calibrated By : Watchararak Puttarat (Technician)  
Approved By : / Sujjar Naknakred (Site Calibration Manager)  
Date of Issue : 12 MAY 2023



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 standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L12 10/30/05-57

Certificate No. T230760

## Calibration Report

Page 2 of 5

Equipment : HOT BLOCK  
Date of Calibration : 25 April 2023  
Environment : Temperature : 22.9-24.4 °C  
Line Voltage : 222.7-227.8 V  
Relative Humidity : 55 - 65 %RH

## Condition of this results of calibration :

1. This equipment was calibrated by insert 20 standard thermocouples type T into its chamber, the other one standard thermocouples type T use for ambient temperature measurement. The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986). All data show below were final values and the initial data from customer request. The temperature scale used was based on ITS - 90.

## 2. Reference Standard Instrument :

| Instrument  | Model  | Instrument No. | Certificate No. | Due Date       |
|-------------|--------|----------------|-----------------|----------------|
| TC          | TYPE T | IN121-IN130    | T222122         | 5 October 2023 |
| TC          | TYPE T | IN131-IN140    | T222122         | 5 October 2023 |
| DATA LOGGER | 34970A | T150           | T222122         | 5 October 2023 |

## 3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244).

## 4. Condition of calibrated item : good

Equipment Description :

Time Constant : 1 Hour 32 Minute At 150 °C  
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

## 5. Adjustment :

( X ) without adjustment

( ) after adjustment

Approved By:

FM-L13 10/30/05-57



### Calibration Report



| Row | Hole |     |     |     |     |     |     |     |
|-----|------|-----|-----|-----|-----|-----|-----|-----|
| R7  | H49  | H50 | H51 | H52 | H53 | H54 | H55 | H56 |
| R6  | H41  | H42 | H43 | H44 | H45 | H46 | H47 | H48 |
| R5  | H33  | H34 | H35 | H36 | H37 | H38 | H39 | H40 |
| R4  | H25  | H26 | H27 | H28 | H29 | H30 | H31 | H32 |
| R3  | H17  | H18 | H19 | H20 | H21 | H22 | H23 | H24 |
| R2  | H9   | H10 | H11 | H12 | H13 | H14 | H15 | H16 |
| R1  | H1   | H2  | H3  | H4  | H5  | H6  | H7  | H8  |

#### II: STANDARD THERMOCOUPLE TYPE T

|            |             |             |             |             |             |             |
|------------|-------------|-------------|-------------|-------------|-------------|-------------|
| H1 = TN121 | H9 = TN129  | H17 = TN137 | H25 = TN125 | H33 = TN133 | H41 = TN121 | H49 = TN129 |
| H2 = TN122 | H10 = TN130 | H18 = TN138 | H26 = TN126 | H34 = TN134 | H42 = TN122 | H50 = TN130 |
| H3 = TN123 | H11 = TN131 | H19 = TN139 | H27 = TN127 | H35 = TN135 | H43 = TN123 | H51 = TN131 |
| H4 = TN124 | H12 = TN132 | H20 = TN140 | H28 = TN128 | H36 = TN136 | H44 = TN124 | H52 = TN132 |
| H5 = TN125 | H13 = TN133 | H21 = TN121 | H29 = TN129 | H37 = TN137 | H45 = TN125 | H53 = TN133 |
| H6 = TN126 | H14 = TN134 | H22 = TN122 | H30 = TN130 | H38 = TN138 | H46 = TN126 | H54 = TN134 |
| H7 = TN127 | H15 = TN135 | H23 = TN123 | H31 = TN131 | H39 = TN139 | H47 = TN127 | H55 = TN135 |
| H8 = TN128 | H16 = TN136 | H24 = TN124 | H32 = TN132 | H40 = TN140 | H48 = TN128 | H56 = TN136 |

Approved By.

FM-L11 108/30-05-57

### Calibration Report

#### Measurement Results

|       |         | Average Standard Reading at each position (°C) |        |        |        |        |        |        |        |        |        |        |        |
|-------|---------|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Point | Setting | Calibration Point                              |        |        |        |        |        |        |        |        |        |        |        |
|       |         | TN121  | TN122  | TN123  | TN124  | TN125  | TN126  | TN127  | TN128  | TN129  | TN130  | TN131  | TN132  |
| 150   | 150.0   | Max  | 149.31 | 149.49 | 149.73 | 148.49 | 149.26 | 149.51 | 149.42 | 148.86 | 148.78 | 149.19 | 149.19 |
|       |         | Min  | 149.14 | 149.21 | 149.54 | 148.36 | 149.08 | 149.65 | 149.22 | 148.65 | 149.07 | 149.07 | 149.07 |
|       |         | Average  | 149.23 | 149.40 | 149.64 | 148.43 | 149.16 | 149.73 | 149.33 | 148.76 | 148.71 | 149.13 | 149.13 |
|       |         |  | TN131  | TN132  | TN133  | TN134  | TN135  | TN136  | TN137  | TN138  | TN139  | TN140  |        |
|       |         | Max  | 149.90 | 150.18 | 150.18 | 149.16 | 148.89 | 149.72 | 149.28 | 149.50 | 150.01 | 149.32 | 149.32 |
|       |         | Min  | 149.78 | 150.06 | 149.69 | 149.03 | 148.76 | 149.49 | 149.12 | 149.37 | 149.90 | 149.23 | 149.23 |
|       |         | Average  | 149.84 | 150.12 | 149.76 | 148.99 | 148.81 | 149.62 | 149.19 | 149.43 | 149.95 | 149.27 | 149.27 |
|       |         |  | TN121  | TN122  | TN123  | TN124  | TN125  | TN126  | TN127  | TN128  | TN129  | TN130  |        |
|       |         | Max  | 149.88 | 149.14 | 149.20 | 150.02 | 148.75 | 149.57 | 149.21 | 149.18 | 150.13 | 148.91 | 148.91 |
|       |         | Min  | 149.67 | 148.94 | 148.98 | 149.53 | 148.58 | 149.43 | 149.06 | 149.01 | 149.91 | 148.72 | 148.72 |
|       |         | Average  | 149.78 | 149.05 | 149.11 | 149.94 | 148.67 | 149.51 | 149.13 | 149.10 | 150.01 | 148.83 | 148.83 |
|       |         |  | TN131  | TN132  | TN133  | TN134  | TN135  | TN136  | TN137  | TN138  | TN139  | TN140  |        |
|       |         | Max  | 149.42 | 149.52 | 149.13 | 148.94 | 148.84 | 150.16 | 149.42 | 149.54 | 149.66 | 150.08 | 150.08 |
|       |         | Min  | 149.27 | 149.36 | 148.99 | 148.81 | 148.70 | 149.99 | 149.27 | 149.39 | 149.52 | 149.97 | 149.97 |
|       |         | Average  | 149.36 | 149.45 | 149.06 | 148.88 | 148.76 | 150.08 | 149.36 | 149.48 | 149.60 | 150.03 | 150.03 |
|       |         |  | TN121  | TN122  | TN123  | TN124  | TN125  | TN126  | TN127  | TN128  | TN129  | TN130  |        |
|       |         | Max  | 149.21 | 149.16 | 149.50 | 148.68 | 148.58 | 149.81 | 149.06 | 150.40 | 148.46 | 149.24 | 149.24 |
|       |         | Min  | 149.03 | 148.93 | 149.27 | 148.48 | 148.42 | 149.62 | 148.78 | 150.26 | 148.14 | 149.04 | 149.04 |
|       |         | Average  | 149.12 | 149.04 | 149.39 | 148.57 | 148.51 | 149.72 | 148.93 | 150.33 | 148.29 | 149.14 | 149.14 |
|       |         |  | TN131  | TN132  | TN133  | TN134  | TN135  | TN136  |        |        |        |        |        |
|       |         | Max  | 148.79 | 148.23 | 149.03 | 149.09 | 148.46 | 149.25 |        |        |        |        |        |
|       |         | Min  | 148.49 | 147.98 | 148.88 | 148.54 | 148.29 | 149.12 |        |        |        |        |        |
|       |         | Average  | 148.61 | 148.06 | 148.94 | 149.02 | 148.35 | 149.19 |        |        |        |        |        |

Approved By.

FM-L11 108/30-05-57

### Calibration Report

#### Measurement Results

| HOT BLOCK    |              |         | Temperature Distribution |                   |
|--------------|--------------|---------|--------------------------|-------------------|
| Setting (°C) | Reading (°C) |         | Stability (±°C)          | Uncertainty (±°C) |
|              | Min, Max     | Average |                          |                   |
| 150.0        | 150, 150.1   | 150.0   | 0.20                     | 0.82              |

The calibration result apply only the above calibrated item.  
The result of test was found accurate as shown on date and place of test only.  
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95 %.

Approved By.

FM-L11 108/30-05-57

### Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-367/23  
Equipment UV/Vis Spectrophotometer  
Model UV-1800  
Manufacturer Shimadzu  
Serial No. A11454908533CD  
ID No. BKK\_EN0018  
Date of receipt 15 September 2023  
Date of calibration 15 September 2023  
Date of issue 22 September 2023

REVIEW BY Sisolk P.  
APPROVED BY KLAL  
NEXT CAL DATE 19/9/2024

Customer name ALS Laboratory Group (Thailand) Co., Ltd.  
Address 104 Soi Phattananan 40, Phattananan Road, Phattananan, Suan Luang, Bangkok 10250

Temperature (23.4 - 24.7) °C (On site)  
Humidity (55.5 - 61.2) %RH (On site)

Equipment condition Good Operation

Calibration Location Organic Prep

Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01

Traceability Wavelength Accuracy is traceable to certificate No. 95917 and 95918  
Photometric Accuracy is traceable to certificate No. 95937 and 95924  
Stray Light is traceable to certificate No. 95908  
The above certificate are traceable to SI unit through NIST Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr.Wanchana Janloey

Approved by

Mr.Kanchit Choothep  
Technical Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced  
except in full, without written approval of the Bara Scientific Co., Ltd.



## Certificate of Calibration

Certificate No. BSCC-UV-367/23

Number of Page(s) 2 of 3

### Calibration Results:

#### 1.Wavelength Accuracy

| Certified Wavelength (nm) | UUC (nm) | Error (nm) | Uncertainty (±nm) |
|---------------------------|----------|------------|-------------------|
| 241.70                    | 241.67   | -0.03      | 0.18              |
| 334.02                    | 334.03   | 0.01       | 0.18              |
| 418.53                    | 418.59   | 0.06       | 0.18              |
| 572.99                    | 573.14   | 0.15       | 0.18              |
| 879.41                    | 879.21   | -0.20      | 0.18              |

#### 2.Photometric Accuracy (UV)

| Wavelength (nm) | Certified Absorbance (A) | UUC (A) | Error (A) | Uncertainty (±A) |
|-----------------|--------------------------|---------|-----------|------------------|
| 235             | 0.0000                   | 0.0000  | 0.0000    | 0.0075           |
|                 | 0.7467                   | 0.7460  | -0.0007   | 0.0075           |
| 257             | 0.0000                   | 0.0000  | 0.0000    | 0.0075           |
|                 | 0.8662                   | 0.8646  | -0.0016   | 0.0075           |
| 313             | 0.0000                   | 0.0000  | 0.0000    | 0.0075           |
|                 | 0.2904                   | 0.2908  | 0.0004    | 0.0075           |
| 350             | 0.0000                   | 0.0001  | 0.0001    | 0.0075           |
|                 | 0.6429                   | 0.6415  | -0.0014   | 0.0075           |

\*CNR = Customer not request

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate. Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced, except in full, without written approval of the Bara Scientific Co., Ltd.

FM-UV-708-02 Rev.01 (23/01/63)

## Certificate of Calibration

Certificate No. BSCC-UV-367/23

Number of Page(s) 3 of 3

### Calibration Results:

#### 3.Photometric Accuracy (Visible)

| Wavelength (nm) | Certified Absorbance (A) | UUC (A) | Error (A) | Uncertainty (±A) |
|-----------------|--------------------------|---------|-----------|------------------|
| 420.0           | 0.0000                   | 0.0000  | 0.0000    | 0.0042           |
|                 | 0.5783                   | 0.5783  | 0.0010    | 0.0042           |
|                 | 0.7628                   | 0.7624  | -0.0004   | 0.0042           |
|                 | 1.0206                   | 1.0216  | 0.0010    | 0.0042           |
| 440.0           | 0.0000                   | 0.0000  | 0.0000    | 0.0042           |
|                 | 0.5621                   | 0.5625  | 0.0004    | 0.0042           |
|                 | 0.7455                   | 0.7452  | -0.0003   | 0.0042           |
|                 | 0.9985                   | 0.9989  | 0.0004    | 0.0042           |
| 460.0           | 0.0000                   | 0.0000  | 0.0000    | 0.0042           |
|                 | 0.5227                   | 0.5229  | 0.0002    | 0.0042           |
|                 | 0.6880                   | 0.6873  | -0.0007   | 0.0042           |
|                 | 0.9487                   | 0.9486  | -0.0001   | 0.0042           |
| 546.1           | 0.0000                   | 0.0000  | 0.0000    | 0.0042           |
|                 | 0.5207                   | 0.5211  | 0.0004    | 0.0042           |
|                 | 0.6973                   | 0.6960  | -0.0013   | 0.0042           |
|                 | 0.9959                   | 0.9944  | -0.0015   | 0.0042           |
| 590.0           | 0.0000                   | 0.0000  | 0.0000    | 0.0042           |
|                 | 0.5544                   | 0.5538  | -0.0006   | 0.0042           |
|                 | 0.7253                   | 0.7236  | -0.0017   | 0.0042           |
|                 | 1.0942                   | 1.0925  | -0.0017   | 0.0042           |
| 635.0           | 0.0000                   | 0.0000  | 0.0000    | 0.0042           |
|                 | 0.5616                   | 0.5612  | -0.0004   | 0.0042           |
|                 | 0.6927                   | 0.6909  | -0.0018   | 0.0042           |
|                 | 1.0881                   | 1.0866  | -0.0015   | 0.0042           |

\*CNR = Customer not request

#### 4.Stray Light\*

| Standard cut-off wavelength (nm) | Wavelength (nm) | Transmission (%) | Absorbance (A) |
|----------------------------------|-----------------|------------------|----------------|
| 200.95±0.11nm                    | 200.55          | 0.9770           | 2.0104         |

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A  
\*Stray Light not NSC-ONSC Accredited.

The measurement uncertainty is base on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

\*\*\*End of Certificate\*\*\*

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate. Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced, except in full, without written approval of the Bara Scientific Co., Ltd.

FM-UV-708-02 Rev.01 (23/01/63)

## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.  
Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100  
Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.com

Certificate No. T231303

Page 1 of 3

## Certificate of Calibration

Equipment : Liquid Bath ( Water )

Manufacturer : MEMMERT

Model : WNB29

Serial No. : L611.0135

Customer Code : BKK\_EN0148

ID No. : T6455A4

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250

Customer Location : ORGANIC PREPARATION LAB

Date of Receipt : 27 June 2023

Calibrated By : Sujjar Naknakred ( Site Calibration Manager )

Approved By : Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 11 JUL 2023

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 standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L1418/31-08-64

## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.

Certificate No. T231303

Page 2 of 3

## Calibration Report

Equipment : Liquid Bath ( Water )

Date of Calibration : 4 July 2023

Environment : Temperature : 22.2-22.5 °C

Line Voltage : 221.6-224.8 V

Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert five resistance thermometer detectors into its water bath , the other one thermocouple type T use for ambient temperature measurement . The calibration was done in according to WI-T36 ( based on ASTM E715-80 ( Reapproved 2001 ) ).  
All data show below were final values and the initial data from customer request , The temperature scale used was based on ITS - 90 .

### 2. Reference Standard Instrument :

| Instrument  | Model   | Instrument No.             | Certificate No. | Due Date      |
|-------------|---------|----------------------------|-----------------|---------------|
| RTD         | 100 OHM | M18 (CH1,CH6-CH7,CH9-CH10) | T230545         | 10 April 2024 |
| DATA LOGGER | 34970A  | T149                       | T230545         | 10 April 2024 |

### 3. This certificate is traceable to :

National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TIS-TIS 17025 CALIBRATION 0244 )

### 4. Condition of calibrated item : good

#### Equipment Description :

Time Constant 3 Hour 45 Minute At 60 °C

### 5. Adjustment :

( X ) without adjustment ( ) after adjustment

Approved By: Boonchai Suriyawong

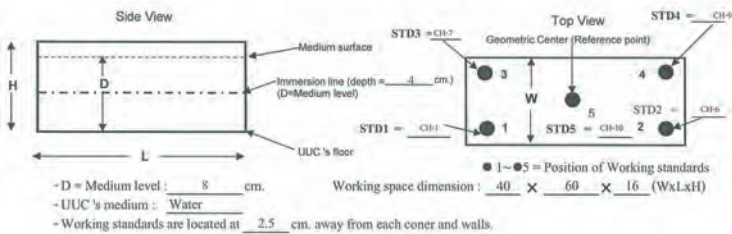
FM-L15 117/15-05-63



Certificate No. T231303

Page 3 of 3

## Calibration Report



## Measurement Results:

| Calibration Point | Average Standard Reading at each position (°C) |       |       |       |       |
|-------------------|--|-------|-------|-------|-------|
|                   | CH-1   | CH-6  | CH-7  | CH-9  | CH-10 |
| 60                | 60.03  | 60.06 | 60.24 | 60.11 | 60.18 |
| 85                | 84.79  | 84.83 | 85.42 | 85.05 | 85.20 |
| 95                | 93.71  | 93.83 | 94.62 | 94.15 | 94.42 |

| Liquid Bath (Water) |              | Temperature Distribution |                 |                    |                     |                      |                      |
|---------------------|--------------|--------------------------|-----------------|--------------------|---------------------|----------------------|----------------------|
| Setting (°C)        | Reading (°C) |                          | Average<br>(°C) | Stability<br>(±°C) | Uniformity<br>(±°C) | Uncertainty<br>(±°C) | Coverage<br>Factor k |
|                     | Min, Max     | Average                  |                 |                    |                     |                      |                      |
| 61.0                | 60.9, 61.1   | 61.0                     | 60.12           | 0.13               | 0.19                | 0.29                 | 2.04                 |
| 86.0                | 85.8, 86.2   | 86.0                     | 85.06           | 0.19               | 0.47                | 0.44                 | 2.17                 |
| 95.0                | 94.6, 95     | 94.9                     | 94.15           | 0.32               | 0.65                | 0.55                 | 2.13                 |

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By: *[Signature]*

FM-L13 117015-05-63

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484

## Certificate of Calibration

Certificate No.: 23T1512  
Page: 1 of 2

Equipment: Digital Thermometer With Sensor

Manufacturer: Testo

Model: 106

Serial No.: 83637871/0122

ID No.: BKK\_LG0055

Condition As-Received: Used item

Received Date: 21 August 2023

Calibration Date: 24 August 2023 to 30 August 2023

Reference: 2308-0616D9C

Ambient Temperature: ( 25 ± 3 ) °C

Relative Humidity: ( 50 ± 20 ) %

Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.

104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khel Suan Luang,  
Bangkok 10250 ThailandProcedure used: Calibration were conducted using in-house calibration procedure CP-T01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into liquid bath temperature controller.  
The temperature scale used was based on ITS-90.

## Condition of this result of calibration

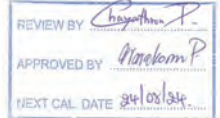
1. Reference standards instruments:

| Instrument                                    | Model | Serial No. | Certificate No. | Due Date    |
|---|-------|------------|-----------------|-------------|
| 1) Digital Thermometer                        | 1529  | A7A809     | 2211274         | 17 Oct 2023 |
| 2) Industrial Platinum Resistance Thermometer | 5627  | 824304     | 2211274         | 17 Oct 2023 |

2. The 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 maintained through:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Puttichai Manop  
Issue Date: 31 August 2023

Approved Signatory:

[ ] Phalinee Prabpaipal  
[ ] Chatchawan Khunpluek  
[x] Wanlop Larpiem

B 0323062

Cert. No.: 23T1512  
Page: 2 of 2

## Result of Calibration:-

Without Adjustment

Function: Temperature measurement

Dimension of probe: Diameter 3 mm., Length 55 mm. Sheath material: Stainless Steel

| Immersion Depth (mm.) | Standard Temperature (°C) | UUC* Reading (°C) | Error (°C) | Uncertainty of Measurement (±°C) |
|-----------------------|---------------------------|-------------------|------------|----------------------------------|
| 50                    | 25.0052                   | 25.0              | -0.0052    | 0.12                             |
| 50                    | 30.0051                   | 30.0              | -0.0051    | 0.12                             |
| 50                    | 35.0063                   | 35.1              | 0.0937     | 0.12                             |
| 50                    | 40.0034                   | 40.1              | 0.0966     | 0.12                             |
| 50                    | 45.0009                   | 45.0              | -0.0009    | 0.12                             |

UUC\*: Unit Under Calibration

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

-000-

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484

## Certificate of Calibration

Certificate No.: 23T1511  
Page: 1 of 2

Equipment: Digital Thermometer With Sensor

Manufacturer: Testo

Model: 106

Serial No.: 83637906/0122

ID No.: BKK\_LG0054

Condition As-Received: Used item

Received Date: 21 August 2023

Calibration Date: 24 August 2023 to 30 August 2023

Reference: 2308-0616D9C

Ambient Temperature: ( 25 ± 3 ) °C

Relative Humidity: ( 50 ± 20 ) %

Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.

104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khel Suan Luang,  
Bangkok 10250 ThailandProcedure used: Calibration were conducted using in-house calibration procedure CP-T01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into liquid bath temperature controller.  
The temperature scale used was based on ITS-90.

## Condition of this result of calibration

1. Reference standards instruments:

| Instrument                                    | Model | Serial No. | Certificate No. | Due Date    |
|---|-------|------------|-----------------|-------------|
| 1) Digital Thermometer                        | 1529  | A7A809     | 2211274         | 17 Oct 2023 |
| 2) Industrial Platinum Resistance Thermometer | 5627  | 824304     | 2211274         | 17 Oct 2023 |

2. The 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 maintained through:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Puttichai Manop  
Issue Date: 31 August 2023

Approved Signatory:

[ ] Phalinee Prabpaipal  
[ ] Chatchawan Khunpluek  
[x] Wanlop Larpiem

B 0323061

a 1178225



Cert. No.: 23T1511  
Page.: 2 of 2

#### Result of Calibration:-

Function: Temperature measurement  
Without Adjustment  
Dimension of probe : Diameter 3 mm., Length 55 mm. Sheath material : Stainless Steel

| Immersion Depth<br>(mm.) | Standard Temperature<br>(°C) | UUC* Reading<br>(°C) | Error<br>(°C) | Uncertainty of Measurement<br>(±°C) |
|--------------------------|------------------------------|----------------------|---------------|-------------------------------------|
| 50                       | 25.0010                      | 25.0                 | -0.0010       | 0.12                                |
| 50                       | 30.0071                      | 30.0                 | -0.0071       | 0.12                                |
| 50                       | 35.0016                      | 35.1                 | 0.0984        | 0.12                                |
| 50                       | 39.9960                      | 40.1                 | 0.1040        | 0.12                                |
| 50                       | 45.0012                      | 45.1                 | 0.0988        | 0.12                                |

UUC\* : Unit Under Calibration

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

-o0o-

a 1178226



Agilent Technologies

Agilent Technologies (Thailand) Limited  
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#### Customer Contact:

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Khwaeng Phatthanakan Khet Suan  
TAX ID : 0105540004859  
bounced-mchom.chanattagarn@alsglobal.com  
227158769519

#### Invoice To:

ALS Laboratory Group (Thailand) Co Ltd  
Head Office  
104 Phatthanakan 40 Phatthanakan Rd  
Khwaeng Phatthanakan Khet Suan

#### SERVICE REPORT

|                                 |                                  |
|---------------------------------|----------------------------------|
| Customer Purchase Order Number: | Customer Number: 79371013        |
| Service Request:                | Service Request Date:            |
| Service Order: 6006068207       | Service Confirmation: 6904837529 |

REVIEW BY Archalee K.  
APPROVED BY Siamw N  
NEXT CAL DATE 06/10/2024

#### Delivery Site:

ALS Laboratory Group (Thailand) Co Ltd  
Head Office  
104 Phatthanakan 40 Phatthanakan Rd  
Khwaeng Phatthanakan Khet Suan

#### Location:

Room  
Bldg  
Lab  
Dept

#### Direct Inquiries to:

Contact Name: Customer Contact Center  
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Contact Telephone: +662 637 6363  
Contact Fax: +662 632 4334

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THB-Krungsri Thai Bank PCL  
Siam Square Bldg. 416/1-2 Rama 1 Rd, Pathumwan, BKK 10330 Thailand

ORIGINAL

Page 1 of 3

Service Confirmation Number: 6904837529  
Service Confirmation Date: 06.04.2023

#### Service Instrument:

| Model Number | Model Description                 | Serial Number | System Handle | Parent Asset |
|--------------|-----------------------------------|---------------|---------------|--------------|
| SYS-IM-7900  | ICPMS 7900 System                 |               |               |              |
| G8410A       | SPS 4 Autosampler                 | AU15430722    | ICP MS 7900   | SYS-IM-7900  |
| G8411A       | ISIS 3 for Agilent 7850/7900/8900 | JP15510227    | ICP MS 7900   | SYS-IM-7900  |
| G3292A       | PSC 6100T Chiller                 | 2U15A1948     | ICP MS 7900   | SYS-IM-7900  |
| G8403A       | Agilent 7900 ICP-MS               | JP15471169    | ICP MS 7900   | SYS-IM-7900  |

#### Service Items:

| Item | Service/Part # | Description                          | Qty  | Entitlement                           | Service Start | Service End |
|------|----------------|--------------------------------------|------|---------------------------------------|---------------|-------------|
| 1000 | EQJ            | Enterprise Operational Qualification | 1.00 | Agreement Entitlement - 100 % covered | 06.04.2023    | 06.04.2023  |
| 1010 | 5185-5850      | ICP-MS Checkout Solutions            | 1.00 | Agreement Entitlement - 100 % covered |               |             |

#### Additional Information:

#### Service Information:

|  |   |                             |
|--|---|-----------------------------|
| <b>Problem Description:</b><br>WU-S-00-ICP MS 7900-5001143313  |   |                             |
| <b>Service Provided:</b><br>Test OQ control of instrument ICPMS = BKK_EL0043. After done all instrument test all Pass.                     |   |                             |
| <b>Service Overview Code:</b><br>Reason Code: Scheduled Service<br>Diagnosis Code: Scheduled Service<br>Resolution Code: Scheduled Service |   |                             |
| <b>Reported Hours:</b><br>6.0  | <b>Travel Hours:</b><br>1.0                                 |                             |
| <b>Customer Field Service Representative Name:</b><br>Panthep Kurasathain  | <b>Customer Field Service Representative Signature:</b><br> | <b>Date:</b><br>06 Apr 2023 |
| <b>Customer Name:</b><br>Archalee Khamjan  | <b>Customer Signature:</b><br>                              | <b>Date:</b><br>06 Apr 2023 |
| <b>Additional Comments:</b>  |   |                             |





## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110

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Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T231676

Page 1 of 6

### Certificate of Calibration

Equipment : HEATING BLOCK  
Manufacturer : Environmental Express  
Model : SC 196  
Serial No. : 6974CECW3285  
Customer Code : BKK\_EL0054  
ID No. : T5306A3  
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250  
Customer Location : Acid Digestion Lab  
Date of Receipt : 13 September 2023  
Calibrated By : Saneek Musikanwan ( Site Calibration Manager )  
Approved By : / Sujjar Naknakred ( Site Calibration Manager )  
Date of Issue : 26 SEP 2023

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 standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L12 109/30-05-57



## Metrological Center

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Certificate No. T231676

Page 2 of 6

### Calibration Report

Equipment : HEATING BLOCK  
Date of Calibration : 22 September 2023  
Environment : Temperature : 21.8-23.1 °C  
Line Voltage : 221.6-226.3 V  
Relative Humidity : 55 - 65 %RH

#### Condition of this results of calibration :

- This equipment was calibrated by insert 20 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20.  
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .
- Reference Standard Instrument :

| Instrument  | Model  | Instrument No. | Certificate No. | Due Date        |
|-------------|--------|----------------|-----------------|-----------------|
| TC          | TYPE T | TN21-TN30      | T230014         | 17 January 2024 |
| TC          | TYPE T | TN31-TN40      | T230014         | 17 January 2024 |
| DATA LOGGER | 34970A | T151           | T230014         | 17 January 2024 |
- This certificate is traceable to :  
National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244 )
- Condition of calibrated item : good  
Equipment Description :  
Time Constant : 2 Hour 20 Minute At 95 °C  
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available
- Adjustment :  
( ) without adjustment ( X ) after adjustment

Approved By. /

FM-L13 108/30-05-57



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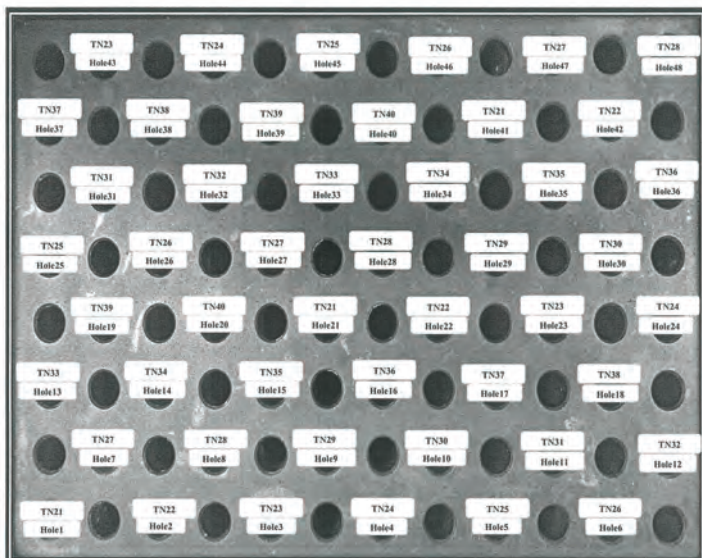
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Certificate No. T231676

Page 3 of 6

### Calibration Report



FRONT CONTROL

Approved By. /

FM-L13 108/30-05-57



## Metrological Center

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Certificate No T231676

Page 4 of 6

### Calibration Report

#### Measurement Results

| Calibration Point |         | Average Standard Reading at each position ( ° C ) |       |       |       |       |       |
|-------------------|---------|---|-------|-------|-------|-------|-------|
| R1 Hole1-Hole6    |         | TN21  | TN22  | TN23  | TN24  | TN25  | TN26  |
| CAL POINT 95      | Max     | 95.01   | 94.41 | 95.20 | 95.41 | 94.51 | 95.17 |
|                   | Min     | 94.57   | 93.95 | 94.75 | 94.92 | 94.00 | 94.72 |
|                   | Average | 94.79   | 94.18 | 94.98 | 95.17 | 94.26 | 94.95 |
| R2 Hole7-Hole12   |         | TN27  | TN28  | TN29  | TN30  | TN31  | TN32  |
|                   | Max     | 95.36   | 95.43 | 95.19 | 95.16 | 95.35 | 94.97 |
|                   | Min     | 94.94   | 94.95 | 94.72 | 94.71 | 94.90 | 94.57 |
|                   | Average | 95.15   | 95.19 | 94.96 | 94.94 | 95.13 | 94.77 |
| R3 Hole13-Hole18  |         | TN33  | TN34  | TN35  | TN36  | TN37  | TN38  |
|                   | Max     | 95.37   | 95.50 | 95.22 | 95.21 | 95.33 | 95.31 |
|                   | Min     | 94.99   | 95.09 | 94.78 | 94.82 | 94.88 | 94.96 |
|                   | Average | 95.18   | 95.30 | 95.00 | 95.02 | 95.11 | 95.13 |
| R4 Hole19-Hole24  |         | TN39  | TN40  | TN21  | TN22  | TN23  | TN24  |
|                   | Max     | 95.59   | 94.42 | 94.52 | 94.24 | 94.63 | 94.67 |
|                   | Min     | 95.21   | 94.06 | 94.13 | 93.88 | 94.28 | 94.27 |
|                   | Average | 95.40   | 94.24 | 94.33 | 94.06 | 94.45 | 94.47 |
| R5 Hole25-Hole30  |         | TN25  | TN26  | TN27  | TN28  | TN29  | TN30  |
|                   | Max     | 95.19   | 95.38 | 92.93 | 95.30 | 95.14 | 95.03 |
|                   | Min     | 94.83   | 95.03 | 92.56 | 94.95 | 94.79 | 94.70 |
|                   | Average | 95.01   | 95.20 | 92.75 | 95.12 | 94.96 | 94.87 |
| R6 Hole31-Hole36  |         | TN31  | TN32  | TN33  | TN34  | TN35  | TN36  |
|                   | Max     | 94.63   | 94.90 | 94.77 | 94.31 | 94.24 | 93.87 |
|                   | Min     | 94.24   | 94.35 | 94.44 | 93.98 | 93.92 | 93.56 |
|                   | Average | 94.43   | 94.72 | 94.60 | 94.14 | 94.08 | 93.71 |
| R7 Hole37-Hole42  |         | TN37  | TN38  | TN39  | TN40  | TN21  | TN22  |
|                   | Max     | 94.30   | 94.44 | 94.04 | 93.81 | 94.89 | 95.35 |
|                   | Min     | 93.95   | 94.05 | 93.67 | 93.48 | 94.39 | 94.90 |
|                   | Average | 94.13   | 94.24 | 93.86 | 93.65 | 94.64 | 95.12 |
| R8 Hole43-Hole48  |         | TN23  | TN24  | TN25  | TN26  | TN27  | TN28  |
|                   | Max     | 95.99   | 95.63 | 95.28 | 95.29 | 95.45 | 94.87 |
|                   | Min     | 95.57   | 95.15 | 94.82 | 94.84 | 94.99 | 94.48 |
|                   | Average | 95.78   | 95.39 | 95.05 | 95.07 | 95.22 | 94.68 |

Approved By. /

FM-L13 108/30-05-57





## Metrological Center

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Certificate No T231676

Page 5 of 6

### Calibration Report

#### Measurement Results

| Calibration Point |         | Average Standard Reading at each position (°C) |        |        |        |        |        |
|-------------------|---------|--|--------|--------|--------|--------|--------|
| R1 Hole1-Hole6    |         | TN21   | TN22   | TN23   | TN24   | TN25   | TN26   |
| CAL POINT         | Max     | 105.23   | 104.32 | 105.43 | 105.25 | 104.44 | 105.27 |
|                   | Min     | 104.94   | 103.95 | 105.15 | 105.04 | 104.11 | 104.96 |
|                   | Average | 105.09   | 104.13 | 105.29 | 105.15 | 104.28 | 105.12 |
| R2 Hole7-Hole12   |         | TN27   | TN28   | TN29   | TN30   | TN31   | TN32   |
|                   | Max     | 105.30   | 105.12 | 105.18 | 105.22 | 105.12 | 105.16 |
|                   | Min     | 105.11   | 104.92 | 104.96 | 105.00 | 104.92 | 104.97 |
|                   | Average | 105.20   | 105.02 | 105.07 | 105.11 | 105.02 | 105.06 |
| R3 Hole13-Hole18  |         | TN33   | TN34   | TN35   | TN36   | TN37   | TN38   |
|                   | Max     | 105.37   | 105.63 | 105.02 | 104.80 | 104.69 | 105.19 |
|                   | Min     | 105.17   | 105.37 | 104.75 | 104.59 | 104.50 | 105.00 |
|                   | Average | 105.27   | 105.50 | 104.88 | 104.69 | 104.60 | 105.09 |
| R4 Hole19-Hole24  |         | TN39   | TN40   | TN21   | TN22   | TN23   | TN24   |
|                   | Max     | 105.31   | 104.43 | 106.41 | 104.71 | 105.63 | 105.82 |
|                   | Min     | 105.08   | 104.22 | 106.15 | 104.41 | 105.37 | 105.56 |
|                   | Average | 105.19   | 104.33 | 106.28 | 104.56 | 105.50 | 105.69 |
| R5 Hole25-Hole30  |         | TN25   | TN26   | TN27   | TN28   | TN29   | TN30   |
|                   | Max     | 104.95   | 106.26 | 103.34 | 105.78 | 105.59 | 105.87 |
|                   | Min     | 104.67   | 105.96 | 103.08 | 105.56 | 105.36 | 105.68 |
|                   | Average | 104.81   | 106.11 | 103.21 | 105.67 | 105.48 | 105.77 |
| R6 Hole31-Hole36  |         | TN31   | TN32   | TN33   | TN34   | TN35   | TN36   |
|                   | Max     | 104.75   | 104.86 | 104.80 | 105.20 | 104.50 | 104.39 |
|                   | Min     | 104.54   | 104.63 | 104.59 | 105.00 | 104.32 | 104.18 |
|                   | Average | 104.65   | 104.75 | 104.69 | 105.10 | 104.41 | 104.28 |
| R7 Hole37-Hole42  |         | TN37   | TN38   | TN39   | TN40   | TN21   | TN22   |
|                   | Max     | 104.30   | 104.90 | 104.85 | 104.65 | 104.88 | 104.85 |
|                   | Min     | 104.09   | 104.72 | 104.66 | 104.49 | 104.63 | 104.52 |
|                   | Average | 104.19   | 104.81 | 104.75 | 104.57 | 104.76 | 104.68 |
| R8 Hole43-Hole48  |         | TN23   | TN24   | TN25   | TN26   | TN27   | TN28   |
|                   | Max     | 105.71   | 105.85 | 105.39 | 105.61 | 105.42 | 105.19 |
|                   | Min     | 105.45   | 105.61 | 105.14 | 105.27 | 105.18 | 104.94 |
|                   | Average | 105.58   | 105.73 | 105.27 | 105.44 | 105.30 | 105.07 |

Approved By:

FM-L13 108/30-05-57



## Metrological Center

SCI ECO Services Company Limited

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Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T231676

Page 6 of 6

### Calibration Report

#### Measurement Results:

| HEATING BLOCK |               |         | Temperature Distribution |                   |
|---------------|---------------|---------|--------------------------|-------------------|
| Setting (°C)  | Reading (°C)  |         | Stability (±°C)          | Uncertainty (±°C) |
|               | Min , Max     | Average |                          |                   |
| 100.0         | 100.3 , 100.5 | 100.4   | 0.26                     | 0.81              |
| 107.0         | 107.0 , 107.1 | 107.1   | 0.19                     | 0.78              |

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k$  which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By:

FM-L13 108/30-05-57

BKK\_EL0037



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968 Rama 4 Road, Silom, Bangkok  
Bangkok 10500 Thailand

Tel: +662 637 6383  
Fax: +662 632 4334  
Email: ccc-sm@agilent.com  
Website: www.agilent.com/thai

Service Confirmation Number: 8504800024  
Service Confirmation Date: 20.03.2023

#### Customer Contact:

ALS Laboratory Group (Thailand) Co.  
Ltd.  
Head Office  
104 Phatthanakan 40 Phatthanakan Rd  
Khuang Phatthanakan Khet Suan  
TAX ID : 0105540004859  
Chanattagarn.lmchom@alsglobal.com  
27603068

#### Invoce To:

ALS Laboratory Group (Thailand) Co.  
Ltd.  
Head Office  
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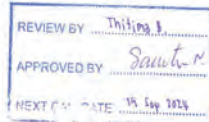
#### Delivery Site:

ALS Laboratory Group (Thailand) Co.  
Ltd.  
Head Office  
104 Phatthanakan 40 Phatthanakan Rd  
Khuang Phatthanakan Khet Suan

Location:  
Room  
Bldg  
Lab  
Dept

#### SERVICE REPORT

|                                 |                                  |
|---------------------------------|----------------------------------|
| Customer Purchase Order Number: | Customer Number: 70371013        |
| Service Request:                | Service Request Date:            |
| Service Order: 6906033911       | Service Confirmation: 6904800024 |



#### Direct Inquiries to:

Contact Name: Customer Contact Center  
Contact E-mail: ccc-sm@agilent.com  
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Acc. No: 012-4452-007  
THB-Krung Thai Bank PCL  
Siem Square Bx. A15/1-2 Rama 1 Rd., Pathumwan, BKK 10330  
Thailand

#### Service Instrument:

| Model Number | Model Description                      | Serial Number | System Handle | Parent Asset |
|--------------|--|---------------|---------------|--------------|
| SYS-IO-5100  | ICP-OES 5100/5110 System               |               |               |              |
| G8010A       | Agilent 5100 SVDV ICP-OES Spectrometer | MY160100EE    | ICP OES 5100  | SYS-IO-5100  |
| G8410A       | SPS 4 Autosampler                      | AU15440764    | ICP OES 5100  | SYS-IO-5100  |

#### Service Items:

| Item | Service/Part # | Description                          | Qty  | Entitlement                           | Service Start | Service End |
|------|----------------|--------------------------------------|------|---------------------------------------|---------------|-------------|
| 1000 | EQD            | Enterprise Operational Qualification | 1.00 | Agreement Entitlement - 100 % covered | 20.03.2023    | 20.03.2023  |

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968 Rama 4 Road, Silom, Bangkok  
Bangkok 10500 Thailand  
Tax ID : 010554298818



Service Confirmation Number: 6004800024  
Service Confirmation Date: 28.03.2023

|                |                   |
|----------------|-------------------|
| REVIEW BY      | <u>Oranon T.</u>  |
| APPROVED BY    | <u>Saatchi N.</u> |
| NEXT CAL. DATE | <u>24.10.2024</u> |

## Service Information:

|  |   |                             |
|--|---|-----------------------------|
| <b>Problem Description:</b><br>WU-S-OQ-ID-5109-5001143313  |   |                             |
| <b>Service Provided:</b><br>Complete DOHW 5100ICPOES<br>Equipment ID: BKK_EL0027, all tests passed   |   |                             |
| <b>Service Overview Code:</b><br>Reason Code: Scheduled Service<br>Diagnosis Code: Scheduled Service<br>Resolution Code: Scheduled Service |   |                             |
| <b>Reported Hours:</b><br>4.0  | <b>Travel Hours:</b><br>2.0   |                             |
| <b>Customer Field Service Representative Name:</b><br>Kanyakorn Sukpharajaree  | <b>Customer Field Service Representative Signature:</b><br><u>Kanyakorn</u> | <b>Date:</b><br>28 Mar 2023 |
| <b>Customer Name:</b><br>Thitima Boongeng  | <b>Customer Signature:</b><br><u>Thitima B.</u>                             | <b>Date:</b><br>28 Mar 2023 |
| <b>Additional Comments:</b>  |   |                             |

Page 2 of 3

## Maintenance Protocol

Atomic Fluorescence Spectrometer  
mercur DUO /  
mercur DUO plusSerial-No.: K170A0143 Customer-No.: \_\_\_\_\_  
Date: 24 May 2023 Carried out by: Srichai Fak-onMaintenance with following Operational Qualification (OQ)  
(requires a separate OQ protocol) ☐

|                       |   |
|-----------------------|---|
| <b>Company</b>        | บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด |
| <b>User</b>           |   |
| <b>Department</b>     | ห้องแล็บปฏิบัติการ                                  |
| <b>Street</b>         | 104 ซอย 40 ถนนพัฒนาการ แขวงสวนหลวง เขตสวนหลวง       |
| <b>Zip Code, City</b> | กรุงเทพมหานคร 10250                                 |
| <b>Country</b>        | ประเทศไทย   |
| <b>Phone</b>          |   |
| <b>Fax</b>            |   |
| <b>E-mail</b>         |   |

## Maintenance works basic unit

tightness visual check inside the Mercur ☒  
 visual check if gold-traps are broken ☒  
 visual check if spectrometer is contaminated ☒  
 visual check of the fluorescence cell ☒  
 visual check of the absorption cell, incl. window ☒  
 reactor cleaning ☒  
 check pump-hose, if necessary change it ☒  
 check swivel drive (SEV) ☒  
 check drying-hose, output gas-liquid-separator ☒  
 test Bubble-Sensor ☒  
 check gas flows ☒  
 check volume flows, reagents ☒  
 recording stray light values ☒  
 measurement with 30 ng/l ☒

## Maintenance works Autosampler

Serial No.: 701 739

lubricate the dosing-winding (Teflon-grease-spray) ☒  
 clean the dosing cylinder, if necessary exchange it ☒  
 lubricate the winding system of the height drive with some drops of oil ☒  
 check the toothed belt ☒  
 check the position of the mechanical stopper (height: 13mm) ☒  
 check the pump rate of mixing pump (<14s AS52, typ.7s/<20s AS52S, typ.10s) ☒  
 check the pump rate of washing cup ☒  
 check the electrical hose connections for good contact ☒  
 check the connectors of the magnetic valves ☒  
 check the dosing hose for buckling, if necessary exchange it ☒

| Device parameter                                 | nominal value                             | actual value                       |
|--|---|------------------------------------|
| visual check general tightness inside the Mercur | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/>  |
| visual check Goldtraps                           | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/>  |
| visual check spectrometer                        |   |                                    |
| Fluorescence cell                                | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/>  |
| Absorption cell, incl. window                    | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/>  |
| lens   | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/>  |
| Swivel drive (SEV)                               | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/>  |
| check pump hoses                                 | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/>  |
| check hoses and hose connectors                  | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/>  |
| check and clean reactor                          | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/>  |
| check drying hose output Gas-liquid-separator    | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/>  |
| check bubble-sensor                              | o.k.: <input checked="" type="checkbox"/> | not o.k.: <input type="checkbox"/> |
| <b>Check gasflow</b>                             |   |                                    |
| Argon pressure valve 4                           | 1.2 - 1.5 bar                             | 1.5 bar                            |
| Valve 1  | 10 Nl/h or 0.166 NL/min                   | 0.163 NL/min                       |
| Valve 2  | 50 Nl/h or 0.833 NL/min                   | 0.403 NL/min                       |
| Valve 3  | 5 Nl/h or 0.083 NL/min                    | 0.140 NL/min                       |
| Valve 4  | 10 Nl/h or 0.166 NL/min                   | 0.108 NL/min                       |
| <b>Check liquidflow</b>                          |   |                                    |
| Acid   | 2.5ml/min ± 1 ml                          | 2.5 ml/min                         |
| Red.-agent                                       | 2.5ml/min ± 1 ml                          | 2.5 ml/min                         |
| Sample   | 10ml/min ± 2 ml                           | 10 ml/min                          |
| <b>Adventitious light - values</b>               | (V)                                       | from file                          |
| 100  | 0   | 0                                  |
| 200  | 0   | 0                                  |
| 300  | 0   | 0                                  |
| 350  | 0   | 0                                  |
| 400  | 0   | 0                                  |
| 450  | 2   | 2                                  |
| 500  | 5   | 5                                  |
| 550  | 10  | 10                                 |
| 575  | 15  | 14                                 |
| 600  | 20  | 20                                 |

| Device parameter  | nominal value              | actual value                                       |
|---|----------------------------|--|
| <b>Analytical parameters Fluorescence cell</b>            |                            |  |
| Conditions.: max.conc.: 10µg/L PMT-voltage: ...360.....V  |                            |  |
| Blank-solution without enrichment / FBR 30 ng/L           | Int > 0.0015<br>RSD < 3 %  | Int...0.00024...<br>Int...0.00172...<br>RSD 0.45 % |
| Conditions.: max.conc.: 1.7µg/L PMT-voltage: ...352.....V |                            |  |
| Blank-solution with enrichment / FBR 30 ng/L              | Int > 0.008<br>RSD < 3 %   | Int...0.00370...<br>Int...0.01060...<br>RSD 2.38 % |
| Fok.- factor ( Int <sub>2</sub> / Int <sub>1</sub> )      | > 3.5                      | 6.16   |
| <b>Analytical parameters Absorption cell</b>              |                            |  |
| Blank-solution without enrichment / FBR 100 ng/L          | Ext. > 0.0012<br>RSD < 5 % | Ext. 0.00093...<br>Ext. 0.00449...<br>RSD 2.58 %   |
| <b>Comments</b>   |                            |  |

Sudchai Paksan  
Signature Technician

Orawan T.  
Signature Customer

24 May 2023

Place, Date (DD/MM/YYYY)

24 May 2023

Place, Date (DD/MM/YYYY)

## Service Report

|  |                                      |
|--|--------------------------------------|
| Customer's address:  | Customer's Ref. No.                  |
| 23 Moos S. 345 Road, Chiang Mai, P.O. Box 100,<br>Saphanburi, 51130 (Thailand)   |                                      |
| PH 000 40 00000000 00000000 00000000<br>00000000 000000  |                                      |
| E-mail:  | Phone:                               |
| Job No. 2305282 PM   | User:                                |
| Instrument model Mercur  | Serial No. K170A0143                 |
| <input type="checkbox"/> Repair (RE) <input checked="" type="checkbox"/> Maintenance (PM) <input type="checkbox"/> Installation (IN) <input type="checkbox"/> Warranty <input type="checkbox"/> Application (AP) <input type="checkbox"/> Site Prep (SP) <input type="checkbox"/> Visit (VI) | Software Version No. 4.7.10.0        |
| Fault / Claim: - problem with maintenance of the unit (170A0143) (170A0143-037) <input type="checkbox"/> Error Code  |                                      |
| - problem with maintenance of the unit (170A0143) (170A0143-037)   |                                      |
| Action taken: - Maintenance of the unit  |                                      |
| - Check device parameter   |                                      |
| - Check gas flow   |                                      |
| - Check liquid flow  |                                      |
| - Check Adventitious light - valves  |                                      |
| # Test run Analytical parameter Fluorescence cell  |                                      |
| Test run Analytical parameter Absorption cell  |                                      |
| Action Pending / Recommendation: - maintenance of the unit   |                                      |
| <input type="checkbox"/> Spare Part <input type="checkbox"/> Instrument Configuration:   |                                      |
| Item No.   | Name                                 |
| 1.   |                                      |
| 2.   |                                      |
| 3.   |                                      |
| 4.   |                                      |
| 5.   |                                      |
| 6.   |                                      |
| 7.   |                                      |
| 8.   |                                      |
| Hereby the undersigned confirm the time devoted, the work performed, the perfect function of the device and the receipt/delivery of the specified spare parts. "Traveled hours and kilometers can only be entered after the return of the service engineer."                                 |                                      |
| Date / Signature of Customer   | Date / Signature of Service Engineer |
| Orawan T.  | Sudchai Paksan                       |
| Work completed?  |                                      |
| <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  |                                      |

5/24/2023 12:46 Page 1/4

## Mercur

|                  |                                |
|------------------|--------------------------------|
| Report file:     | C:\WinAAS\TMP\2023\May\Pro_032 |
| Program version: | 4.7.10.0                       |
| Operator:        | PSU_OTA                        |
| Laboratory:      | ALS-BKK                        |
| Code:            | II_Hg095_2023                  |
| Remarks:         |                                |
| Food, water      |                                |

## Method parameters

|   |  |
|---|--|
| Method  | Without enrichment / FBR 30ng/L_PM24052023 |
| Created on  | 5/24/2023                                  |
| Time  | 12:27                                      |
| Program   |  |
| <b>Parameters Mercur Technique: Hg fluorescence</b> |  |
| Line  | 253.7 nm                                   |
| Lamp type   | Hg-LP                                      |
| Integr. mode  | Peak height                                |
| PMT   | 360 V                                      |
| AZ time   | 5 s  |
| Delay   | 0 s  |
| Working mode  | w/o enrich.                                |
| FBR technique                                       | on   |
| Pump speed  | 3  |
| Sample load time                                    | 10 s                                       |
| Reaction time                                       | 10 s                                       |
| Waiting time AZ                                     | 5 s  |
| Delay   | 0 s  |
| Purge time1   | 28 s                                       |
| Purge time2   | 15 s                                       |
| <b>Autosampler</b>                                  |  |
| Autosampler   | AS51S/F                                    |
| Working mode  | continuous                                 |
| Integr. time  | 30 s                                       |
| Peak smoothing                                      | 8/5  |
| System cleaning                                     | Acid                                       |
| Wash time acid                                      | 10 s                                       |
| Soaking time  | 20 s                                       |
| Gas load time                                       | 5 NL/h                                     |
| Gas wash time2                                      | 10 NL/h                                    |
| Tray type   | 87/139                                     |
| Dilution  |  |



## QC parameters

|                    |                 |                  |                 |
|--------------------|-----------------|------------------|-----------------|
| QC type            | Conc. check     | QC check samp. 2 | ---             |
| QC check samp. 1   | ---             | Conc.            | ---             |
| Conc.              | ---             | Error limit      | ---             |
| Error limit        | ---             | Reaction         | flag + continue |
| Rep. measurement   | off             | QC std.2 no.     | 1(30.000 ng/L)  |
| QC std.1 no.       | 1(30.000 ng/L)  | QC std.2 limit   | ± 50.00%        |
| QC std.1 limit     | ± 50.00%        | Reaction         | flag + continue |
| QC std. act.       | flag + continue | QC Recal factor  | Off             |
| Expect. blank abs. | 0.0100± 0.0100  |                  |                 |
| QC precision       | off             |                  |                 |

## Calibration settings

|                     |                 |                   |            |
|---------------------|-----------------|-------------------|------------|
| Calib. meth         | Standard calib. | Calibr. unit      | ng/L       |
| No. standards       | 1               | Conversion fac.   | 1000000    |
| Type of standards   | ---             | Standard prep.    | Premixed   |
|                     |                 | Blank correct.    | ---        |
|                     |                 | Recalib. std. no. | ---        |
| Output unit         | µg/L            | Conversion fac.   | 1000       |
| Calib. stat.        | Mean            | Meas. cycles      | 3          |
|                     |                 | Blind cycles      | 1          |
| Stock sol. 1        | ---             | Stock sol. 2      | ---        |
| Stock sol. 3        | ---             | Stock sol. 4      | ---        |
| Type of cal. curve  | linear          | Intercept         | calculated |
| Weighted cal.       | off             | Grubbs stat.      | off        |
| Check of cal. curve | no outlier test |                   |            |

## Sample statistics

|               |        |              |   |
|---------------|--------|--------------|---|
| Stat. mode    | Mean   | Meas. cycles | 2 |
| Confid. level | 95.4 % | Blind cycles | 1 |
| Grubbs stat.  | ---    |              |   |

## Calibration standards

| No | Name     | State | Pos | Conc./<br>ng/L | Ints                       | SD                   | RSD/%          |
|----|----------|-------|-----|----------------|----------------------------|----------------------|----------------|
| 1  | Cal-Zero | (--)  | 79  | 0.000          | H: 0.000249<br>A: 0.004274 | 0.000132<br>0.001698 | 53.13<br>39.72 |
| 2  | Cal-Std1 | (--)  | 80  | 30.000         | H: 0.001720<br>A: 0.02172  | 0.000007<br>0.000023 | 0.459<br>0.107 |

Hg

Mercur

## Calibration function 1

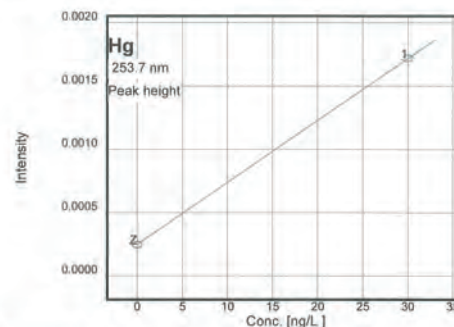
5/24/2023 12:44 Calibration (Peak height)

Ints=k1+k2\*conc

k1=0.000249 k2=0.000049

Recal. factor: ---

|                 |                     |              |           |
|-----------------|---------------------|--------------|-----------|
| Slope           | 0.00005 Ints/(ng/L) | R2-adjusted  | 1.0000    |
| sc0             | 1.000000 ng/L       |              |           |
| Lower limit     | 0 ng/L              | Upper limit  | 33.0 ng/L |
| Detection limit | ---                 | Deter. limit | ---       |



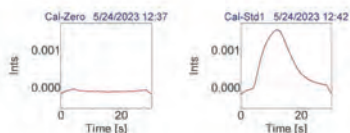
## Measurements and events (sorted by time)

| Hg          | Without enrichment / FBR 30ng/L_PM 24052023 |          |    |             |       | 5/24/2023 | 12:36 |
|-------------|---|----------|----|-------------|-------|-----------|-------|
| ID          | Conc.                                       | Ints     | BG | SD          | RSD/% | Int. type | Time  |
| Cal-Zero    |   | 0.000143 |    |             |       | PkH       | 12:37 |
|             |   | 0.000397 |    |             |       |           | 12:38 |
|             |   | 0.000207 |    |             |       |           | 12:40 |
|             | 0ng/L                                       | 0.000249 |    | 0.0001324   | 53.13 |           | 12:40 |
| Cal-Std1    |   | 0.001720 |    |             |       | PkH       | 12:42 |
|             |   | 0.001712 |    |             |       |           | 12:43 |
|             |   | 0.001728 |    |             |       |           | 12:44 |
|             | 30.00ng/L                                   | 0.001720 |    | 0.000007897 | 0.459 |           | 12:44 |
| Calibration | Calibration function: 01                    |          |    |             |       |           | 12:44 |

Mercur

## Peak plots

Hg



Mercur

## Mercur

|                  |                                |                       |           |               |
|------------------|--------------------------------|-----------------------|-----------|---------------|
| Report file:     | C:\WinAAS\TMP\2023\May\Pro_033 |                       |           |               |
| Program version: | 4.7.10.0                       | Printed on:           | 5/24/2023 | 14:01         |
|                  |                                | Recording started on: | 5/24/2023 | 13:37 GMT+7.0 |
| Operator:        | PSU,OTA                        |                       |           |               |
| Laboratory:      | ALS-BKK                        |                       |           |               |
| Code:            | II_Hg095_2023                  |                       |           |               |

Remarks:

Food,water

## Method parameters

Hg

|            |                                     |      |       |
|------------|-------------------------------------|------|-------|
| Method     | Enrichment / FER 30ng/L PM_24052023 |      |       |
| Created on | 5/24/2023                           | Time | 13:36 |
| Program    | ---                                 |      |       |

## Parameters Mercur Technique: Hg fluorescence

|                  |                  |                   |         |
|------------------|------------------|-------------------|---------|
| Line             | 253.7 nm         |                   |         |
| Lamp type        | Hg-LP            |                   |         |
| Integr. mode     | Peak height      | Integr. time      | 40 s    |
| PMT              | 352 V            |                   |         |
| AZ time          | 5 s              | Peak smoothing    | 12/11   |
| Delay            | 0 s              |                   |         |
|                  | ---              |                   |         |
| Working mode     | Enr. w/o reload. | System cleaning   | Off     |
| FBR technique    | off              | Wash time acid    | 10 s    |
| Pump speed       | 3                | Soaking time      | 20 s    |
| Sample load time | 10 s             | Gas load time     | 10 NL/h |
| Reaction time    | 10 s             |                   |         |
| Waiting time AZ  | 10 s             | Gas AZ wait       | 10 NL/h |
| Purge time1      | 30 s             |                   |         |
| Purge time2      | 15 s             | Gas wash time2    | 5 NL/h  |
| Purge time3      | 20 s             |                   |         |
| Heat time coll.1 | 20 s             | Cool. time coll.1 | 30 s    |

Mercur

## QC parameters

|                    |                 |                  |                 |
|--------------------|-----------------|------------------|-----------------|
| QC type            | Conc. check     | QC check samp. 2 | ---             |
| QC check samp. 1   | ---             | Conc.            | ---             |
| Conc.              | ---             | Error limit      | ---             |
| Error limit        | ---             | Reaction         | flag + continue |
| Rep. measurement   | off             | QC std.2 no.     | 1(30.000 ng/L)  |
| QC std.1 no.       | 1(30.000 ng/L)  | QC std.2 limit   | ± 50.00%        |
| QC std.1 limit     | ± 50.00%        | Reaction         | flag + continue |
| QC std. act.       | flag + continue | Reaction         | flag + continue |
| Expect. blank abs. | 0.0100± 0.0100  | Reaction         | flag + continue |
| QC precision       | off             | Reaction         | off             |
|                    |                 | QC Recal. factor | Off             |

## Calibration settings

|                     |                 |                   |            |
|---------------------|-----------------|-------------------|------------|
| Calib. meth         | Standard calib. | Calibr. unit      | ng/L       |
| No. standards       | 1               | Conversion fac.   | 1000000    |
| Type of standards   | ---             | Standard prep.    | Premixed   |
|                     |                 | Blank correct.    | ---        |
|                     |                 | Recalib. std. no. | ---        |
| Output unit         | µg/L            | Conversion fac.   | 1000       |
| Calib. stat.        | Mean            | Meas. cycles      | 3          |
|                     |                 | Blind cycles      | 1          |
| Stock sol. 1        | ---             | Stock sol. 2      | ---        |
| Stock sol. 3        | ---             | Stock sol. 4      | ---        |
| Type of cal. curve  | linear          | Intercept         | calculated |
| Weighted cal.       | off             | Grubbs stat.      | off        |
| Check of cal. curve | no outlier test |                   |            |

## Sample statistics

|               |        |              |   |
|---------------|--------|--------------|---|
| Stat. mode    | off    | Meas. cycles | 1 |
| Confid. level | 95.4 % | Blind cycles | 1 |
| Grubbs stat.  | ---    |              |   |

## Calibration standards

| No | Name     | State | Pos | Conc./<br>ng/L | Ints                      | SD                   | RSD/%          |
|----|----------|-------|-----|----------------|---------------------------|----------------------|----------------|
| 1  | Cal-Zero | (-)   | ##  | 0.000          | H: 0.003700<br>A: 0.02531 | 0.000081<br>0.000153 | 2.192<br>0.607 |
| 2  | Cal-Std1 | (-)   | ##  | 30.000         | H: 0.01060<br>A: 0.06689  | 0.000253<br>0.002766 | 2.386<br>4.136 |

Hg

Mercur

## Calibration function 1

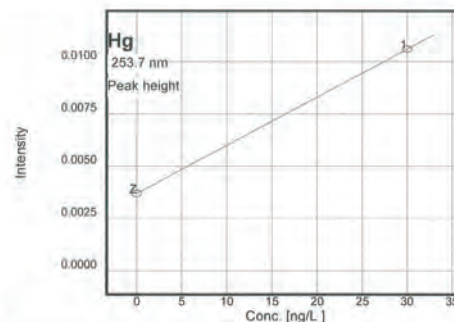
5/24/2023 14:00 Calibration (Peak height)

Ints=k1+k2\*conc

k1=0.003700 k2=0.000230

Recal. factor: ---

|                 |                     |              |           |
|-----------------|---------------------|--------------|-----------|
| Slope           | 0.00023 Ints/(ng/L) | R2-adjusted  | 1.0000    |
| sc0             | 1.00000 ng/L        |              |           |
| Lower limit     | 0 ng/L              | Upper limit  | 33.0 ng/L |
| Detection limit | ---                 | Deter. limit | ---       |

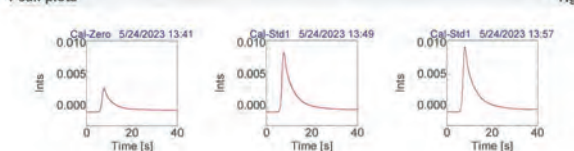


## Measurements and events (sorted by time)

| Hg          | Enrichment / FER         | 30ng/L   | PM_24052023 | 5/24/2023   | 13:37 |
|-------------|--------------------------|----------|-------------|-------------|-------|
| ID          | Conc.                    | Ints     | BG          | SD          | RSD/% |
| Cal-Zero    |                          | 0.003792 |             |             | PkH   |
|             |                          | 0.003666 |             |             | 13:41 |
|             |                          | 0.003640 |             |             | 13:43 |
|             | 0ng/L                    | 0.003700 |             | 0.000081090 | 2.192 |
|             |                          |          |             |             | 13:44 |
| Cal-Std1    |                          | 0.008498 |             |             | PkH   |
|             |                          | 0.008333 |             |             | 13:49 |
|             |                          | 0.008961 |             |             | 13:50 |
|             | 30.00ng/L                | 0.008931 |             | 0.0005830   | 6.528 |
|             |                          |          |             |             | 13:52 |
| Cal-Std1    |                          | 0.01031  |             |             | PkH   |
|             |                          | 0.01074  |             |             | 13:57 |
|             |                          | 0.01076  |             |             | 13:58 |
|             | 30.00ng/L                | 0.01060  |             | 0.0002530   | 2.386 |
|             |                          |          |             |             | 14:00 |
| Calibration | Calibration function: 01 |          |             |             | 14:00 |

Mercur

## Peak plots



Hg

Mercur

## Mercur

|                       |                                |
|-----------------------|--------------------------------|
| Report file:          | C:\WinAAS\TMP\2023\May\Pro_034 |
| Program version:      | 4.7.10.0                       |
| Printed on:           | 5/24/2023 14:33                |
| Recording started on: | 5/24/2023 14:19 GMT+7.0        |
| Operator:             | PSU,OTA                        |
| Laboratory:           | ALS-BKK                        |
| Code:                 | IL_Hg095_2023                  |

Remarks:

Food,water

## Method parameters

|            |  |
|------------|--|
| Method     | Without enrichment / Abs / FBR 100ng/L_PM 24052023 |
| Created on | 5/24/2023 Time 14:18                               |
| Program    | ---  |

## Parameters Mercur Technique: Hg absorption

|                  |             |                 |         |
|------------------|-------------|-----------------|---------|
| Line             | 253.7 nm    |                 |         |
| Lamp type        | Hg-LP       |                 |         |
| Integr. mode     | Peak height | Integr. time    | 55 s    |
| PMT              | 225 V       |                 |         |
| AZ time          | 5 s         | Peak smoothing  | 2/5     |
| Delay            | 8 s         |                 |         |
|                  | ---         |                 |         |
| Working mode     | w/o enrich. | System cleaning | Acid    |
| FBR technique    | on          | Wash time acid  | 15 s    |
| Pump speed       | 4           | Soaking time    | 20 s    |
| Sample load time | 8 s         | Gas load time   | 5 NL/h  |
| Reaction time    | 12 s        |                 |         |
| Waiting time AZ  | 15 s        |                 |         |
| Delay            | 10 s        |                 |         |
| Purge time1      | 50 s        |                 |         |
| Purge time2      | 10 s        | Gas wash time2  | 10 NL/h |

Hg

Mercur



## QC parameters

|                    |                 |                  |                 |
|--------------------|-----------------|------------------|-----------------|
| QC type            | Conc. check     | QC check samp. 2 | ---             |
| QC check samp. 1   | ---             | Conc.            | ---             |
| Conc.              | ---             | Error limit      | ---             |
| Error limit        | ---             | Reaction         | flag + continue |
| Rep. measurement   | off             | QC std.2 no.     | 1(100.00 ng/L)  |
| QC std.1 no.       | 1(100.00 ng/L)  | QC std.2 limit   | ± 0.00%         |
| QC std.1 limit     | ± 50.00%        | Reaction         | flag + continue |
| QC std. act.       | flag + continue | QC Recal.factor  | Off             |
| Expect. blank abs. | 0.0100± 0.0100  | Reaction         | flag + continue |
| QC precision       | off             | Reaction         | off             |

## Calibration settings

|                     |                 |                   |            |
|---------------------|-----------------|-------------------|------------|
| Calib. meth         | Standard calib. | Calibr. unit      | ng/L       |
| No. standards       | 1               | Conversion fac.   | 1000000    |
| Type of standards   | ---             | Standard prep.    | Premixed   |
|                     |                 | Blank correct.    | ---        |
|                     |                 | Recalib. std. no. | ---        |
| Output unit         | µg/L            | Conversion fac.   | 1000       |
| Calib. stat.        | Mean            | Meas. cycles      | 3          |
|                     |                 | Blind cycles      | 1          |
| Stock sol. 1        | ---             | Stock sol. 2      | ---        |
| Stock sol. 3        | ---             | Stock sol. 4      | ---        |
| Type of cal. curve  | linear          | Intercept         | calculated |
| Weighted cal.       | off             | Grubbs stat.      | off        |
| Check of cal. curve | no outlier test |                   |            |

## Sample statistics

|              |        |              |   |
|--------------|--------|--------------|---|
| Stat. mode   | Mean   | Meas. cycles | 2 |
| Confd. level | 95.4 % | Blind cycles | 1 |
| Grubbs stat. | ---    |              |   |

## Calibration standards

| No | Name     | State | Pos | Conc./<br>ng/L | Abs                        | SD                   | RSD/%          |
|----|----------|-------|-----|----------------|----------------------------|----------------------|----------------|
| 1  | Cal-Zero | (-)   | ##  | 0.00           | H: 0.000932<br>A: 0.035926 | 0.000138<br>0.006208 | 14.88<br>17.28 |
| 2  | Cal-Std1 | (-)   | ##  | 100.00         | H: 0.004494<br>A: 0.061286 | 0.000116<br>0.001275 | 2.566<br>2.082 |

Hg

Mercury

## Calibration function 1

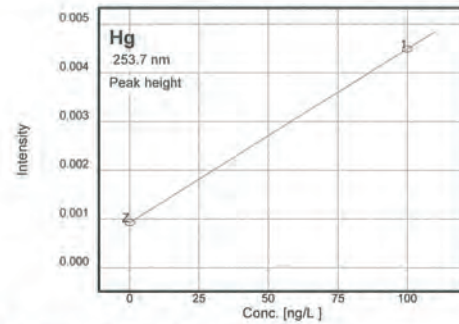
5/24/2023 14:33 Calibration (Peak height)

Abs=k1+k2\*conc

k1=0.000932 k2=0.000036

Recal. factor: ---

|                 |                    |                |                   |
|-----------------|--------------------|----------------|-------------------|
| Slope           | 0.00004 Abs/(ng/L) | R2-adjusted    | 1.0000            |
| sc0             | 1.00000 ng/L       | Charact. conc. | 122.411 (ng/L)/1% |
| Lower limit     | 0 ng/L             | Upper limit    | 110. ng/L         |
| Detection limit | ---                | Deter. limit   | ---               |



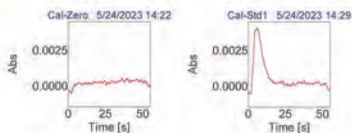
## Measurements and events (sorted by time)

| Hg          | Without enrichment / Abs / FBR 100ng/L_PM 24052023 | 5/24/2023 | 14:19      |
|-------------|--|-----------|------------|
| ID          | Conc.  | Abs       | BG         |
| Cal-Zero    |  | 0.001039  |            |
|             |  | 0.000775  |            |
|             |  | 0.000981  |            |
|             | 0ng/L  | 0.000932  | 0.00013872 |
|             |  | 0.004528  | 14.88      |
| Cal-Std1    |  | 0.004364  |            |
|             |  | 0.004589  |            |
|             | 100.ng/L   | 0.004494  | 0.00011623 |
|             |  |           | 2.566      |
| Calibration | Calibration function: 01                           |           | 14:33      |

Mercury

## Peak plots

Hg



Mercury

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
334/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0-2719-9484

Cert. No.: 23TM1103  
Page : 1 of 3

## Certificate of Calibration

|                       |  |
|-----------------------|--|
| Equipment :           | Autoclave  |
| Manufacturer :        | Sanyo  |
| Model :               | MLS-3781   |
| Serial No. :          | 830167   |
| ID No. :              | BKK_ML0037   |
| Submitted by :        | ALS Laboratory Group (Thailand) Co.,Ltd.<br>104 Phatthanakan 40, Phatthanakan Rd.,<br>Khwaeng Phatthanakan, Khet Suan Luang,<br>Bangkok 10250 Thailand |
| Location :            | Media Preparation Room   |
| Received Order :      | 17 July 2023   |
| Calibration Date :    | 17 July 2023   |
| Ambient Temperature : | ( 26 ± 10 ) °C   |
| Relative Humidity :   | ( 50 ± 30 ) %  |
| Calibrated by :       | Preecha Hlahib   |
| Approved by :         | <br>Approved Signatory   |
|                       | ( ) Pornthippa Tameyakul<br>( ) Malee Butkruea<br>(✓) Suwit Imjai  |
| Issue Date :          | 24 July 2023   |

The Uncertainties are for a confidence probability of approximately 95%

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A 0053615





Equipment : Autoclave  
Condition As-Received : Used Item  
Reference : 2307-0285OC-3  
Procedure Used :-

Cert. No.: 23TM1103  
Page : 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with 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 | MY57013823 | 23LM66    | TPA       | 25 Mar 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.

4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3\*\*

(\*\* = Categorization of pathogens according to hazard and categories of containment, second edition, 1990 )

It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.

This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

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

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source



|                          | Environmental |           |          |
|--------------------------|---------------|-----------|----------|
|                          | ( °C )        | ( %R.H. ) | ( Volt ) |
| Beginning of Calibration | 22            | 53        | 220      |
| Finished of Calibration  | 22            | 54        | 220      |

| Position | Description        | Ref. Std. ID No.: |
|----------|--------------------|-------------------|
| 1 =      | Center of chamber  | 22-17TC-01        |
| 2 =      | Temperature sensor | 23-17TC-02        |
| 3 =      | Exhaust port       | 19-17TC-03        |

a 1159503



Equipment : Autoclave  
Condition As-Received : Used Item  
Reference : 2307-0285OC-3

Cert. No.: 23TM1103  
Page : 3 of 3

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Operating parameter Set : Temperature = 121 °C  
Sterilization period = 15 minute

| UUC* Setting ( °C ) | UUC* Reading ( °C ) | Position | Average* Standard Reading ( °C ) | Stability ( ± °C ) | Pressure Reading ( MPa ) | Uncertainty ( ± °C ) | Coverage Factor k |
|---------------------|---------------------|----------|----------------------------------|--------------------|--------------------------|----------------------|-------------------|
| 121                 | 121                 | 1        | 120.877                          | 0.39               | 0.12                     | 1.0                  | 2                 |
|                     |                     | 2        | 120.870                          |                    |                          |                      |                   |
|                     |                     | 3        | 120.866                          |                    |                          |                      |                   |

Average\* : The average of 30 values in each position.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

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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a 1159504



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 23TM1146  
Page : 1 of 3

## Certificate of Calibration

Equipment : Incubator

Manufacturer : SHEL-LAB

Model : 1915A

Serial No. : 0200599

ID No. : BKK\_ML0010

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand

Location : Incubation & Micrological Reading

Received Order : 17 July 2023

Calibration Date : 17 July 2023

Ambient Temperature : ( 26 ± 10 ) °C

Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Man Pattanapongpaiboon

Approved by :   
Approved Signatory

( ) Pornthippa Tameyakul  
( ) Malee Butkruea  
( ) Suwit Imjai

Issue Date : 24 July 2023

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services, Equipment Calibration and Testing Services.

A 0056489



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2307-0285OC-1

Cert. No.: 23TM1146  
Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector ( RTD ).

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 | MY49001451 | 23LM27    | TPA       | 25 Feb 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.

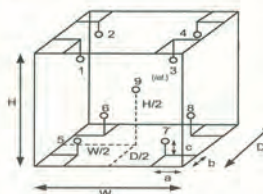
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

| Environment during calibration |           |          |
|--------------------------------|-----------|----------|
|                                | Beginning | Finished |
| Temp. ( °C )                   | 24        | 24       |
| REL.Humid. ( % )               | 54        | 56       |
| AC Supply ( Volt )             | 221       | 223      |



Probe installation Details :

a = 10 cm  
b = 10 cm  
c = 10 cm

Dimension of Chamber :

D = 0.50 m  
W = 0.75 m  
H = 1.2 m  
Capacity = 0.45 m<sup>3</sup>

| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1          | 19RTD-2/1         |
| 2          | 19RTD-2/2         |
| 3          | 19RTD-2/3         |
| 4          | 19RTD-2/4         |
| 5          | 19RTD-2/5         |
| 6          | 19RTD-2/6         |
| 7          | 19RTD-2/7         |
| 8          | 19RTD-2/8         |
| 9 (ref.)   | 19RTD-2/9         |

a 1172189





Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2307-0285OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 23TM1148  
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 |
|------------------------|-------------------|-------------------|------------------------------|-----------------------------|------------------------|-------------------|
| 35.0                   | 35.0              | 35.0              | 0.055                        | 0.30                        | 0.44                   | 2                 |

| Calibration Point (°C) | Measured Temperature (°C) |        |        |        |        |        |        |        |          | Uncertainty (±°C) |
|------------------------|---------------------------|--------|--------|--------|--------|--------|--------|--------|----------|-------------------|
|                        | 1                         | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9 (ref.) |                   |
| 35.0                   | 34.888                    | 34.933 | 34.815 | 34.813 | 35.064 | 35.019 | 35.156 | 35.141 | 35.087   | 0.30              |

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 %.

-000-

Malee

a 1172188



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2713-3900-27 FAX. 0-2719-9484



Cert. No.: 22TM1571  
Page : 1 of 3

## Certificate of Calibration

Equipment : Hot Air Oven

Manufacturer : Binder

Model : ED 240/E2

Serial No. : 00-15533

ID No. : BKK\_ML0013

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand

Location : Media Preparation Room

Received Order : 21 November 2022

Calibration Date : 21 November 2022

Ambient Temperature : ( 26 ± 10 ) °C

Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Krisda Malee

Approved by :   
Approved Signatory

( ) Pornthippa Tameyakul  
( / ) Malee Butkruea  
( ) Suwit Imjai

Issue Date : 29 November 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0048150



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2211-0623OC-1

Cert. No.: 22TM1571  
Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument-

| Instrument           | Model  | Serial No. | Cert. No. | Due Date    |
|----------------------|--------|------------|-----------|-------------|
| 1 ) Data Acquisition | 34970A | MY44067817 | 22LM121   | 22 Aug 2023 |

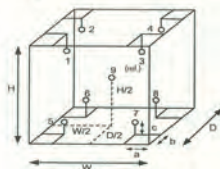
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( \* ) After Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Not Available



Probe Installation Details :

Dimension of Chamber :

|            |                    |
|------------|--------------------|
| a = 5.0 cm | D = 0.50 m         |
| b = 5.0 cm | W = 0.80 m         |
| c = 5.0 cm | H = 0.60 m         |
|            | Capacity = 0.24 m³ |

| Environment during calibration |           |          |
|--------------------------------|-----------|----------|
|                                | Beginning | Finished |
| Temp. (°C)                     | 26        | 26       |
| REL.Humid. (%)                 | 53        | 55       |
| AC Supply ( Volt )             | 219       | 220      |

| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1          | 21-15TC-01        |
| 2          | 21-15TC-02        |
| 3          | 21-15TC-03        |
| 4          | 21-15TC-04        |
| 5          | 21-15TC-05        |
| 6          | 21-15TC-06        |
| 7          | 21-15TC-07        |
| 8          | 21-15TC-08        |
| 9 (ref.)   | 21-15TC-09        |

Malee

a 1138049



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2211-0623OC-1  
Result of Calibration :- ( \* ) After Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 22TM1571  
Page : 3 of 3

| Calibration Point (°C) | UUC* Setting (°C) | UUC* Reading (°C) | Temperature stability (± °C) | Temperature uniformity (°C) | Overall Variation (°C) | Uncertainty (±°C) | Coverage Factor k |
|------------------------|-------------------|-------------------|------------------------------|-----------------------------|------------------------|-------------------|-------------------|
| 180                    | 180               | 180               | 0.70                         | 1.5                         | 2.9                    | 1.4               | 2                 |

| Calibration Point (°C) | Measured Temperature (°C) |         |         |         |         |         |         |         |          |
|------------------------|---------------------------|---------|---------|---------|---------|---------|---------|---------|----------|
|                        | 1                         | 2       | 3       | 4       | 5       | 6       | 7       | 8       | 9 (ref.) |
| 180                    | 179.520                   | 180.585 | 178.855 | 179.482 | 178.827 | 179.938 | 179.074 | 180.199 | 180.068  |

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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Malee

a 1138053





Cert. No.: 23TM637  
Page : 1 of 3

## Certificate of Calibration

Equipment : Water Bath  
Manufacturer : Memmert  
Model : WNE 45  
Serial No. : L712.0429  
ID No. : BKK\_ML0056  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand  
Location : Incubator & Microbiological Reading

Received Order : 20 April 2023  
Calibration Date : 20 April 2023  
Ambient Temperature : (26 ± 10) °C  
Relative Humidity : (50 ± 30) %

Calibrated by : Kunchit Promprai

Approved by :   
Approved Signatory

( ) Ponthippa Tamayakul  
(✓) Malee Butkruea  
( ) Suwit Imjai

Issue Date : 24 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services & Equipment Calibration and Testing Services.

A 0053357



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2304-0253OC-1  
Procedure Used :-

Cert. No.: 23TM637  
Page : 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-

| Instrument          | Model  | Serial No. | Cert. No. | Due Date    |
|---------------------|--------|------------|-----------|-------------|
| 1) Data Acquisition | 34970A | MY44073381 | 22LM78/1  | 12 May 2023 |

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

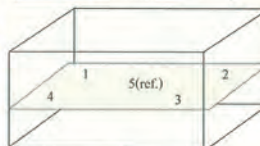
3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Heat transfer medium used : Water

|                          | Environmental |           | AC Voltage Supply |
|--------------------------|---------------|-----------|-------------------|
|                          | ( °C )        | ( %R.H. ) | ( Volt )          |
| Beginning of Calibration | 25            | 45        | 223               |
| Finished of Calibration  | 25            | 43        | 223               |



Front

| Position : | Ref. Std. S/N.: |
|------------|-----------------|
| 1          | 4803988-006     |
| 2          | 4803988-007     |
| 3          | 4804539-014     |
| 4          | 4804539-015     |
| 5(ref.)    | 4804539-016     |

a 1158265



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2304-0253OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 23TM637  
Page : 3 of 3

| Calibration point ( °C ) | UUC* Setting ( °C ) | UUC* Reading ( °C ) | Average* Standard Reading ( °C ) |        |        |        |          | Uncertainty ( ± °C ) |
|--------------------------|---------------------|---------------------|----------------------------------|--------|--------|--------|----------|----------------------|
|                          |                     |                     | 1                                | 2      | 3      | 4      | 5 (ref.) |                      |
| 44.5                     | 44.5                | 44.5                | 44.492                           | 44.463 | 44.475 | 44.510 | 44.491   | 0.15                 |
| 45.0                     | 45.0                | 45.0                | 45.005                           | 44.962 | 44.979 | 45.016 | 44.986   | 0.15                 |

| Calibration point ( °C ) | Uniformity ( °C ) | Stability ( ± °C ) | Coverage Factor k |
|--------------------------|-------------------|--------------------|-------------------|
| 44.5                     | 0.051             | 0.022              | 2                 |
| 45.0                     | 0.080             | 0.026              | 2                 |

Average\* : The average of 30 values in each position.

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.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

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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a 1158264



## ภาคผนวก ด

สำเนาหนังสืออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน









| ลำดับที่ | สารมลพิษ            | วิธีวิเคราะห์   |
|----------|---------------------|---|
| 19       | Copper              | 1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method <sup>(4)</sup>                   |
| 20       | Cyanide             | Distillation, Colorimetric Method <sup>(4)</sup>  |
| 21       | 2,4'-DDD            | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>   |
| 22       | 4,4'-DDD            | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>   |
| 23       | 2,4'-DDE            | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>   |
| 24       | 4,4'-DDE            | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>   |
| 25       | 2,4'-DDT            | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>   |
| 26       | 4,4'-DDT            | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>   |
| 27       | Dieldrin            | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>   |
| 28       | Endosulfan Sulfate  | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>   |
| 29       | Endosulfan I        | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>   |
| 30       | Endosulfan II       | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>   |
| 31       | Endrin              | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>   |
| 32       | Endrin Aldehyde     | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>   |
| 33       | Formaldehyde        | Distillation, Colorimetric Method <sup>(4)</sup>  |
| 34       | Free Chlorine       | 1) DPD Ferrous Titrimetric Method <sup>(4)</sup><br>2) Iodometric Method <sup>(4)</sup>   |
| 35       | Heptachlor          | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>   |
| 36       | Heptachlor epoxide  | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>   |
| 37       | Hexavalent Chromium | Filtration, Colorimetric Method <sup>(4)</sup>  |
| 38       | 3-Hydroxycarbofuran | High-Performance Liquid Chromatographic Method <sup>(4)</sup>   |
| 39       | Lead                | 1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method <sup>(4)</sup>                   |
| 40       | Manganese           | 1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method <sup>(4)</sup>                   |
| 41       | Mercury             | 1) Digestion, Cold-Vapor Atomic Absorption Spectrometric<br>Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma/Mass<br>spectrometric Method <sup>(4)</sup> |
| 42       | Methiocarb          | High-Performance Liquid Chromatographic Method <sup>(4)</sup>   |
| 43       | Methoxychlor        | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>   |

วิมล  
(นางรักกัญจน์ อัครสกุลวิไล)  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์มลพิษ  
กรมการสิ่งแวดล้อม

44 Methomyl...

| ลำดับที่ | สารมลพิษ                | วิธีวิเคราะห์   |
|----------|-------------------------|---|
| 44       | Methomyl                | High-Performance Liquid Chromatographic Method <sup>(4)</sup>   |
| 45       | Nickel                  | 1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method <sup>(4)</sup>   |
| 46       | Oil & Grease            | 1) Liquid-Liquid, Partition-Gravimetric Method <sup>(4)</sup><br>2) Soxhlet Extraction Method <sup>(4)</sup>  |
| 47       | Oxamyl                  | High-Performance Liquid Chromatographic Method <sup>(4)</sup>   |
| 48       | Propoxur                | High-Performance Liquid Chromatographic Method <sup>(4)</sup>   |
| 49       | pH                      | Electrometric Method <sup>(4)</sup>   |
| 50       | Phenols                 | 1) Distillation, Chloroform Extraction Method <sup>(4)</sup><br>2) Distillation, Direct Photometric Method <sup>(4)</sup>   |
| 51       | Selenium                | 1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method <sup>(4)</sup>   |
| 52       | Sulfide                 | Iodometric Method <sup>(4)</sup>  |
| 53       | Temperature             | Laboratory and Field Methods <sup>(4)</sup>   |
| 54       | Total Dissolved Solids  | Dried at 180 °C <sup>(4)</sup>  |
| 55       | Total Kjeldahl Nitrogen | Semi-Micro Kjeldahl Method <sup>(4)</sup>   |
| 56       | Total Suspended Solids  | Dried at 103-105 °C <sup>(4)</sup>  |
| 57       | Toxaphene               | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>   |
| 58       | Trivalent Chromium      | 1) Digestion, Inductively Coupled Plasma Method;<br>Colorimetric Method; Calculation <sup>(4)</sup><br>2) Digestion, inductively Coupled Plasma/<br>Mass Spectrometric Method; Colorimetric Method;<br>Calculation <sup>(4)</sup> |
| 59       | Zinc                    | 1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma/Mass<br>Spectrometric Method <sup>(4)</sup>  |

น้ำใต้ดิน จำนวน 126 รายการ

| ลำดับที่ | สารมลพิษ     | วิธีวิเคราะห์  |
|----------|--------------|--|
| 1        | Acenaphthene | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup> |
| 2        | Acetone      | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>           |

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กรมการสิ่งแวดล้อม

3 Aldrin...

| ลำดับที่ | สารมลพิษ                | วิธีวิเคราะห์   |
|----------|-------------------------|---|
| 3        | Aldrin                  | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 4        | Anthracene              | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 5        | Antimony                | 1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method <sup>(4)</sup> |
| 6        | Arsenic                 | 1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method <sup>(4)</sup> |
| 7        | Atrazine                | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 8        | Barium                  | 1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method <sup>(4)</sup> |
| 9        | Benz(a)anthracene       | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 10       | Benzene                 | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 11       | Benzo(a)fluoranthene    | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 12       | Benzo(k)fluoranthene    | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 13       | Benzoic Acid            | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 14       | Benzo(a)pyrene          | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 15       | Benzo(g,h,i)perylene    | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 16       | Beryllium               | 1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method <sup>(4)</sup> |
| 17       | Bis(2-chloroethyl)ether | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |

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18 Bis(2-ethylhexyl)phthalate...

| ลำดับที่ | สารมลพิษ                   | วิธีวิเคราะห์   |
|----------|----------------------------|---|
| 18       | Bis(2-ethylhexyl)phthalate | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 19       | Bromodichloromethane       | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 20       | Bromoform                  | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 21       | Butanol                    | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 22       | Butyl Benzyl Phthalate     | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 23       | Cadmium                    | 1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method <sup>(4)</sup> |
| 24       | Carbazole                  | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 25       | Carbon Disulfide           | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 26       | Carbon tetrachloride       | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 27       | Chlordane                  | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 28       | p-Chloroaniline            | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 29       | Chlorobenzene              | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 30       | Chlorodibromomethane       | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 31       | Chloroform                 | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 32       | 2-Chlorophenol             | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 33       | Chromium                   | 1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method <sup>(4)</sup> |

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34 Chromium (III)...




| ลำดับที่ | สารมลพิษ              | วิธีวิเคราะห์  |
|----------|-----------------------|--|
| 34       | Chromium (III)        | 1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation <sup>(8)</sup> |
| 35       | Chromium (VI)         | Colorimetric Method <sup>(4)</sup>   |
| 36       | Chrysene              | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>  |
| 37       | Cyanide               | Distillation, Colorimetric Method <sup>(4)</sup>   |
| 38       | 2,4-D                 | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>  |
| 39       | DDD                   | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>  |
| 40       | DDE                   | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>  |
| 41       | DDT                   | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>  |
| 42       | Dibenz(a,h)anthracene | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>  |
| 43       | Di-n-Butyl Phthalate  | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>  |
| 44       | 1,2-Dichlorobenzene   | Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>  |
| 45       | 1,3-Dichlorobenzene   | Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>  |
| 46       | 1,4-Dichlorobenzene   | Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>  |
| 47       | 3,3-Dichlorobenzidine | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>  |
| 48       | 1,1-Dichloroethane    | Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>  |
| 49       | 1,2-Dichloroethane    | Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>  |
| 50       | 1,1-Dichloroethylene  | Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>  |

  
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 กรมควบคุมมลพิษ (ป.ป.ช.)


51 cis-1,2-Dichloroethylene...

| ลำดับที่ | สารมลพิษ                   | วิธีวิเคราะห์   |
|----------|----------------------------|---|
| 51       | cis-1,2-Dichloroethylene   | Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>           |
| 52       | trans-1,2-Dichloroethylene | Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>           |
| 53       | 2,4-Dichlorophenol         | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup> |
| 54       | 1,2-Dichloropropane        | Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>           |
| 55       | 1,3-Dichloropropane        | Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>           |
| 56       | 1,3-Dichloropropene        | Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>           |
| 57       | Dieldrin                   | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup> |
| 58       | Diethyl Phthalate          | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup> |
| 59       | 2,4-Dimethylphenol         | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup> |
| 60       | 2,4-Dinitrophenol          | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup> |
| 61       | 2,4-Dinitrotoluene         | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup> |
| 62       | 2,6-Dinitrotoluene         | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup> |
| 63       | Di-n-Octyl Phthalate       | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup> |
| 64       | Endosulfan                 | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup> |
| 65       | Endrin                     | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup> |
| 66       | Ethylbenzene               | Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>           |
| 67       | Fluoranthene               | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup> |

  
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 กรมควบคุมมลพิษ (ป.ป.ช.)


68 Fluorene...

| ลำดับที่ | สารมลพิษ                  | วิธีวิเคราะห์   |
|----------|---------------------------|---|
| 68       | Fluorene                  | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 69       | Heptachlor                | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 70       | Heptachlor epoxide        | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 71       | Hexachlorobenzene         | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 72       | Hexachloro-1,3-butadiene  | Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 73       | n-Hexane                  | Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 74       | α-HCH                     | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 75       | β-HCH                     | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 76       | γ-HCH                     | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 77       | Hexachlorocyclopentadiene | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 78       | Hexachloroethane          | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 79       | Indeno(1,2,3-cd)pyrene    | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 80       | Isophorone                | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 81       | Lead                      | 1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>      |
| 82       | Manganese                 | 1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>      |
| 83       | Mercury                   | 1) Cold Vapor Atomic Absorption Spectrometric Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup> |

  
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 กรมควบคุมมลพิษ (ป.ป.ช.)

84 Methanol...

| ลำดับที่ | สารมลพิษ  | วิธีวิเคราะห์   |
|----------|---|---|
| 84       | Methanol  | 1) Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup><br>2) Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup> |
| 85       | Methoxychlor  | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 86       | Methyl Bromide  | Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 87       | Methylene Chloride  | Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 88       | 2-Methylphenol  | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 89       | 2-Methylnaphthalene   | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 90       | Methyl tert-Butyl Ether   | Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 91       | Naphthalene   | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 92       | Nickel  | 1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>                        |
| 93       | Nitrobenzene  | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 94       | N-Nitrosodiphenylamine  | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 95       | N-Nitrosodi-n-Propylamine   | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |
| 96       | Polychlorinated Biphenyls<br>- PCB 1016<br>- PCB 1221<br>- PCB 1232<br>- PCB 1242<br>- PCB 1248<br>- PCB 1254<br>- PCB 1260 | Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>   |

  
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 กรมควบคุมมลพิษ (ป.ป.ช.)

97 Pentachlorophenol...



| ลำดับที่ | สารมลพิษ                                | วิธีวิเคราะห์  |
|----------|---|--|
| 97       | Pentachlorophenol                       | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>   |
| 98       | pH                                      | Electrometric Method <sup>(4)</sup>  |
| 99       | Phenanthrene                            | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>   |
| 100      | Phenol                                  | 1) Distillation, Direct Photometric Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup> |
| 101      | Pyrene                                  | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>   |
| 102      | Selenium                                | 1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method <sup>(4)</sup>    |
| 103      | Silver                                  | 1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method <sup>(4)</sup>    |
| 104      | Styrene                                 | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>   |
| 105      | 1,1,2,2-Tetrachloroethane               | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>   |
| 106      | Tetrachloroethylene                     | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>   |
| 107      | Toluene                                 | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>   |
| 108      | Toxaphene                               | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>   |
| 109      | TPH (C <sub>8</sub> -C <sub>6</sub> )   | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(1,3,20)</sup>  |
| 110      | TPH (C <sub>8</sub> -C <sub>12</sub> )  | Solvent Extraction, Gas Chromatographic Method <sup>(9,21)</sup>   |
| 111      | TPH (C <sub>15</sub> -C <sub>33</sub> ) | Solvent Extraction, Gas Chromatographic Method <sup>(9,21)</sup>   |
| 112      | 1,2,4-Trichlorobenzene                  | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>   |
| 113      | 1,1,1-Trichloroethane                   | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>   |

114 1,1,2-Trichloroethane...

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และประเมินผลกระทบสิ่งแวดล้อม

| ลำดับที่ | สารมลพิษ               | วิธีวิเคราะห์   |
|----------|------------------------|---|
| 114      | 1,1,2-Trichloroethane  | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 115      | Trichloroethylene      | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 116      | 2,4,5-Trichlorophenol  | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 117      | 2,4,6-Trichlorophenol  | Liquid-Liquid Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 118      | 1,3,5-Trimethylbenzene | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 119      | Vanadium               | 1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method <sup>(4)</sup> |
| 120      | Vinyl Acetate          | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 121      | Vinyl Chloride         | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 122      | m-Xylene               | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 123      | o-Xylene               | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 124      | p-Xylene               | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 125      | Xylene (Total)         | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(4)</sup>  |
| 126      | Zinc                   | 1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method <sup>(4)</sup> |

ภาคเคมี (ต่อเนื่องจาก) จำนวน 16 รายการ

| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์  |
|----------|----------|--|
| 1        | Antimony | Isokinetic, Digestion, Inductively Coupled Plasma<br>Method <sup>(4)</sup> |
| 2        | Arsenic  | Isokinetic, Digestion, Inductively Coupled Plasma<br>Method <sup>(4)</sup> |

3 Carbon Monoxide...

(นางริกาญจน์ อัครสกุลวิไล)  
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และประเมินผลกระทบสิ่งแวดล้อม

| ลำดับที่ | สารมลพิษ                    | วิธีวิเคราะห์   |
|----------|-----------------------------|---|
| 3        | Carbon Monoxide             | 1) Sampling Bag Non-Dispersive Infrared Method <sup>(4)</sup><br>2) Non-Dispersive Infrared Method <sup>(4)</sup><br>3) Instrumental Analyzer Method <sup>(4)</sup>                                 |
| 4        | Chlorine                    | 1) Absorption Sampling, Ion Chromatographic<br>Method <sup>(4)</sup><br>2) Isokinetic Sampling, Ion Chromatographic Method <sup>(4)</sup>   |
| 5        | Copper                      | Isokinetic, Digestion, Inductively Coupled Plasma<br>Method <sup>(4)</sup>  |
| 6        | Dioxins                     | Isokinetic Sampling, Analysis by ISO/IEC 17025<br>Accredited Laboratory or Analysis by Department<br>of Industrial Works Registered Laboratory<br>(Dioxins/Furans Analysis Approved) <sup>(4)</sup> |
| 7        | Hydrogen Chloride           | 1) Absorption Sampling, Ion Chromatographic<br>Method <sup>(4)</sup><br>2) Isokinetic Sampling, Ion Chromatographic Method <sup>(4)</sup>   |
| 8        | Hydrogen Sulfide            | Absorption Sampling, Iodometric Method <sup>(4)</sup>   |
| 9        | Lead                        | Isokinetic, Digestion, Inductively Coupled Plasma<br>Method <sup>(4)</sup>  |
| 10       | Mercury                     | 1) Isokinetic Sampling, Digestion, Cold-Vapor Atomic<br>Absorption Spectrometric Method <sup>(4)</sup><br>2) Isokinetic, Digestion, Inductively Coupled Plasma<br>Method <sup>(4)</sup>             |
| 11       | Opacity                     | Ringelmann's Method <sup>(2)</sup>  |
| 12       | Oxides of Nitrogen          | 1) Absorption Sampling, Phenoldisulfonic Acid<br>Method <sup>(4)</sup><br>2) Chemiluminescence Method <sup>(4)</sup><br>3) Instrumental Analyzer Method <sup>(4)</sup>                              |
| 13       | Sulfur Dioxide              | 1) Absorption Sampling, Barium-Thorin Titrimetric<br>Method <sup>(4)</sup><br>2) UV Fluorescence Method <sup>(4)</sup><br>3) Instrumental Analyzer Method <sup>(4)</sup>                            |
| 14       | Sulfuric Acid               | Isokinetic Sampling, Barium-Thorin Titrimetric<br>Method <sup>(4)</sup>   |
| 15       | Total Suspended Particulate | Isokinetic Sampling, Gravimetric Method <sup>(4)</sup>  |
| 16       | Xylene                      | Absorption Sampling, Gas Chromatographic<br>Method <sup>(4)</sup>   |

สิ่งบ่งชี้...

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และประเมินผลกระทบสิ่งแวดล้อม

สิ่งบ่งชี้หรือวัตถุที่ไม่ใช่แล้ว จำนวน 35 รายการ


| ลำดับที่ | สารมลพิษ  | วิธีวิเคราะห์  |
|----------|-----------|--|
| 1        | Aldrin    | 1) Waste Extraction, Separatory Funnel Liquid-Liquid<br>Extraction, Gas Chromatographic/Mass Spectrometric<br>Method <sup>(1,3,20)</sup><br>2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup><br>3) Automated Soxhlet Extraction, Gas Chromatographic<br>Method <sup>(22,31)</sup>  |
| 2        | Antimony  | 1) Waste Extraction, Digestion, Inductively Coupled<br>Plasma Method <sup>(1,6,13)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled<br>Plasma/Mass Spectrometric Method <sup>(1,6,18)</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup><br>4) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method <sup>(7,16)</sup> |
| 3        | Arsenic   | 1) Waste Extraction, Digestion, Inductively Coupled<br>Plasma Method <sup>(1,6,13)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled<br>Plasma/Mass Spectrometric Method <sup>(1,6,18)</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup><br>4) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method <sup>(7,16)</sup> |
| 4        | Barium    | 1) Waste Extraction, Digestion, Inductively Coupled<br>Plasma Method <sup>(1,6,13)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled<br>Plasma/Mass Spectrometric Method <sup>(1,6,18)</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup><br>4) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method <sup>(7,16)</sup> |
| 5        | Beryllium | 1) Waste Extraction, Digestion, Inductively Coupled<br>Plasma Method <sup>(1,6,13)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled<br>Plasma/Mass Spectrometric Method <sup>(1,6,18)</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup><br>4) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method <sup>(7,16)</sup> |

6 Cadmium...

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และประเมินผลกระทบสิ่งแวดล้อม




| ลำดับที่ | สารมลพิษ       | วิธีวิเคราะห์  |
|----------|----------------|--|
| 6        | Cadmium        | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup><br>4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>   |
| 7        | Chlordane      | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,20)</sup><br>2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup><br>3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>   |
| 8        | Chromium       | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup><br>4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>   |
| 9        | Chromium (III) | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation Method <sup>(1,6,13,17)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation Method <sup>(1,6,16,17)</sup><br>3) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7,8,13,17)</sup><br>4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7,8,16,17)</sup> |
| 10       | Chromium (VI)  | 1) Waste Extraction, Colorimetric Method <sup>(1,6,17)</sup><br>2) Alkaline Digestion, Colorimetric Method <sup>(8,17)</sup>   |

  
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 กรมควบคุมมลพิษ


11 Cobalt...

| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์  |
|----------|----------|--|
| 11       | Cobalt   | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup><br>4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup> |
| 12       | Copper   | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup><br>4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup> |
| 13       | 2,4-D    | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,20)</sup><br>2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup><br>3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>   |
| 14       | DDD      | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,20)</sup><br>2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup><br>3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>   |
| 15       | DDE      | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,20)</sup><br>2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup><br>3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>   |
| 16       | DDT      | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,20)</sup>   |

  
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 กรมควบคุมมลพิษ

2) Soxhlet...

| ลำดับที่ | สารมลพิษ   | วิธีวิเคราะห์  |
|----------|------------|--|
| 17       | Dieldrin   | 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup><br>3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup><br>1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,20)</sup><br>2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup><br>3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup> |
| 18       | Endrin     | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,20)</sup><br>2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup><br>3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>   |
| 19       | Heptachlor | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,20)</sup><br>2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup><br>3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>   |
| 20       | Lead       | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup><br>4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>   |
| 21       | Lindane    | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,20)</sup><br>2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup><br>3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>   |
| 22       | Mercury    | 1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(1,6,18)</sup>  |

  
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 กรมควบคุมมลพิษ

2) Waste Extraction...

| ลำดับที่ | สารมลพิษ     | วิธีวิเคราะห์   |
|----------|--------------|---|
| 23       | Methoxychlor | 2) Waste Extraction, Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method <sup>(1,6,19)</sup><br>3) Waste Extraction, Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(1,6,20)</sup><br>4) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(1,8)</sup><br>5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method <sup>(9)</sup><br>6) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(20)</sup> |
| 24       | Mirex        | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,20)</sup><br>2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup><br>3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>  |
| 25       | Molybdenum   | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup><br>4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>  |
| 26       | Nickel       | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup><br>4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>  |

  
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 กรมควบคุมมลพิษ

27 Polychlorinated...



| ลำดับที่ | สารมลพิษ  | วิธีวิเคราะห์   |
|----------|---|---|
| 27       | Polychlorinated biphenyls (PCBs)<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',5,6-Heptachlorobiphenyl<br>- Nonachlorobiphenyl | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(1,6,23)</sup><br>2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,23)</sup><br>3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup> |

28 PentachlorophenoL...

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ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์มลพิษ

| ลำดับที่ | สารมลพิษ          | วิธีวิเคราะห์  |
|----------|-------------------|--|
| 28       | Pentachlorophenol | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,23)</sup><br>2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup><br>3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>   |
| 29       | pH                | Electrometric Method <sup>(27,36)</sup>  |
| 30       | Selenium          | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,4,13)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>(7,13)</sup><br>4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup> |
| 31       | Silver            | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,4,13)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,4,16)</sup>  |
| 32       | Thallium          | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,4,13)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,4,16)</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>(7,13)</sup><br>4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup> |
| 33       | Toxaphene         | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,23)</sup><br>2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup><br>3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>   |
| 34       | Vanadium          | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,4,13)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>(7,13)</sup>   |

4) Digestion...

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| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์  |
|----------|----------|--|
| 35       | Zinc     | 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup><br>1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,13)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,4,16)</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>(7,13)</sup><br>4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup> |

ดิน จำนวน 125 รายการ

| ลำดับที่ | สารมลพิษ     | วิธีวิเคราะห์   |
|----------|--------------|---|
| 1        | Acenaphthene | Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>  |
| 2        | Acetone      | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,20)</sup>  |
| 3        | Aldrin       | 1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup><br>2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup> |
| 4        | Anthracene   | Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>  |
| 5        | Antimony     | 1) Digestion, Inductively Coupled Plasma Method <sup>(7,13)</sup><br>2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>                 |
| 6        | Arsenic      | 1) Digestion, Inductively Coupled Plasma Method <sup>(7,13)</sup><br>2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>                 |
| 7        | Atrazine     | 1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup><br>2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup> |
| 8        | Barium       | 1) Digestion, Inductively Coupled Plasma Method <sup>(7,13)</sup><br>2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>                 |

9 Benz(a)anthracene...

(นางวิภาญจน์ อัครสกุลวิไล)  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์มลพิษ

| ลำดับที่ | สารมลพิษ                   | วิธีวิเคราะห์   |
|----------|----------------------------|---|
| 9        | Benz(a)anthracene          | Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>  |
| 10       | Benzene                    | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,20)</sup>  |
| 11       | Benzo(b)fluoranthene       | Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>  |
| 12       | Benzo(k)fluoranthene       | Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>  |
| 13       | Benzolc acid               | Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>  |
| 14       | Benzo(a)pyrene             | Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>  |
| 15       | Benzo(g,h,i)perylene       | Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>  |
| 16       | Beryllium                  | 1) Digestion, Inductively Coupled Plasma Method <sup>(7,13)</sup><br>2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup> |
| 17       | Bis(2-chloroethyl)ether    | Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>  |
| 18       | Bis(2-ethylhexyl)phthalate | Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>  |
| 19       | Bromodichloromethane       | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,20)</sup>  |
| 20       | Bromoform                  | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,20)</sup>  |
| 21       | Butanol                    | Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(12,20)</sup>   |
| 22       | Butyl Benzyl Phthalate     | Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>  |
| 23       | Cadmium                    | 1) Digestion, Inductively Coupled Plasma Method <sup>(7,13)</sup><br>2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup> |
| 24       | Carbazole                  | Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>  |
| 25       | Carbon Disulfide           | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,20)</sup>  |

26 Carbon tetrachloride...

(นางวิภาญจน์ อัครสกุลวิไล)  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์มลพิษ



| ลำดับที่ | สารมลพิษ             | วิธีวิเคราะห์  |
|----------|----------------------|--|
| 26       | Carbon tetrachloride | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(14,24)</sup>   |
| 27       | Chlordane            | 1) Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(10,22)</sup><br>2) Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup>   |
| 28       | p-Chloroaniline      | Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup>   |
| 29       | Chlorobenzene        | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(14,24)</sup>   |
| 30       | Chlorodibromomethane | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(14,24)</sup>   |
| 31       | Chloroform           | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(14,24)</sup>   |
| 32       | 2-Chlorophenol       | Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup>   |
| 33       | Chromium             | 1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup><br>2) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method <sup>(7,16)</sup>  |
| 34       | Chromium (III)       | 1) Digestion, Inductively Coupled Plasma Method;<br>Alkaline Digestion, Colorimetric Method; Calculation<br>Method <sup>(7,15,17)</sup><br>2) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method; Alkaline Digestion,<br>Colorimetric Method; Calculation Method <sup>(7,16,17)</sup> |
| 35       | Chromium (VI)        | Alkaline Digestion, Colorimetric Method <sup>(8,17)</sup>  |
| 36       | Chrysene             | Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup>   |
| 37       | Cyanide              | Extraction, Distillation, Colorimetric Method <sup>(25,28)</sup>   |
| 38       | 2,4-D                | 1) Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(10,22)</sup><br>2) Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup>   |
| 39       | DDO                  | 1) Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(10,22)</sup><br>2) Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup>   |

วิมล  
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ผู้อำนวยการศูนย์การวิเคราะห์ทางเคมี

40 DDE...

| ลำดับที่ | สารมลพิษ                   | วิธีวิเคราะห์   |
|----------|----------------------------|---|
| 40       | DDE                        | 1) Soxhlet Extraction, Gas Chromatographic/<br>Method <sup>(10,22)</sup><br>2) Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup> |
| 41       | DDT                        | 1) Soxhlet Extraction, Gas Chromatographic/<br>Method <sup>(10,22)</sup><br>2) Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup> |
| 42       | Dibenz(a,h)anthracene      | Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup>  |
| 43       | Di-n-Butyl Phthalate       | Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup>  |
| 44       | 1,2-Dichlorobenzene        | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(14,24)</sup>  |
| 45       | 1,3-Dichlorobenzene        | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(14,24)</sup>  |
| 46       | 1,4-Dichlorobenzene        | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(14,24)</sup>  |
| 47       | 3,3-Dichlorobenzidine      | Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup>  |
| 48       | 1,1-Dichloroethane         | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(14,24)</sup>  |
| 49       | 1,2-Dichloroethane         | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(14,24)</sup>  |
| 50       | 1,1-Dichloroethylene       | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(14,24)</sup>  |
| 51       | cis-1,2-Dichloroethylene   | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(14,24)</sup>  |
| 52       | trans-1,2-Dichloroethylene | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(14,24)</sup>  |
| 53       | 2,4-Dichlorophenol         | Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup>  |
| 54       | 1,2-Dichloropropane        | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(14,24)</sup>  |
| 55       | 1,3-Dichloropropane        | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(14,24)</sup>  |
| 56       | 1,3-Dichloropropene        | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(14,24)</sup>  |

วิมล  
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ผู้อำนวยการศูนย์การวิเคราะห์ทางเคมี

57 Dieldrin...

| ลำดับที่ | สารมลพิษ             | วิธีวิเคราะห์   |
|----------|----------------------|---|
| 57       | Dieldrin             | 1) Soxhlet Extraction, Gas Chromatographic/<br>Method <sup>(10,22)</sup><br>2) Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup> |
| 58       | Diethyl Phthalate    | Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup>  |
| 59       | 2,4-Dimethylphenol   | Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup>  |
| 60       | 2,4-Dinitrophenol    | Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup>  |
| 61       | 2,4-Dinitrotoluene   | Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup>  |
| 62       | 2,6-Dinitrotoluene   | Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup>  |
| 63       | Di-n-Octyl Phthalate | Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup>  |
| 64       | Endosulfan           | 1) Soxhlet Extraction, Gas Chromatographic/<br>Method <sup>(10,22)</sup><br>2) Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup> |
| 65       | Endrin               | 1) Soxhlet Extraction, Gas Chromatographic/<br>Method <sup>(10,22)</sup><br>2) Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup> |
| 66       | Ethylbenzene         | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(14,24)</sup>  |
| 67       | Fluoranthene         | Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup>  |
| 68       | Fluorene             | Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup>  |
| 69       | Heptachlor           | 1) Soxhlet Extraction, Gas Chromatographic/<br>Method <sup>(10,22)</sup><br>2) Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup> |
| 70       | Heptachlor Epoxide   | 1) Soxhlet Extraction, Gas Chromatographic/<br>Method <sup>(10,22)</sup><br>2) Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup> |

วิมล  
(นางวิมล วัชรกุลกิจ)  
ผู้อำนวยการศูนย์การวิเคราะห์ทางเคมี

71 Hexachlorobenzene...

| ลำดับที่ | สารมลพิษ                  | วิธีวิเคราะห์   |
|----------|---------------------------|---|
| 71       | Hexachlorobenzene         | 1) Soxhlet Extraction, Gas Chromatographic/<br>Method <sup>(10,22)</sup><br>2) Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup> |
| 72       | Hexachloro-1,3-butadiene  | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(14,24)</sup>  |
| 73       | n-Hexane                  | Purge and Trap, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(14,24)</sup>  |
| 74       | α-HCH                     | 1) Soxhlet Extraction, Gas Chromatographic/<br>Method <sup>(10,22)</sup><br>2) Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup> |
| 75       | β-HCH                     | 1) Soxhlet Extraction, Gas Chromatographic/<br>Method <sup>(10,22)</sup><br>2) Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup> |
| 76       | γ-HCH                     | 1) Soxhlet Extraction, Gas Chromatographic/<br>Method <sup>(10,22)</sup><br>2) Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup> |
| 77       | Hexachlorocyclopentadiene | Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup>  |
| 78       | Hexachloroethane          | Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup>  |
| 79       | Indeno(1,2,3-cd)pyrene    | Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup>  |
| 80       | Isophorone                | Automated Soxhlet Extraction, Gas Chromatographic/<br>Mass Spectrometric Method <sup>(25,31)</sup>  |
| 81       | Lead                      | 1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup><br>2) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method <sup>(7,16)</sup>                     |
| 82       | Manganese                 | 1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup><br>2) Digestion, Inductively Coupled Plasma/<br>Mass Spectrometric Method <sup>(7,16)</sup>                     |
| 83       | Mercury                   | 1) Digestion, Cold-Vapor Atomic Absorption<br>Spectrometric Method <sup>(18)</sup>  |

วิมล  
(นางวิมล วัชรกุลกิจ)  
ผู้อำนวยการศูนย์การวิเคราะห์ทางเคมี

2) Thermal...



| ลำดับที่ | สารมลพิษ                         | วิธีวิเคราะห์   |
|----------|----------------------------------|---|
| 84       | Methanol                         | 2) Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry <sup>(19)</sup>   |
| 85       | Methoxychlor                     | 3) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(20)</sup>                 |
| 86       | Methyl Bromide                   | Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(12,24)</sup>           |
| 87       | Methylene Chloride               | 1) Soxhlet Extraction, Gas Chromatographic Method <sup>(25,22)</sup>                              |
| 88       | 2-methylphenol                   | 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup> |
| 89       | 2-Methylnaphthalene              | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>                  |
| 90       | Methyl tert-Butyl Ether          | Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>    |
| 91       | Naphthalene                      | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>                  |
| 92       | Nickel                           | Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>    |
| 93       | Nitrobenzene                     | 1) Digestion, Inductively Coupled Plasma Method <sup>(7,13)</sup>                                 |
| 94       | N-Nitrosodiphenylamine           | 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,14)</sup>              |
| 95       | N-Nitrosodipropylamine           | Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>    |
| 96       | Polychlorinated biphenyls (PCBs) | Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>    |
|          | - Aroclor 1016                   | 1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup>                              |
|          | - Aroclor 1221                   | 2) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(25,31)</sup>                    |
|          | - Aroclor 1232                   |   |

สำนักงานสิ่งแวดล้อมแห่งชาติ  
(นางวิภาดา ชัยกุลกิจ)

- Aroclor 1242...

| ลำดับที่ | สารมลพิษ                                 | วิธีวิเคราะห์  |
|----------|--|--|
|          | - Aroclor 1242                           |  |
|          | - Aroclor 1248                           |  |
|          | - Aroclor 1254                           |  |
|          | - Aroclor 1260                           |  |
|          | - 2-Chlorobiphenyl                       |  |
|          | - 2,2',3,5'-Tetrachlorobiphenyl          |  |
|          | - 2,2',5,5'-Tetrachlorobiphenyl          |  |
|          | - 2,3',4,4'-Tetrachlorobiphenyl          |  |
|          | - 2,2',3,4,5'-Pentachlorobiphenyl        |  |
|          | - 2,2',4,5,5'-Pentachlorobiphenyl        |  |
|          | - 2,3,3',4,6'-Pentachlorobiphenyl        |  |
|          | - 2,2',3,4,4',5'-Hexachlorobiphenyl      |  |
|          | - 2,2',3,4,5,5'-Hexachlorobiphenyl       |  |
|          | - 2,2',3,5,5',6'-Hexachlorobiphenyl      |  |
|          | - 2,2',4,4',5,5'-Hexachlorobiphenyl      |  |
|          | - Hexachlorobiphenyl                     |  |
|          | - 2,2',4,4',5,5'-Hexachlorobiphenyl      |  |
|          | - 2,2',3,3',4,4',5'-Heptachlorobiphenyl  |  |
|          | - 2,2',3,4,4',5,5'-Heptachlorobiphenyl   |  |
|          | - 2,2',3,4,4',5,6'-Heptachlorobiphenyl   |  |
|          | - 2,2',3,4,4',5,6'-Heptachlorobiphenyl   |  |
|          | - 2,2',3,3',4,4',5,6'-Nonachlorobiphenyl |  |
| 97       | Pentachlorophenol                        | Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup> |
| 98       | Phenanthrene                             | Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup> |
| 99       | Phenol                                   | Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup> |
| 100      | Pyrene                                   | Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup> |

สำนักงานสิ่งแวดล้อมแห่งชาติ  
(นางวิภาดา ชัยกุลกิจ)

101 Selenium...

| ลำดับที่ | สารมลพิษ                                | วิธีวิเคราะห์   |
|----------|---|---|
| 101      | Selenium                                | 1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup>                                 |
| 102      | Silver                                  | 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,14)</sup>              |
| 103      | Styrene                                 | 1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup>                                 |
| 104      | 1,1,2,2-Tetrachloroethane               | 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>              |
| 105      | Tetrachloroethylene                     | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>                  |
| 106      | Toluene                                 | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>                  |
| 107      | Toxaphene                               | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>                  |
| 108      | TPH (C <sub>9</sub> -C <sub>9</sub> )   | 1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup>                              |
| 109      | TPH (C <sub>9</sub> -C <sub>16</sub> )  | 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup> |
| 110      | TPH (C <sub>16</sub> -C <sub>32</sub> ) | 1) Solvent Extraction, Gas Chromatographic Method <sup>(11,21)</sup>                              |
| 111      | 1,2,4-Trichlorobenzene                  | 2) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(25,31)</sup>                    |
| 112      | 1,1,1-Trichloroethane                   | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>                  |
| 113      | 1,1,2-Trichloroethane                   | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>                  |
| 114      | Trichloroethylene                       | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>                  |
| 115      | 2,4,5-Trichlorophenol                   | Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>    |

สำนักงานสิ่งแวดล้อมแห่งชาติ  
(นางวิภาดา ชัยกุลกิจ)

116 2,4,6-Trichlorophenol...

| ลำดับที่ | สารมลพิษ               | วิธีวิเคราะห์  |
|----------|------------------------|--|
| 116      | 2,4,6-Trichlorophenol  | Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup> |
| 117      | 1,3,5-Trimethylbenzene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>               |
| 118      | Vanadium               | 1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup>                              |
| 119      | Vinyl Acetate          | 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>           |
| 120      | Vinyl Chloride         | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>               |
| 121      | m-Xylene               | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>               |
| 122      | o-Xylene               | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>               |
| 123      | p-Xylene               | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>               |
| 124      | Xylene (Total)         | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>               |
| 125      | Zinc                   | 1) Digestion, Inductively Coupled Plasma Method <sup>(7,12)</sup>                              |
|          |                        | 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,14)</sup>           |

## เอกสารอ้างอิง


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สำนักงานสิ่งแวดล้อมแห่งชาติ  
(นางวิภาดา ชัยกุลกิจ)

7. United States...




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(นางริกาญจน์ นัครสกุลวิไล)  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ของมลพิษ  
(ประเทศไทย) สำนักงาน

20. United States

20. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Mercury in Sediment and Tissue Sample by Atomic Fluorescence Spectrometry. SW-846 Method 7474, 2007.
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(นางริกาญจน์ นัครสกุลวิไล)  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ของมลพิษ  
(ประเทศไทย) สำนักงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ การวิจัยและเตือนภัยมลพิษโรงงาน กรมโรงงานอุตสาหกรรม โทร. ๐ ๒๒๐๓ ๔๐๐๒, ๔๐๐๓



ที่ ๒๓ ๐๓๓๐(๑)/ ๕๓๗๕

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๐๔ มีนาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และขอพิจารณาผลของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๔ กุมภาพันธ์ ๒๕๖๖

ตามที่หนังสือที่อ้างถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ห้องปฏิบัติการ  
วิเคราะห์เอกชน เลขทะเบียน ๖-๒๐๔-๕๓๗๕ สถานที่ตั้งเลขที่ ๑๐๔ ซอยพัฒนาการ ๔๐ ถนนพัฒนาการ แขวงพัฒนาการ  
เขตสามพร้าว กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ออกเลือกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๕ ราย

- |                                  |                          |
|----------------------------------|--------------------------|
| ๑) นายนคร สุขเจริญ               | ทะเบียนเลขที่ ๖-๒๐๔-๖๑๑๒ |
| ๒) นายบัญชา นามเขตต์             | ทะเบียนเลขที่ ๖-๒๐๔-๖๑๑๓ |
| ๓) นายอรุณพล นิยมวิทย์พันธ์      | ทะเบียนเลขที่ ๖-๒๐๔-๖๑๑๔ |
| ๔) นางสาวพัชรียา พงษ์สมบัติ      | ทะเบียนเลขที่ ๖-๒๐๔-๖๑๑๕ |
| ๕) นางสาวภาณิดา สุวรรณศรีกุล     | ทะเบียนเลขที่ ๖-๒๐๔-๖๑๑๖ |
| ๖) นางสาวกรรณิณี อึ้งดี          | ทะเบียนเลขที่ ๖-๒๐๔-๖๑๑๗ |
| ๗) นายสมโภช วัธสา                | ทะเบียนเลขที่ ๖-๒๐๔-๖๑๑๘ |
| ๘) นายณัฐนันท์ ปานประเสริฐ       | ทะเบียนเลขที่ ๖-๒๐๔-๖๑๑๙ |
| ๙) ว่าที่ร้อยตรีภาณุพงศ์ แสนศิริ | ทะเบียนเลขที่ ๖-๒๐๔-๖๑๒๐ |
| ๑๐) นายณัฐนันท์ พุดศิริ          | ทะเบียนเลขที่ ๖-๒๐๔-๖๑๒๑ |
| ๑๑) นายณัฐนันท์ เชื้อละออง       | ทะเบียนเลขที่ ๖-๒๐๔-๖๑๒๒ |
| ๑๒) นางสาวกาญจนา คังคุด          | ทะเบียนเลขที่ ๖-๒๐๔-๖๑๒๓ |
| ๑๓) นางสาววันฉัตร นิยมกลาง       | ทะเบียนเลขที่ ๖-๒๐๔-๖๑๒๔ |
| ๑๔) นางสาวกัญญารัตน์ ศรีนิลลา    | ทะเบียนเลขที่ ๖-๒๐๔-๖๑๒๕ |
| ๑๕) นายศิริวัฒน์ พาณิชย์         | ทะเบียนเลขที่ ๖-๒๐๔-๖๑๒๖ |
| ๑๖) นางสาวกนกภรณ์ อูระ           | ทะเบียนเลขที่ ๖-๒๐๔-๖๑๒๗ |
| ๑๗) นางสาวจิตติภา ปะเทืองสุข     | ทะเบียนเลขที่ ๖-๒๐๔-๖๑๒๘ |
| ๑๘) นางสาวอริสา วิริยะขันติธรรม  | ทะเบียนเลขที่ ๖-๒๐๔-๖๑๒๙ |
| ๑๙) นางสาวภาณิดา ยอดอินทร์       | ทะเบียนเลขที่ ๖-๒๐๔-๖๑๓๐ |

๒. ให้เพิ่มเจ้าหน้าที่...

๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ ราย
- ๑) นายกฤษณ์พิศ กิตติคุณนิษฐ์ ทะเบียนเลขที่ ๖-๒๐๔-๖๑๐๐๑
- ๒) นายภัทรพล สว่างใจธรรม ทะเบียนเลขที่ ๖-๒๐๔-๖๑๐๐๒
- ๓) นายณัฐวัฒน์ เพ็ญชัยคำ ทะเบียนเลขที่ ๖-๒๐๔-๖๑๐๐๓
- ๔) นายศิริโชค พงษ์ประสม ทะเบียนเลขที่ ๖-๒๐๔-๖๑๐๐๔
- ๕) นายณัฐวัฒน์ คังคุด ทะเบียนเลขที่ ๖-๒๐๔-๖๑๐๐๕

อนึ่ง หนังสือฉบับนี้จะส่งมอบหมายพร้อมหนังสือที่ยื่นขอขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
ที่ ๒๓ ๐๓๓๐(๑)/๒๐๖๔ ลงวันที่ ๒๘ มกราคม ๒๕๖๔ คือในวันที่ ๒ กันยายน ๒๕๖๖ ทั้งนี้ สามารถยื่นคำขอ  
ผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ที่ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



(นางริกาญจน์ นัครสกุลวิไล)

อธิบดีกรมมาตรฐานวิธีการวิเคราะห์และเตือนภัยมลพิษโรงงาน  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ของมลพิษ  
(ประเทศไทย) สำนักงาน

กองวิจัยและเตือนภัยมลพิษโรงงาน  
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ  
โทร. ๐ ๒๒๐๓ ๖๓๑๒ ต่อ ๒๒๐๓-๕  
โทรสาร ๐ ๒๒๐๓ ๖๓๑๒ ต่อ ๒๒๐๓-๔  
ไปรษณีย์อิเล็กทรอนิกส์ sarabangudw@mail.go.th



“อุตสาหกรรมสีเขียว ประเทศไทยก้าวหน้า”





ที่ อภ ๐๓๓๐(๑)/ ๖๑๖๕

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๒๓ มีนาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๑๐ มีนาคม ๒๕๖๖

ตามหนังสือที่อ้างถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด  
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๒๐๔๔ สถานที่ตั้งเลขที่ ๑๐๔ ซอยพัฒนาการ ๔๐  
ถนนพัฒนาการ แขวงพัฒนาการ เขตสวนหลวง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการ  
วิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้เปลี่ยนแปลงชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการ  
วิเคราะห์ จากเดิม นางสาวสุวิมล มงคลจิ๋วพิทย์ ทะเบียนเลขที่ ๖-๒๐๐๔-๖-๔๗๑๑๙ เป็น นางสาวอัญญพร มงคลจิ๋วพิทย์  
ทะเบียนเลขที่ ๖-๒๐๐๔-๖-๔๗๑๑๙

ทั้งนี้ หากท่านมีความประสงค์จะยื่นคำขอใดๆ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์  
ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ที่แนบมาด้วย

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

สุวิมล

(นายประสม คำพงษ์)  
ผู้อำนวยการกองวิจัยและพัฒนาสิ่งแวดล้อมโรงงาน  
ปฏิบัติการกรมโรงงานอุตสาหกรรม

กองวิจัยและพัฒนาสิ่งแวดล้อมโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๕๓๐ ๖๓๓๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๕๓๐ ๖๓๓๒ ต่อ ๒๑๑๙

ไปรษณีย์อิเล็กทรอนิกส์ saraban@dlw.mail.go.th



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา จุลอุตสาหกรรมสีเขียว"



คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน

แบบ ปอ.1

วันที่ 4 เดือน สิงหาคม พ.ศ. 2566

ข้าพเจ้า ( ) ผู้รับใบอนุญาตประกอบกิจการโรงงาน

( ✓ ) บริษัท/ห้างหุ้นส่วนจำกัด เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

ตั้งอยู่ที่เลขที่ 104

หมู่ที่ -

ตรอก/ซอย

พัฒนาการ 40

ถนน

พัฒนาการ

ตำบล/แขวง

พัฒนาการ

อำเภอ/เขต

สวนหลวง

จังหวัด

กรุงเทพมหานคร

รหัสไปรษณีย์ 10250

โทรศัพท์

02 760-3040

โทรสาร

0 2 760-3197

ได้รับทราบระเบียบกรมโรงงานอุตสาหกรรมว่าด้วยการขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน พ.ศ. 2560 โดยตลอดแล้วและยินยอม  
ปฏิบัติตามระเบียบทุกประการ และได้แนบเอกสารต่างๆ ตามรายการเอกสารประกอบการพิจารณา (แบบ ปอ.1-1) มาพร้อมนี้

รายการขอดำเนินการ

| การดำเนินการ   | รายละเอียด (รายการ) |   |           |                                      |     |
|--|---------------------|---|-----------|--------------------------------------|-----|
|  | น้ำเสีย/น้ำทิ้ง     | น้ำใต้ดิน   | อากาศเสีย | สิ่งปฏิกูลหรือ<br>วัสดุที่ไม่ใช้แล้ว | ดิน |
| [ ] ขอขึ้นทะเบียนห้องปฏิบัติการ<br>วิเคราะห์เอกชน                                  |                     |   |           |                                      |     |
| [ ✓ ] ต่ออายุห้องปฏิบัติการวิเคราะห์<br>เอกชน                                      | 59                  | 126   | 16        | 35                                   | 125 |
| [ ✓ ] เปลี่ยนแปลงสารมลพิษที่วิเคราะห์<br>( ✓ ) เพิ่มสารมลพิษ<br>( ) ยกเลิกสารมลพิษ | -                   | -   | 12        | -                                    | -   |
| [ ✓ ] เปลี่ยนแปลงบุคลากร<br>( ✓ ) เพิ่มบุคลากร<br>( ✓ ) ยกเลิกบุคลากร              | จำนวน<br>จำนวน      | 38 ราย (รายละเอียดตาม แบบ ปอ.1)<br>2 ราย (รายละเอียดตาม แบบ ปอ.1) |           |                                      |     |
| [ ] ยกเลิกห้องปฏิบัติการวิเคราะห์เอกชน   |                     |   |           |                                      |     |
| [ ] อื่นๆ โปรดระบุ   |                     |   |           |                                      |     |

จึงเรียนมาเพื่อโปรดพิจารณา

นายประสม คำพงษ์  
เพื่อโปรดพิจารณา

ลงชื่อ

(นางศุภณีย์ เลขากุลพร)

(นายประสม คำพงษ์)  
ผู้อำนวยการกองวิจัยและพัฒนาสิ่งแวดล้อมโรงงาน

ALS Laboratory Group  
(Thailand) Co., Ltd.



ผู้มีอำนาจลงนามแทนนิติบุคคล  
ประทับตรา (ถ้ามี)

F-ED-LR-01- 1/1



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right solutions.  
right partner.