

Annex E1

## Calibration Certificates for Air Quality



## ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

### SUB-CONTRACTING REPORT

|         |   |                |                    |
|---------|---|----------------|--------------------|
| CONTACT | : MR K.W. FAN   | WORK ORDER     | : <b>HK1943780</b> |
| CLIENT  | : ENVIROTECH SERVICES CO.   |                |                    |
| ADDRESS | : RM113, 1/F, MY LOFT, 9 HOI WING ROAD,<br>TUEN MUN, N.T. HONG KONG | SUB-BATCH      | : 1                |
|         |   | DATE RECEIVED  | : 9-OCT-2019       |
|         |   | DATE OF ISSUE  | : 22-OCT-2019      |
| PROJECT | : ----  | NO. OF SAMPLES | : 1                |
|         |   | CLIENT ORDER   | : ----             |

#### General Comments

- Sample(s) were received in ambient condition.
- Sample(s) analysed and reported on an as received basis.
- Sample information (Project name, Sample ID, Sampling date/ time) is provided by client.
- Calibration was subcontracted to and analysed by Action United Enviro Services.

#### Signatories

This document has been signed by those names that appear on this report and are the authorised signatories

Signatories

Position

Richard Fung

General Manager

This is the Final Report and supersedes any preliminary report with this batch number.

Results apply to sample(s) as submitted. All pages of this report have been checked and approved for release.

**ALS Technichem (HK) Pty Ltd**  
Part of the **ALS Laboratory Group**

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WORK ORDER : HK1943780  
SUB-BATCH : 1  
CLIENT : ENVIROTECH SERVICES CO.  
PROJECT : ----



| ALS Lab ID    | Client's Sample ID | Sample Type | Sample Date | External Lab Report No. |
|---------------|--------------------|-------------|-------------|-------------------------|
| HK1943780-001 | S/N: 831656        | Equipments  | 09-Oct-2019 | S/N: 831656             |

## Equipment Verification Report (TSP)

### Equipment Calibrated:

Type: Laser Dust monitor  
 Manufacturer: Sibata LD-5R  
 Serial No. 831656  
 Equipment Ref: Nil  
 Job Order HK1943780

### Standard Equipment:

Standard Equipment: Higher Volume Sampler  
 Location & Location ID: AUES office (calibration room)  
 Equipment Ref: HVS 018  
 Last Calibration Date: 22 August 2019

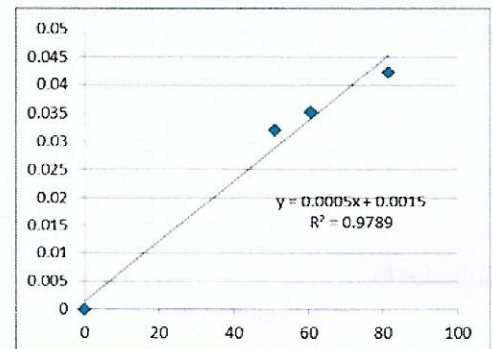
### Equipment Verification Results:

Testing Date: 14 October 2019

| Hour     | Time          | Mean Temp °C | Mean Pressure (hPa) | Concentration in mg/m <sup>3</sup> (Standard Equipment) | Total Count (Calibrated Equipment) | Count/Minute (Total Count/min) |
|----------|---------------|--------------|---------------------|---|------------------------------------|--------------------------------|
| 2hr02min | 09:13 ~ 11:15 | 25.8         | 1017.6              | 0.042   | 9927                               | 81.5                           |
| 2hr      | 11:20 ~ 13:20 | 25.8         | 1017.6              | 0.035   | 7282                               | 60.7                           |
| 2hr01min | 13:24 ~ 15:25 | 25.8         | 1017.6              | 0.032   | 6163                               | 51.1                           |

### Linear Regression of Y or X

Slope (K-factor): 0.0005  
 Correlation Coefficient 0.9894  
 Date of Issue 22 October 2019



### Remarks:

1. **Strong Correlation (R>0.8)**
2. Factor 0.0005 should be applied for TSP monitoring

\*If R<0.5, repair or re-verification is required for the equipment

Operator : Fai So Signature : *Fai So* Date : 22 October 2019

QC Reviewer : Ben Tam Signature : *Ben Tam* Date : 22 October 2019

## TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET

Location : Gold King Industrial Building, Kwai Chung Date of Calibration: 22-Aug-19  
 Location ID : Calibration Room Next Calibration Date: 22-Nov-19

### CONDITIONS

|                          |        |                            |         |
|--------------------------|--------|----------------------------|---------|
| Sea Level Pressure (hPa) | 1005.5 | Corrected Pressure (mm Hg) | 754.125 |
| Temperature (°C)         | 29.2   | Temperature (K)            | 302     |

### CALIBRATION ORIFICE

|                    |          |                   |          |
|--------------------|----------|-------------------|----------|
| Make->             | TISCH    | Qstd Slope ->     | 2.0968   |
| Model->            | 5025A    | Qstd Intercept -> | -0.00065 |
| Calibration Date-> | 5-Feb-19 | Expiry Date->     | 5-Feb-20 |

### CALIBRATION

| Plate No. | H2O (L) (in) | H2O (R) (in) | H2O (in) | Qstd (m3/min) | I (chart) | IC corrected | LINEAR REGRESSION |             |                |
|-----------|--------------|--------------|----------|---------------|-----------|--------------|-------------------|-------------|----------------|
|           |              |              |          |               |           |              | Slope =           | Intercept = | Corr. coeff. = |
| 18        | 6.6          | 6.6          | 13.2     | 1.714         | 56        | 55.39        | Slope =           | 37.1811     |                |
| 13        | 5.2          | 5.2          | 10.4     | 1.522         | 50        | 49.46        | Intercept =       | -7.4343     |                |
| 10        | 4.1          | 4.1          | 8.2      | 1.351         | 44        | 43.52        | Corr. coeff. =    | 0.9969      |                |
| 8         | 2.6          | 2.6          | 5.2      | 1.076         | 34        | 33.63        |                   |             |                |
| 5         | 1.7          | 1.7          | 3.4      | 0.870         | 24        | 23.74        |                   |             |                |

#### Calculations :

$$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$$

$$IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

Qstd = standard flow rate

IC = corrected chart responses

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration ( deg K )

Pstd = actual pressure during calibration ( mm Hg )

#### For subsequent calculation of sampler flow:

$$1/m(( I )[\text{Sqrt}(298/Tav)(Pav/760)]-b)$$

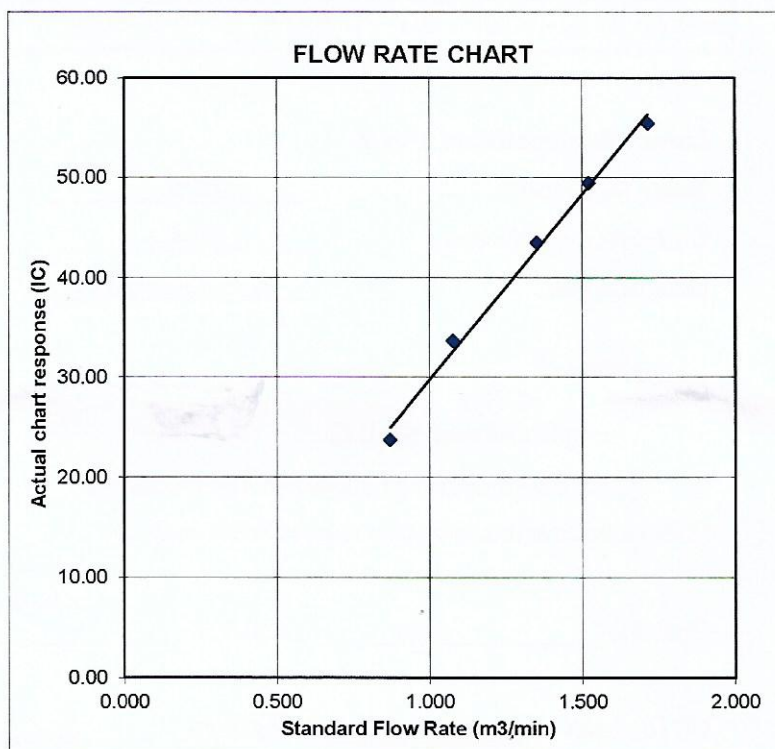
m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure



# Certificate of Calibration

| Calibration Certification Information |                             |           |       |
|---------------------------------------|-----------------------------|-----------|-------|
| Cal. Date: February 5, 2019           | Rootsmeter S/N: 438320      | Ta: 293   | °K    |
| Operator: Jim Tisch                   |                             | Pa: 753.1 | mm Hg |
| Calibration Model #: TE-5025A         | Calibrator S/N: <b>1941</b> |           |       |

| Run | Vol. Init (m3) | Vol. Final (m3) | ΔVol. (m3) | ΔTime (min) | ΔP (mm Hg) | ΔH (in H2O) |
|-----|----------------|-----------------|------------|-------------|------------|-------------|
| 1   | 1              | 2               | 1          | 1.4830      | 3.2        | 2.00        |
| 2   | 3              | 4               | 1          | 1.0430      | 6.4        | 4.00        |
| 3   | 5              | 6               | 1          | 0.9300      | 7.9        | 5.00        |
| 4   | 7              | 8               | 1          | 0.8870      | 8.7        | 5.50        |
| 5   | 9              | 10              | 1          | 0.7320      | 12.7       | 8.00        |

| Data Tabulation |               |  |           |             |   |
|-----------------|---------------|--|-----------|-------------|---|
| Vstd (m3)       | Qstd (x-axis) | $\sqrt{\Delta H \left( \frac{Pa}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)}$ (y-axis) | Va        | Qa (x-axis) | $\sqrt{\Delta H \left( \frac{Ta}{Pa} \right)}$ (y-axis) |
| 1.0036          | 0.6767        | 1.4197   | 0.9958    | 0.6714      | 0.8821  |
| 0.9993          | 0.9581        | 2.0078   | 0.9915    | 0.9506      | 1.2475  |
| 0.9973          | 1.0723        | 2.2448   | 0.9895    | 1.0640      | 1.3947  |
| 0.9962          | 1.1231        | 2.3544   | 0.9884    | 1.1144      | 1.4628  |
| 0.9908          | 1.3536        | 2.8395   | 0.9831    | 1.3431      | 1.7642  |
| <b>QSTD</b>     | <b>m=</b>     | <b>2.09680</b>   | <b>QA</b> | <b>m=</b>   | <b>1.31298</b>  |
|                 | <b>b=</b>     | <b>-0.00065</b>  |           | <b>b=</b>   | <b>-0.00040</b>   |
|                 | <b>r=</b>     | <b>0.99999</b>   |           | <b>r=</b>   | <b>0.99999</b>  |

| Calculations  |  |
|---|--|
| Vstd= $\Delta Vol \left( \frac{Pa - \Delta P}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)$                                 | Va= $\Delta Vol \left( \frac{Pa - \Delta P}{Pa} \right)$                                 |
| Qstd= Vstd/ΔTime  | Qa= Va/ΔTime   |
| For subsequent flow rate calculations:  |  |
| Qstd= $1/m \left( \left( \sqrt{\Delta H \left( \frac{Pa}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)} \right) - b \right)$ | Qa= $1/m \left( \left( \sqrt{\Delta H \left( \frac{Ta}{Pa} \right)} \right) - b \right)$ |

| Standard Conditions                       |           |
|---|-----------|
| Tstd:                                     | 298.15 °K |
| Pstd:                                     | 760 mm Hg |
| <b>Key</b>                                |           |
| ΔH: calibrator manometer reading (in H2O) |           |
| ΔP: rootsmeter manometer reading (mm Hg)  |           |
| Ta: actual absolute temperature (°K)      |           |
| Pa: actual barometric pressure (mm Hg)    |           |
| b: intercept                              |           |
| m: slope                                  |           |

| RECALIBRATION  |
|--|
| US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30 |