QUALITY ASSURANCE PROJECT PLAN (QAPjP) and QA Report for Pacific 2001

Prepared by: Xinghua Fan and Jeff Brook

Date: July 25, 2001

Table of Contents

1. **Principal Investigator**
   Jeff Brook, Meteorological Service of Canada, 4905 Dufferin Street, Toronto, Ontario, M3H 5T4
   Scott Mabury, Department of Chemistry, University of Toronto, 80 St. George Street, Ontario, M5S 3H6

2. **Team Members**
   Xinghua Fan, Department of Chemistry, University of Toronto, 80 St. George Street, Ontario, M5S 3H6

3. **Measurement Program**
   Low volume filter measurements of OC in PM2.5.

4. **Measurement Species and Units**
   OC: $\mu g\ m^{-3}$ at $0^{o}C$ and 1 atm

5. **Representative Size Range (if PM)**
   Low volume IOGAPS PM2.5 (PM size <2.5 μm)

6. **Measurement Platform (surface, airborne)**
   IOGAPS: 2 m above ground level on an outside platform

7. **Measurement Sites (surface only)**
   IOGAPS: Slocan Park

8. **Measurement Objective(s)**
   IOGAPS: to measure non-volatile and semi-volatile OC associated with PM2.5 in an urban/suburban location

9. **Measurement Details**
   9.1. Field Measurements
   9.1.1. Measurement Principle
   The gaseous phase organic compounds are removed by an XAD-coated denuder, and the PM2.5 is collected by a quartz filter which is placed downstream of the denuder; semi-volatile organic compounds lost from the PM2.5 on the quartz filter are trapped by three stages of back-up filters referred to as SIFs (XAD-4 coated quartz filters).

   9.1.2. Instrumentation (Manufacturer/Model)
   IOGAPS This is a single denuder system with a PM2.5 URG Model 2000-30EH cyclone at the inlet. The cyclone is followed by an 8-channel XAD-4 coated denuder (diameter: 52 mm and length is 60 cm long, URG model 2000-30B8) which is coated to remove the gaseous organics. The denuder is followed by a four-stage filterpack containing one quartz filter

(Whatman No. 1851-8866, ultra-high purity quartz filter) followed by three SIFs.

9.1.3. Flow System

IOGAPS: The flow inlet is a URG PM2.5 cyclone followed by a denuder/filter pack system described above. Five meters of Tygon tubing connects the downstream end of the filter pack to an URG-3000-02C mass flow accumulator at a set point of 16.7 LPM (at 0^{o}C and 1 atmosphere). The flow controller is connected to a diaphragm pump that exhausts to the atmosphere.

9.1.4. Inlet Height Above Ground (if surface)

IOGAPS: approx. 2 m above ground level on an outside platform.

9.1.5. Nominal Flow Rate

The flow is set at 16.7 LPM.

9.1.6. Flow Measurement/Control

The flow is measured by an URG-3000-02C mass flow accumulator.

9.1.7. Flow Temperature and Pressure

Volumes will be reported at 0^{o}C and 1 atmosphere

9.1.8. Sampling Times/Period/Frequency

IOGAPS: Two samples to be collected per day, each for about 11 hours from (PDT) 1000 – 2100 and 2200-0900.

9.1.9. Sampling Methods

All the non-sampled and sampled filters and SIFs will be stored in a freezer on site. The non-sampled filters and SIFs are stored in an air-tight jar; while the sampled filters and SIFs are stored in petri-slides, which are put in a sealed “Zip-lock” bag.

9.1.10. Filter Type/Coating Type/Reagent Type

The filters are ultra-high purity quartz filter (Whatman No. 1851-8866). All the solvent (methanol, hexane, and dichloromethane) are optima grade from Fisher Scientific Co.

9.1.11. Planned Changes to Instruments or Methods During Study

Not planned

9.2. Laboratory Measurements (If Applicable)

9.2.1. Laboratory Name and Address

The sampled denuder will be extracted and cleaned the Pacific Environmental Science Centre in North Vancouver. All the analysis will

be carried out in the ARQB-MSC labs at 4905 Dufferin Street, Downsview, Ontario, M3H 5T4.

9.2.2. Analytical Method(s)

OC/EC: TOT (thermal optical transmittance) instrument

9.2.3. Sample Extraction or Work-up

Denuder: solvent extraction by hexane/dichloromethane/methanol

9.2.4. Analytical Detection Limits

OC/EC: 0.03 μm^{-3}.

10. Quality Assurance/Quality Control

10.1. Field Quality Assurance/Quality Control

10.1.1. Traceability

N/A

10.1.2. Calibration

The flow will be calibrated by Gang Lu of Meteorological Service of Canada using DryCal® DC-2M mass flow calibrator (Bios international corporation) once every week.

10.1.3. Zeros and spans

N/A

10.1.4. Blanks

Blanks will be collected twice a day for each sampling.

10.1.5. Field Quality Control procedures

For filter pack sampling, disposable gloves will be worn when loading/unloading filters in a clean room. Filters will be inspected for holes when loaded and unloaded in the lab and field. The filter pack with denuder assembly will be checked leaks; Flow controller zero readings will be monitored to insure there is no significant drift; All the filter packs will be double bagged before and after exposure. All the filters will be stored in petri slides in a freezer.

10.1.6. Precision determination

All the filters will be analysed for EC/OC in duplicate to ensure the precision within +/- 10%.

10.1.7. Comparison with other measurements

OC/EC results determined by IOGAPS in this study will be compared with the OC/EC results determined by a filterpack/cyclone combination.

10.1.8. Inspections and Audits

The mass flow will be checked once every week.

10.2. Laboratory Quality Assurance/Quality Control

10.2.1. Traceability

N/A

10.2.2. Calibration procedures

Calibrations for the measurements of OC/EC using TOT instrument will be carried out three times a day (before, in the middle of, and after analysis). The calibration range will be controlled within +/- 5%.

10.2.3. Blanks

Lab blanks will be analyzed once a day; field blanks will be collected twice a day for each sampling and will analyzed in each batch of samples.

10.2.4. Other lab QC

The calibration check standard solutions will be used to check the performance of TOT instrument.

10.2.5. Precision determination

Analytical precision will be controlled within +/- 5%, calculated as the standard deviation between duplicate sample analyses (run on every 10^{th} sample) divided by the mean value of the duplicate samples.

10.2.6. Comparison with other methods

N/A

10.2.7. Audits

N/A

11. Data Management and Quality Control

11.1. Raw Data Recording

Raw data include sampling date and time, denuder ID, mass flow including leak check), daily temperature (high, low, and average), pressure, and some other meteorological conditions (i.e., wind, rain)

11.2. Final Data Reporting

Samples will be collected twice a day (each 11 hours). Final data will be reported twice a day.

11.3. Data Quality Control and Validation

All reported data values will be flagged as either Valid (V) or Invalid (I). Raw data will inspected and all instrument and power failures, flow and duration problems (off by > +/- 10%) will be flagged as invalid.

Percentage changes exceeding +/- 75% from one recorded value to the next will be investigated.

11.4. Validity Flags

V0 Valid value
V1 Valid value but comprised wholly or partially of below-MDL data
V2 Valid estimated value
V3 Valid interpolated value
V4 Valid value despite failing to meet some QC or statistical criteria
V5 Valid value but qualified because of possible contamination (e.g., pollution source, laboratory contamination source)
V6 Valid value but qualified due to non-standard sampling conditions (e.g., instrument malfunction, sample handling)
M1 Missing value because no value is available
M2 Missing value because invalidated by data originator
H1 Historical data that have not been assessed or validated

11.5. Below Method Detection Limit Values

If the results turn out to be zero, or negative, or below method detection limit, the data will be flagged as V1, but where possible the result will be reported.

11.6. Derived Parameters

N/A

11.7. Explanation of Zero or Negative Data

If the final results turn out to be zero or negative, the reasons should be investigated and the data will be flagged as V1, but the result will be reported.

12. Data Quality Objectives (Pre-Study)

12.1. Accuracy

The TOT instrument will be calibrated three times a day (before, in the middle of, and after analysis). If the accuracy is less than 90%, the reason must be investigated and the instrument recalibrated prior to next analysis.

12.2. Precision

Analytical precision will be controlled within +/- 5%, calculated as the standard deviation of between duplicate sample analyses (run on every 10^{th} sample) divided by the mean value of the duplicate samples.

12.3. Comparability

N/A

12.4. Representativeness

Depending upon meteorological conditions, the measurements at the Slocan Park site will be representative of the typical urban/suburban pollution mix that is not been significantly processed photochemically.

12.5. Completeness

IOGAPS duration completeness objective = 95%, calculated as the hours sampled divided by the pre-defined sampling period of 11 hours.
IOGAPS sampling completeness objective = 100 % of the planned number of samples.

12.6. Other Quality Information

The OC in PM2.5 will be sum of the OC from the quartz filters and those from three stages of SIFs, which catch any breakthrough by the evaporation of semivolatile organic compounds from the quartz filter.

End of Pre-Study QAPjP

Start of Post-Study QA Report

13. Significant Changes to Site, Instruments or Methods During Study

14. Post-study Data Quality Indicators (DQIs)

    14.1.1. Accuracy

    14.1.2. Precision

    14.1.3. Comparability

    14.1.4. Representativeness

    14.1.5. Completeness

    14.2. Blank correction (describe whether done and method used):

    14.3. Other Quality Information

15. References: