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

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Date: 2001-06-22

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3. **Measurement Program**
   a) Gas/particle partition measurements of Polycyclic Aromatic Compounds with the IOGAPS
   b) Gas/particle partition measurements of Polycyclic Aromatic Compounds with the HiC IOGAPS

4. **Measurement Species and Units**
   Gas and particle phase polycyclic aromatic compounds (PAHs)
   Unit: ng m^{-3} at ambient temperature and pressure

5. **Representative Size Range (if PM)**
   IOGAPS <2.5 μm
   HiC IOGAPS <2.5 μm

6. **Measurement Platform (surface, airborne)**
   Slocan site: IOGAPS inlet is about 1m above the floor of a platform that is about 1 m above ground
   HIC IOGAPS inlet is about 2.5 m above the 1 m high platform
   Langley: IOGAPS inlet is about 1m above the floor of a platform that is about 1 m above ground
   HIC IOGAPS inlet is about 2.5 m above the 1 m high platform

7. **Measurement Sites (surface only)**
   IOGAPS one at Slocan Park and one at Langley
   HiC-IOGAPS one at Slocan Park and one at Langley

8. **Measurement Objective(s)**
   IOGAPS: to determine the gas/particle partitioning of PAC in urban location
   HiC IOGAPS: as with IOGAPS but sampling air 5 times faster
   Compare IOGAPS and HiC IOGAPS instruments

9. Measurement Details

9.1. Field Measurements

9.1.1. Measurement Principle

PAC will be analysed using High Pressure Liquid Chromatography with UV and flourescence detection.

9.1.2. Instrumentation (Manufacturer/Model)

The IOGAPS comprises two samplers in one box. One is the "denuder" sampler and the other is a "conventional" filter/sorbent geometry sampler. The Denuder sampler comprises a URG 2.5 μm cyclone inlet, an 8-channel annular diffusion denuder [5.2 cm diameter x 30 cm long] coated by a patented method with finely ground XAD-4 resin and a filterpack which holds a 47mm diameter filter (either quartz or Teflon coated glass fiber) and two Sorbent Impregnated Filters (SIFs) the preparation of which is currently being patented. The conventional sampler is identical to the denuder except that it has no denuder. Air is sampled at a flow rate of 16.7 L/min. The two samplers are enclosed in a box which is mounted vertically and which can be heated a few degrees above ambient to prevent condensation in the denuders. See photo.

The HiC IOGAPS comprises an URG 10 μm cyclone inlet which, at a sampling rate of approximately 90 L/min, has a cut off of 2.5 μm. The sampling train comprises the cyclone, two 8-channel, XAD-4 coated annular diffusion denuders in tandem, a 90mm diameter filter pack containing a quartz or Teflon coated glass fiber filter followed by 3 SIFs and a backup filter to trap any fine particles which might escape the SIFs. The sampler is contained inside a box which can be heated a few degrees above ambient to prevent condensation in the denuders. See Photo below.

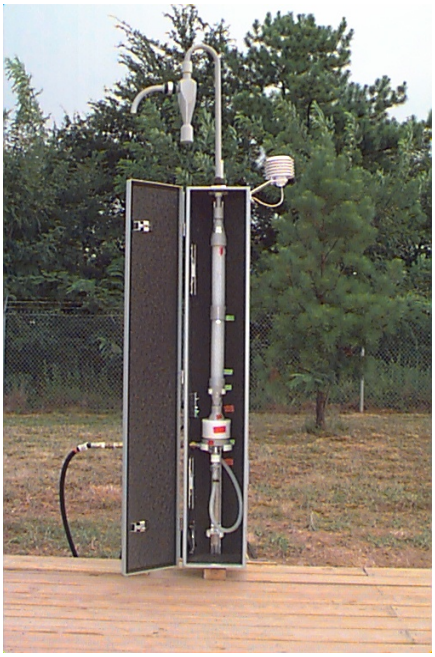

Photo of the IOGAPS and the PI (+Note: in this photo, a 60cm denuder is shown)

Photo of the HiC IOGAPS

9.1.3. Flow System

IOGAPS (described above) is connected by a 25 foot long sampling line to the URG sampling console that contains the air pump and mass flow meter. The air flow is set by a manual valve. The exhaust from the pump passes through a Schlumberger Gallus 2000 gas meter to yield the total volume flow and then exhausted to the atmosphere.
The HiC IOGAPS (described above) is connected to a URG pump by a 25 ft (the unit is manufactured in the USA so all dimensions are in British units) line. The air flow is set by a manual control and measured and recorded by a computerized data logger. The temperature and pressure are also recorded by the data logger. The exhaust from the pump passes through a filter then to the atmosphere.

9.1.4. Inlet Height Above Ground (if surface)

Slocan site: IOGAPS inlet is about 1m above the floor of a platform that is about 1 m above ground
HIC IOGAPS inlet is about 2.5 m above the 1 m high platform
Langley: IOGAPS inlet is about 1m above the floor of a platform that is about 1 m above ground
HIC IOGAPS inlet is about 2.5 m above the 1 m high platform

9.1.5. Nominal Flow Rate

The nominal flow rate for the IOIGAPS is 16.7 L/min (1 m^3 h^{-1})
The nominal flow rate of the HiC IOGAPS is 85 L/min (5.1 m^3 h^{-1})

9.1.6. Flow Measurement/Control

The IOGAPS units have mass flow meters and Schlumberger Gallus 2000 dry gas meters for total volume
The HiC IOGAPS utilizes a mass flow meter. The data is recorded and stored through a computerized data logger.

9.1.7. Flow Temperature and Pressure

ambient temperature and pressure

9.1.8. Sampling Times/Period/Frequency

IOGAPS will collect 2 12-h samples per day starting at 0800 and 2000 h (PST) each day (or according to PAC2001 protocol should it change)
HiC IOGAPS will collect 2 12-h samples per day starting at 0800 and 2000 h (PST) each day (or according to PAC2001 protocol should it change)

9.1.9. Sampling Methods

Currently being developed

9.1.10. Filter Type/Coating Type/Reagent Type

Quartz and Teflon coated glass fiber filters
SIFs are currently being patented - no information can be given at this time.

9.1.11. Planned Changes to Instruments or Methods During Study

No major changes are planned or anticipated at either Slocan or Langley sites

9.2. Laboratory Measurements (If Applicable)

9.2.1. Laboratory Name and Address

Analyses will be done at Environment Canada in the laboratory of the PI at 4905 Dufferin Street, Toronto, ON M3H 5T4

9.2.2. Analytical Method(s)

Denuders	PAH	HPLC/UV/Fluorescence
Filters	PAH	HPLC/UV/Fluorescence

9.2.3. Sample Extraction or Work-up

Denuders	solvent extraction
Filters	solvent extraction
SIFs	solvent extraction

9.2.4. Analytical Detection Limits

varies with the individual PAC - under development

10. Quality Assurance/Quality Control

10.1. Field Quality Assurance/Quality Control

10.1.1. Traceability

Flow rates will be checked on site with a NIST traceable mass flow meter.

10.1.2. Calibration

Flow rates will be checked on site with a NIST traceable mass flow meter.

10.1.3. Zeros and spans

N/A

10.1.4. Blanks

Blank denuder extracts will be taken at the beginning of the program and after every 5 denuder extractions
Blank (lab to site travel) will accompany each sampler on every collection
Blanks will be taken from the stock of filters (lab blanks) every 5 days

Filters not used during the sampling period will be analysed back at the lab after the program as travel blanks.

10.1.5. Field Quality Control procedures

Filter packs: Disposable gloves are used when loading and unloading filters. Filters are inspected for holes, creases and continuity when loaded and unloaded. Filter orientation (front vs back) is checked as each filter is loaded. Filter screens are checked for orientation (there is a front and back to each screen) when loading filters. O-rings on filter stages are checked for condition. Filter pack is checked for tightness. A coloured plastic tape is applied to the filter pack to indicate direction of air flow so that filter packs cannot be inserted in the reverse direction.
Denuders: direction of air flow through a denuder is always left to right when viewing etched denuder number in normal orientation. Disposable gloves are used when handling denuders. Denuder cap O-rings are inspected and replaced if not tight or if leaking occurs during extractions. Denuders are wrapped in bubble wrap and placed in their box prior to travel to any site. After sampling the denuders are transported in a cool-a-tron back to the lab.

10.1.6. Precision determination

Insufficient funds, samplers and personnel to carry out precision measurements.

10.1.7. Comparison with other measurements

Since ALL filter sorbent methods (hi-vol etc), because of their sampling geometry are subject to major errors, and since the IOGAPS was designed to eliminate those errors, the IOGAPS methods cannot and should not be compared to hi-vol methods. Other methods may be compared with the IOGAPS to determine their biases.

10.1.8. Inspections and Audits

10.2. Laboratory Quality Assurance/Quality Control

10.2.1. Traceability

10.2.2. Calibration procedures

Sampler flow rates will be checked at the beginning and at the end of the sampling program by a NIST traceable mass flow meter.
Standards are spiked on each denuder prior to the denuder placement in the field to determine potential chromatographing losses. The denuders are spiked with a second standard prior to extraction to determine extraction efficiency.

10.2.3. Blanks

Denuder: For a denuder there is no such thing as a blank. There are only pre sample extracts. These are collected before any denuder is used in the field, and every 5 uses thereafter.
Filter blanks (travel blanks) are taken to each site for every measurement.
Blank SIFs are periodically taken from the supply and set aside as blanks.

10.2.4. Other lab QC

For the HPLC analyses, a standard is run at the beginning of a set of analyses, and after every 3 samples.

10.2.5. Precision determination

10.2.6. Comparison with other methods

none planned - cannot afford such luxuries

10.2.7. Audits

Cannot afford this

11. Data Management and Quality Control

11.1. Raw Data Recording

Data is recorded in the field on specially designed field data log sheets. The parameters recorded are transferred to a computer data file.

11.2. Final Data Reporting

After chemical analysis, data will be 12-h averaged gas particle partition data for the various PAC reported. No raw data will be reported.

11.3. Data Quality Control and Validation

under development

11.4. Validity Flags

under development

11.5. Below Method Detection Limit Values

As no "below detection" samples are anticipated for the PAH, we will address this problem if it arises.

11.6. Derived Parameters

Gas/particle partition coefficients are determined by expressing the percent of measured PAC determined from chemical analysis of the denuder divided by the sum of that found on the denuder plus the filter plus the SIFs (i.e. the total atmospheric loading). It is anticipated that these will be night vs day 12-h samples. We shall also be able to report

the partition coefficient as a function of the average temperature over the 12-h sampling period.

11.7. Explanation of Zero or Negative Data

"Zero" is not reported. If a compound cannot be detected above the detection limit it is listed as ND "not detected"

12. Data Quality Objectives (Pre-Study)

12.1. Accuracy

12.2. Precision

12.3. Comparability

12.4. Representativeness

12.5. Completeness

12.6. Other Quality Information

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: