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

Prepared by:
Date:

Table of Contents

1. **Principal Investigator**
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2. **Team Members**

3. **Measurement Program**
   Measurements of CO2, CO, methaneMeasurements of volatile organic compounds (VOC)

4. **Measurement Species and Units**
   Carbon monoxide (CO), carbon dioxide (CO2), methane (CH4)
   VOC: determined VOC are: acetylene, ethene, ethane, propyne, propene, cyclopropane, propane, butyne, 1,3-butadiene, 1-butene, i-butene, cis-2-butene, trans-2-butene, n-butane, i-butane, isoprene, cyclopentene, 1-pentene, cis-2-pentene, trans-2-pentene, 2-methyl-1-butene, 2-methyl-2-butene, 3-methyl-1-butene, cyclopentane, n-pentane, i-pentane, 2,2-dimethylpropane, benzene, cyclohexene, 1-methylcyclopentene, 1-Hexene, cis-2-hexene, trans-2-hexene, c-3-hexene, 2-me-1-pentene, 3-methyl-1-pentene, t-3-methyl-2-pentene, 4-methyl-1-pentene, c-4-methyl-2-pentene, t-4-methyl-2-pentene, 2-ethyl-1-butene, cyclohexane, methylcyclopentane, n-hexane, 2-methyl-Pentane, 3-methyl-Pentane, 2,2-Dimebutane, 2,3-dimebutane, toluene, t-2-heptene, methylcyclohexane, n-heptane, 2-methylhexane, 3-methylhexane, 2,2-dimethylpentane, 2,3-dimethylpentane, 2,4-dimethylpentane, 2,2,3-trimethylbutane, styrene, et-benzene, o-xylene, m-xylene, p-xylene, 1-octene, c-2-octene, t-2-octene, c-1,2-dimethylcyclohexane, t-1,2-dimethylcyclohexane, c-1,3-dimethylcyclohexane, t-1,3-dimethylcyclohexane, c-1,4-dimecyclohexane, t-1,4-dimethylcyclohexane, n-octane, 2-methylheptane, 3-methylheptane, 2,4-dimethylhexane, 2,5-dimethylhexane, 2,3,4-trimethylpentane, n-propylbenzene, iso-propylbenzene, 1,2,3-trimebenzene, 1,3,5-trimethylbenzene, 2-ethyltoluene, 3-ethyltoluene, 4-ethyltoluene, 1-nonene, n-nonane, 2,2,5-trimethylhexane, napthalene, n-Butylbenzene, iso-butylbenzene, sec-butylbenzene, 1,2-diethbenzene, 1,3-diethylbenzene, 1,4-diethylbenzene, n-decane, 3,6-dimethyloctane, undecane, hexylbenzene, alpha-pinene, alpha-terpinene, b-pinene, camphene, 2-carene, 3-carene, limonene, myrcene, p-cymene, benzaldehyde, tert-butylmethylether, indan

   All concentrations are given in ppb.
   n.d. = not detected (=0.000 ppb)
   LDL = Lower Detection Limit (<0.006 ppb)

5. **Representative Size Range (if PM)**
   N/A

6. Measurement Platform (surface, airborne)
Surface

7. Measurement Sites (surface only)
Sumas Mountain

8. Measurement Objective(s)
Analyzing CO2, CO, methane, and volatile organic compounds (VOC). At each sampling site one sample was taken every day. More samples may be taken during high episodes.

9. Measurement Details

9.1. Field Measurements

9.1.1. Measurement Principle
Gas Chromatograph

9.1.2. Instrumentation (Manufacturer/Model)
Stainless steel inlet line and connections. Diaphragm vacuum pump and compressor (type UN05) from KNF Neuberger, Inc, Trenton, NJ.
Gas Chromatography (GC) System (HP 5890 Series II for VOC and HP 5890 Series I for CO, CO_2, and Methane).

9.1.3. Flow System
N/A

9.1.4. Inlet Height Above Ground (if surface)
50 cm stainless steel inlet line to the pump, roughly 3 m above ground

9.1.5. Nominal Flow Rate
200 ml/min

9.1.6. Flow Measurement/Control
No real flow control. Needle valve for adjusting the flow. The pressure in the can will be used to control the sampling.

9.1.7. Flow Temperature and Pressure
N/A

9.1.8. Sampling Times/Period/Frequency
1 sample taken for 60 minutes each day.

9.1.9. Sampling Methods
Air will be collected in stainless steel canisters (internally electropolished by the SUMMA® process) equipped with stainless steel metal bellows valve. For collecting the cans a diaphragm pump will be used. Prior pressurizing the cans up to 30 psi at a flow of 200mL/min the cans willl be

flushed with ambient air two times. The samples will be collected for about 60 minutes (variations possible).
Canister will be sent at the end of campaign.

9.1.10. Filter Type/Coating Type/Reagent Type
N/A

9.1.11. Planned Changes to Instruments or Methods During Study
N/A

9.2. Laboratory Measurements (If Applicable)
9.2.1. Laboratory Name and Address
Prof. Rudolph chemistry laboratory, Petrie 207, York University.

9.2.2. Analytical Method(s)
CO, CO2, methane: samples will be analyzed on GC equipped with FID detector. First the samples had to pass a catalyst (Ni on silica/alumina surface). For separation a packed column (15ft, packed with 60/80 Carboxen^{TM} 1000) will be used.
VOC: The samples will be analyzed on two gas chromatographs, each equipped with a flame ionization detector (GC-FID). The separation in each GC used a different column; an aluminum oxide porous layer open tubular (PLOT) column and a DB-1 wall coated open tubular (WCOT) column. Prior to separation, the hydrocarbons in the samples will be concentrated from (typically) 1 litre (STP) of air by a two step cryogenic enrichment procedure. Peak identification is based on retention time and established by comparison with standards.

9.2.3. Sample Extraction or Work-up
N/A

9.2.4. Analytical Detection Limits
CO: detection limit of 14 ppb
CO2: det. limit of 6 ppb
Methane: det. limit of 9 ppb
VOC: for all det. limit of 0.006 ppb.

10. Quality Assurance/Quality Control
10.1. Field Quality Assurance/Quality Control
10.1.1. Traceability
N/A

10.1.2. Calibration
N/A

10.1.3. Zeros and spans
N/A

10.1.4. Blanks
Used pumps are proven for not contaminating the samples. Blanks not necessary

10.1.5. Field Quality Control procedures
N/A

10.1.6. Precision determination
N/A

10.1.7. Comparison with other measurements
N/A

10.1.8. Inspections and Audits
N/A

10.2. Laboratory Quality Assurance/Quality Control
10.2.1. Traceability
N/A

10.2.2. Calibration procedures
CO, CO_2, methane: in high pressure cylinder compressed ambient air, calibrated by Atmospheric Environment Service Canada (AES)
VOC: absolute calibrated VOC mix standard (from Conservation and Protection Environment Canada, Daniel Wang)

10.2.3. Blanks
For blanks helium (6.0) is led though a tube cooled with liquid nitrogen and collected in a stainless steel canister. These blanks are on both VOC- GC systems daily in the morning. Unusually high peaks are subtracted from the sample peak area.

10.2.4. Other lab QC
CO, CO_2, methane: standard is run daily and checked for reproducibility
VOC: 10% of the samples are rerun to check reproducibility. The values were in agreement within the above-described conditions.

10.2.5. Precision determination
See Above

10.2.6. Comparison with other methods
Some VOC can be analyzed on both GC systems. For each sample agreements were checked.

10.2.7. Audits

We participated at various international Intercomparisons and performed very well (agreement better than 10 % for vast majority of compounds).

11. Data Management and Quality Control

11.1. Raw Data Recording

The evaluated data will be stored on the computer running the GC's. The chromatograms and the data excel files are stored on these computers and as well on the main lab computer. Frequency of raw data will vary.

11.2. Final Data Reporting

Same as raw data.

11.3. Data Quality Control and Validation

N/A

11.4. Validity Flags

No flags will be used. The total error will be given for each compound once. If not mentioned otherwise these errors apply to all samples

11.5. Below Method Detection Limit Values

N/A

11.6. Derived Parameters

N/A

11.7. Explanation of Zero or Negative Data

N/A

12. Data Quality Objectives (Pre-Study)

12.1. Accuracy

N/A

12.2. Precision

N/A

12.3. Comparability

N/A

12.4. Representativeness

N/A

12.5. Completeness

N/A

12.6. Other Quality Information

N/A

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: