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

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2. **Team Members**

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3. **Measurement Program**

REA HNO3 fluxes.
MSP MOUDI *2. Particle composition/size.
WEDD *3. High temporal resolution NH3 concentrations.
TSI APS3320. Particle size distribution.

4. **Measurement Species and Units**

REA HNO3 concentration & fluxes. moles m^{-3}. moles m^{-2} s^{-1}.
MSP MOUDI *2 Particle composition/size. moles m^{-3}.
WEDD *3. High temporal resolution NH3 concentrations. moles m^{-3}.
TSI APS3320. Particle size distribution. # cm^{-3}.

5. **Representative Size Range (if PM)**

MSP MOUDI 0.056 – 18 μm. (10 stages plus inlet stage). Cut-points temperature and flow corrected.
TSI APS3320. 0.5 – 20 μm.

6. **Measurement Platform (surface, airborne)**

All equipment to be deployed at surface sites.
REA HNO3 – short tower (? If available w/ associated sonic)
MSP MOUDI – short tower if available.
WEDD *3. short tower if available.
TSI APS3320. short tower if available

7. **Measurement Sites (surface only)**

Sumas Mountain: REA HNO3, MSP MOUDI, WEDD
Langley: MSP MOUDI, WEDD
Slocan Park: WEDD, TSI APS3320

8. Measurement Objective(s)

Sumas Mountain: Gas-particle partitioning of NHx/NO3-HNO3 also REA HNO3 for atmosphere-surface exchange of HNO3
Slocum Park – Urban NH3 concentrations
3 WEDD sites: transect of NH3 concentrations
2 MOUDIs contribution to spatial variability of PM and composition

9. Measurement Details

9.1. Field Measurements

9.1.1. Measurement Principle

WEDD: NH3 by fluorescence
TSI: Size by acceleration
REA: HNO3 by denuder capture
MOUDI: Size by streamline divergence and impaction, composition by IC

9.1.2. Instrumentation (Manufacturer/Model)

WEDD: Built in house
HNO3 REA: MET Support APS & IU (Sonic = Metek)
APS: TSI APS 3320
MOUDI: MSP MOUDI 110

9.1.3. Flow System

REA HNO3 – internal pump & external compressor for zero air.
MSP MOUDI – GAST pump.
WEDD *3. – internal pumps (air and peristaltic).
TSI APS3320 – internal pump.

9.1.4. Inlet Height Above Ground (if surface)

REA HNO3 – short tower (? If available w/ associated sonic). Optimal height for inlet = 10* roughness elements assuming homogeneous fetch of 100* height.
MSP MOUDI – short tower if available. Optimal height for inlet = 10* roughness elements.
WEDD *3. short tower if available. Optimal height for inlet = 10* roughness elements.
TSI APS3320. short tower if available. Optimal height for inlet = 10* roughness elements.

9.1.5. Nominal Flow Rate

REA HNO3 – 1.6 l/min
MSP MOUDI – 30 l/min
WEDD *3. – 1-2 l/min
TSI APS3320. 1 l/min

9.1.6. Flow Measurement/Control

WEDD: Flow meters & critical orifice

HNO3 REA: Flow meters & critical orifice
MOUDI: Flow meters

9.1.7. Flow Temperature and Pressure

Ambient

9.1.8. Sampling Times/Period/Frequency

REA HNO3 – 3 hr during day under clear skies, otherwise day v. night
MSP MOUDI – day v. night
WEDD – 2 minute averages.
TSI APS3320. 2 minute averages

9.1.9. Sampling Methods

REA HNO3 – Denuders coated with NaCl. Analysis by IC. Storage in air tight box prior to deployment. In air tight box subsequent to deployment.
MSP MOUDI – Aluminum foils coated with silicon spray. Analysis by IC. Sparyed in ammonia free box, stored (max. 24 hours) in sealed stack prior to deployment. Rolled and storage in test tube after deployment. Stored in fridge prior to analysis.
WEDD – Calibrated using liquid standard suite every second day.

9.1.10. Filter Type/Coating Type/Reagent Type

MOUDI filters – Aluminium w/ silicon spray coating
REA HNO3 – Denuders coated with NaCl in ethanol.

9.1.11. Planned Changes to Instruments or Methods During Study

For urban site need co-located CO
For REA system need homogeneous fetch & elevation from ground

9.2. Laboratory Measurements (If Applicable)

9.2.1. Laboratory Name and Address

Atmospheric Science Program, Department of Geography,
Indiana University, Bloomington, IN47405, USA.

9.2.2. Analytical Method(s)

MOUDI: NH4+, K+, Mg++, Na+, NO2-, Cl, $SO_4^{=}$, NO_3^{-} ion chromatography
REA: ion chromatography for NO3-

9.2.3. Sample Extraction or Work-up

MOUDI	extraction in oxalic acid
REA denuders	extraction in D.I. water

9.2.4. Analytical Detection Limits

For IC twice average blank (typical values 0.003 ng/mL).

10. Quality Assurance/Quality Control

10.1. Field Quality Assurance/Quality Control

10.1.1. Traceability

Flow meters for MOUDI flow calibrated to reference Brooks mass flow meter.
All other flows measured using A.P. Buck Inc. mini-buck calibrator (serial # 052406) independently calibrated 5/30/01.

10.1.2. Calibration

IC standards from DIONEX.
WEDD calibration standards also tested on IC

10.1.3. Zeros and spans

WEDD: Every second day

10.1.4. Blanks

3 blanks per REA sampling run
1 blank per MOUDI sample

10.1.5. Field Quality Control procedures

All systems operated using standard protocols. All sample labeling identifies system, location and time. Gloves used for all chemical equipment.

10.1.6. Precision determination

WEDD precision evaluated from co-location and operation (period of 2 days).
IC precision determined from 10 replicas of every standard used (5 point standard calibration run for every day of samples processed).

10.1.7. Comparison with other measurements

None planned

10.1.8. Inspections and Audits

None planned

10.2. Laboratory Quality Assurance/Quality Control

10.2.1. Traceability

IC standards from DIONEX.

10.2.2. Calibration procedures

IC calibrated every 50 samples.

10.2.3. Blanks

2 Blanks run on IC for each MOUDI sample.
3 Blanks run on IC for each REA sample.

Both in addition to field blanks.

10.2.4. Other lab QC
N/A

10.2.5. Precision determination
IC precision determined from 10 replicas of every standard used (5 point standard calibration run for every day of samples processed). Precision defined as +/- standard deviation of replica samples/mean.

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
REA HNO3 – 3 hr during day under clear skies, otherwise day v. night
MSP MOUDI – day v. night
WEDD – 2 minute averages collected on Campbell Scientific loggers 21X or 23X from 1 sec. data.
TSI APS3320 -2 minute averages stored from 1 sec. data

11.2. Final Data Reporting
REA HNO3 – 3 hr during day under clear skies, otherwise day v. night.
HNO3 concentrations and fluxes
MSP MOUDI – day v. night for major ions
WEDD – 60 minute averages.
TSI APS3320. 60 minute averages.

11.3. Data Quality Control and Validation
All data will be quality controlled.
No NH3 data will be reported if exceeds highest calibration standard or consecutive values differ by > 50%.
REA data: No flux or concentration will be reported for concentrations less than 2*blank.
MOUDI. No data will be reported for concentrations less than 2*blank
APS: No data will be reported for periods when consecutive values differ by > 50%.

11.4. Validity Flags
As NARSTO

11.5. Below Method Detection Limit Values
MDL twice average blank for IC and WEDD

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
Blind analysis of standards provided by NERI from EMEP.

12.2. Precision
Precision defined as +/- standard deviation of replica samples/mean.

12.3. Comparability

12.4. Representativeness
- The measurements at the Slocan Park site will be representative of the typical urban/suburban pollution mix that is not processed photochemically.
- The measurements at the Langley site will be representative of processed air pollution in which secondary pollutants, such as ozone and secondary particulate matter, will have formed.
- The measurements at the Sumas Mountain site will be representative of processed air pollution with significant influence from biogenic and ammonia sources. They will also be representative of the free boundary layer air and thus representative of the processes affecting the evolution of pollutants throughout the diurnal cycle. They will also capture the visibility reduction at the eastern end of the Lower Fraser Valley.

12.5. Completeness
REA HNO3 – 50% of all samples (concentrations and fluxes)
MSP MOUDI – 80% of N compounds all samples
WEDD – 50% of all 1 hour average periods will have > 50% data capture.
TSI APS3320 - 80% of all 1 hour periods will have > 80% data capture.

12.6. Other Quality Information