NILU : OR 8/2000
REFERENCE : O-96013
DATE : FEBRUARY 2000
ISBN : 82-425-1155-1

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Environmental Information and Monitoring Programme (EIMP). Air Quality Monitoring Component

Mission 16 Report

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1 Introduction

The 16th mission to Egypt covered the period october 24th to november 11th 1999. The mission was undertaken by senior scientist Ove Hermansen in cooperation with Bjarne Sivertsen. Of the work programme activities A-I, the following tasks were covered:

C: Procurement

Specifications for additional equipment needs and consumables.

E: Training

Introduce new techniques for sampling and analysis of volatile organic compounds (VOC) and on the job training of the staff at Centre for Environmental Hazards Mitigation (CEHM) at the Cairo University, Giza.

F: QA/QC

Introduce new SOPs for VOC sampling and analysis to be used in the EIMP Air Quality Manual.

2 E Training

2.1 General

The main purpose of this mission was to introduce a new technique for analysis of volatile organic compounds (VOC) in air samples, and to do on the job training of the staff at Centre for Environmental Hazards Mitigation (CEHM) at the Cairo University, Giza. Due to major changes in staff at the laboratory during the visit, it was not possible to complete the training program according to the original plan.

The analysis method for VOCs is relatively complicated and full attention from personnel with broad experience from gas chromatography is essential to complete the training within the period of three weeks.

The gas chromatograph expert left the laboratory to start in a new job in the second week of the mission. The training was started again with another chemist, who left the laboratory after the second week. A new chemist with some experience in gas chromatography was engaged by the laboratory management during the third week. The three remaining days of the training visit was not sufficient to complete the training. The new chemist will also need some training on the gas chromatograph before being introduced to the new analysis techniques.

2.2 Training for instrument operation and maintenance, VOC-sampling

Principle and operation of the VOC-samplers were performed with people from the chemical laboratory as well as people from the air quality laboratory at CEHM. SOPs for sampling and an instruction list can be found in appendix B and D.

Descriptions of the sampling equipment can be found in appendixes F, G and H.

2.3 Training for instrument operation and maintenance, VOC-analysis

Training on the analysis techniques was delayed because of a malfunction of the gas delivery system for the gas chromatography. Principles and necessary preparations was performed with the chemists responsible for the operation of the instrument. Unfortunately, both chemists left the laboratory during the visit. Theory and principles were presented for the new chemist at the end of the visit. The laboratory will arrange an instrument course for this chemist to be prepared for participating in a new training visit later.
Preliminary SOP for VOC analysis can be found in appendix C.

2.4 On-the-job training

On-the-job training was performed on the VOC samplers. One sampler was used for sampling in Cairo, and the sample was brought back to the laboratory. It was not possible to complete the on-the-job training in the chemical laboratory due to the changes in staff during this visit (as explained in chapter 2.1).

2.5 Chemical analysis

During the second week of the visit, it became apparent that the laboratory did not have the standard mixtures needed to perform the VOC-analysis. The purge and trap unit for the gas chromatograph is constructed for water and soil analysis and need some technical modifications before it can be used for air samples. Some extra equipment are needed for these modifications (appendix I and J).
Because of this, chemical analysis of VOCs in air samples could not be started during the visit.

2.6 Work description

25. October

Visit at the CEHM laboratory, Cairo University.

Meeting with Dr. Ahmed Soliman Abd Ellah and Bjarne Sivertsen.

Discussing NO_2-data, VOC-samplers´ connection to sample tubes, constant temperature/pressure chamber for conditioning of filters.

Dr. Ahmed Soliman Abd Ellah gave a presentation of the laboratory, equipment, activities and personnel.

Introduced to Hany Nabil, responsible for operating the gas chromatograph and the one to undergo training of the VOC-method.

VOC-sampler:

Making an overview of principles and operation of the sampler together with Hany Nabil. Sampler could not be charged without an adapter for the power cable (american plug). Hany went out and bought an adapter at the market.

Prepared the sampler for programming, tested valves and canister vacuum.

VOC-gas chromatograph:

The purge & trap unit connected to the GC has been used for semi-volatiles in soil and water samples. It is not built for air samples.

Tested the capacity of the compressor delivering air to the N_2-generator.

N_2 used as carrier gas, should be He.

26. October

Cairo University:

N_2-generator defect. Serviceman will be contacted.

Meeting with Dr. Ahmed Soliman Abd Ellah and Ahmed Sayd.

Programmed and prepared the sampler together with Ahmed Sayd. Went with him to Ghemoryia Street station to locate the sampler for sampling. Sampler might have a leakage problem, have to check the solenoid valve. All samplers will be checked for leakage.

Back to the laboratory, discussed the working principles for the purge & trap unit with Hany Nabil. Have to check min. temperature of the cold trap and what kind of desorbent in use.

Shows out that there are probably no reference standards in the laboratory. This must be checked out with Dr. Ahmed Soliman.

Went back to the office at EEAA.

Met Ulla Lund, discussed some interlaboratory-results from the CEHM lab. Will do some checking on method, blind values and calculation of samples of biological origin.
Sent a message to Rolf Dreiem, asking him to bring a copy of the EMEP-report.

27 October
Cairo University:
Nobody present at arrival. Hany arrived after 1½ hour. N_2-generator still defect. Part to be changed by the supplier during the day.
Since Soliman was not present and nobody present at the air lab, I was not able to check out the standard gases.
Went back to the EEAA-office to work with the SOP for VOC-sampling.
Short talk at the office with Dr. Tarek El Araby.

28 October
Cairo University:
N_2-generator still defect. Soliman has arranged to get a N_2-cylinder instead.
Unpacked and prepared the remaining VOC-samplers. Programmed all timers. All samplers set up for leakage testing after the weekend. Solenoid valves will be checked after charging batteries. Cables and adapters needed for charging will be obtained on saturday (30. October).
Disassembled the Purge & Trap unit together with Hany Nabil. Examinated function and principles, studied the couplings. The unit is not prepared for light hydrocarbons. Some technical modifications are needed, involving the use of an external coolant. CO_2-cylinder and couplings must be purchased. No manuals for the unit present in the laboratory. Dr. Ahmed Soliman Abd Ellah will contact the supplier to get the manuals. Installed the PC-software for computer-control of the unit.
Dr. Ahmed Soliman Abd Ellah sent a fax to check cost of He-cylinders.
Ref. standards are available at the Air lab. according to Dr. Ahmed Soliman Abd Ellah. When I asked Ahmed Sayd, I was told that there were no such standards at the air lab. Must be checked again with to Dr. Ahmed Soliman Abd Ellah next day, since he had left the laboratory.

31. October
Vacuum pump arrived at EEAA. Some paperwork has to be done before it vcan be sent to the laboratory.
Cairo university:
No cables or adapters present yet. Still not possible to charge the batteries and check the solenoid valves.
Not able to check the reference standards with Dr. Ahmed Soliman Abd Ellah since he was not present. The staff at the air lab. did not know any such standards, but some single gases for qualitative analysis and semi quantitative analysis should be possible to get.
Went back to the office at EEAA to work on SOPs, since no work could be done with the samplers.

1. November
Cairo University:
Brought the vacuum pump to CEHM.
Was going to continue training with Hany Nabil on the VOC-method, but he was not present.

Unpacked the vacuum pump and checked all parts. Vacuum-couplings not compatible with the connections. Dr. Ahmed Soliman Abd Ellah contacted a man from the workshop, explained and made drawings to him so he could make a connection in the workshop.

Connectors/adapters and cables for all samplers present in the lab. Samplers connected for charging.

Worked with the purge & trap unit again, this time with Dr. Ahmed Soliman Abd Ellah. Discussed the needs for couplings and tubing to make the necessary modifications. Dr. Ahmed Soliman Abd Ellah will ask Hany Nabil to get all the parts.

2. November

Cairo University:

Delivered 20 passive samplers and filters that Rolf Dreiem brought from NILU, to CEHM.

Hany Nabil still not present. Later in the day it turned out that Mr. Nabil had got a new job at EEAA and had already left CEHM. It was decided that the training would have to start over again, now with Dr. Ahmed Soliman Abd Ellah who again will train the person to fill mr. Nabils position in the future. This is far from an ideal solution since Dr. Ahmed Soliman Abd Ellah is a busy man being in charge of the chemistry laboratory as well as having his lectures at the university.

VOC-samplers still not charged. Checked all couplings visually and with a volt-meter. Extension cable defect. Repaired the cable and reconnected all samplers for charging until next day.

Connected the vacuum pump and the vacuum meter. Set up the tubing to check the vacuum system. The man from the workshop arrived with the connection he had made from the day before. Excellent work! Canisters can now be vacuumised in the laboratory.

Discussed the needs for couplings and tubing necessary for the flushing and cleaning of the canisters.

Performed more training on the purge & trap unit with Dr. Ahmed Soliman Abd Ellah. Discussing principles for technical modifications and use of external coolant.

Back at the office at EEAA:

Made a complete list of tubing and couplings needed for the VOC-method, with illustrations. Found two local representatives in Cairo.

3. November

Got some tube connections from Rolf Dreiem that was brought to the university.

Cairo University:

Small talk with Estelle Bjoernestad about the QA/QC work while waiting for the lab staff to arrive.

Dr. Ahmed Soliman Abd Ellah busy for the rest of the day with audit of the laboratory.

Finished the connections on the vacuum pump. Run a leakage test. Looked promising. The new connection from the workshop seems to need some time under vacuum for degassing.

Did some tests on the samplers. Charging voltage seems to be OK, but batteries will not charge.

Went back to the office to write a memo on status on the VOC-training.

4. November

Cairo University:
Started the vacuum pump again to perform some degassing while waiting for the laboratory staff to arrive.
Still no tube connectors ordered. Dr. Ahmed Soliman Abd Ellah would have this finished by Saturday.
Dr. Gehad Genidy would look after the samplers so that they will be charged during the weekend.
Went back to the office. Flemmings last day of work on the project.

7. november
Cairo University:
Nobody present at the laboratory to work on the VOC-method. Unable to check status on procurements.
Did some more testing on the vacuum pump and the VOC samplers. Two of the batteries now partially charged.
Wrote a note for Dr. Ahmed Soliman Abd Ellah, stressing that we had to show some more progress very soon.
Went back to the office after waiting for three hours.
Started to write on the Mission report.

8. november
Cairo University:
Met Dr. Gehad Genidy in the laboratory. He ensured that he would be available the whole day and that training could start immediately. Since Dr. Genidy had not been taking part in the training earlier, this ment that training would have to start from the beginning again. I was told that Mohammed Abd El Maugood also would take part in the training. Mr. Maugood later denied this. Director Dr. Jehia Abdel Hady entered the laboratory, presenting Dr. Hanaa Salem that also would be available during the rest of my visit. Dir. Dr. Hady kindly asked me to address him directly if any needs or problems.
Held a meeting with Dr. Gehad Genidy and Dr. Hanaa Salem to discuss further progress of the VOC-activities. Emphasized the problems of manning and missing parts for the instrument. It was suggested that training could start again next day. Explained that the three remaining days were not enough to undergo three weeks of training, especially since there were no one left in the laboratory who could operate the gas chromatograph.
Dr. Hanaa Salem will inform Dir. Dr. Hady about the need to inform EIMP that actions will be taken to solve the problems of manning for the training.
It was decided that next day would be spent going through the basic principles for VOC-sampling and analysis.
Went back to the office.
A letter at my desk from Dr. Ahmed Soliman Abd Ellah informed me that he had not been in charge of the laboratory at CEHM since 4. November.
Had some discussions about the new situation with colleges in the office, and later with Mohammed Fathy.
Did some writing on the Mission report.

9. November

Cairo university:

Met Dr. Gehad Genidy who introduced me to Mr. Sayed Badawy who will be responsible for gas chromatographic analysis from now on. Mr. Badawy have some experience from GC/MS analysis, but will need training to operate the gas chromatograph in the CEHM laboratory. Went through principles, function and operation of the VOC-sampler again, this time with Dr. Genidy and Mr. Badawy.

Asked Yassin Fathi about a more powerful battery charger. He contacted a person at the geo-lab who had one. He did not want to use the charger due to danger of explotion. Yassin Fathi told that all VOC-sampling stations have 220 V power connection. Agreed that the samplers should be connected to the powerline while operated.

Discussed the cleaning procedure for canisters using the vacuum pump, with Dr. Genidy and Mr. Badawy.

Sayed Badawy showed me the laboratory for the GC/MS and X-ray diffraction. The MS is normally operated without using the gas chromatograph.

Met Dr. Ahmed Soliman Abd Ellah who informed me about his new position as a consultant to CEHM and others. He will take part in training of new staff in the laboratory.

Explained principle and function of the Purge & Trap unit to Dr Genidy and Mr. Badawy. Discussed differences of Purge & Trap techniques contra techniques for canister samples. Explained the technical modifications needed for using the P&T with air samples.

Showed the GC-software and the P&T control-software to Sayed. Emphasised the importance of training and practicing on the gas chromatograph before next training visit. Laboratory staff made a search for manuals for the GC-software as well for the P&T unit. It was agreed that these manuals must be delivered by the supplier.

Back to EEAA to write on the report.

Made a list of actions to be carried out and items to be purchased before next training visit.

10. November

Cairo University:

Gave the list of necessary items and actions to Dr. Tarek El Araby and Dr. Gehad Genidy

Checked the VOC samplers again, two more batteries were OK. Discussed charging problems with Rolf Dreiem.

Discussed the SOPs with Sayed Badawy. Emphasized the importance of training on the GC as part of the preparations before next visit. Mr. Badawy discussed this with Dr. Amany G Taher who suggested that it could be arranged with mr. Hany Nabil to do the training.

Dr Amany introduced me to Dr. Mohamed I El Anbaawy, at present responsible for the Chemistry laboratory. He gave a brief orientation about the changes in the laboratory. Discussed some necessary preparations before next visit. Dr. Anbaawy told that Mr. Hany would be contacted to arrange the training on the gas chromatograph.

Had a talk with Shereen Aly Mohamed, responsible for the laboratory's database. She is performing the sample registration and the reporting of final data from the lab.

Went back to EEAA to do some more preparations on the SOP's.

11. November
Went with Rolf Dreiem to have a look at the storage room.
Cairo University:
Brought a SOP for the VOC analysis method to Sayed Badawy.
Checked the version no.s of the software for the gas chromatograph and the Purge & Trap unit.
Disconnected all VOC-samplers and put them aside for storing.
Agreed with Sayed Badawy to get a dust cover for the pump and vacuum gauge.
Got three out of four CVs for new lab. personell to bring back to the laboratory.
Went back to the office to finish the mission report.

3 F QA/QC

SOPs were made for cleaning the sampling canisters and for handling the VOC samplers. SOPs for the analysis methods should be developed as part of the training programme. Since the training programme could not be completed, the SOPs for analysis should be considered as preliminary procedures.

3.1 QC and calibration routines

Calibration routines are described in appendix C, Preliminary SOP for determination of light hydrocarbons in air, analysis.

3.2 Sampling programme

The VOC sampling programme is described in Mission 15 report, appendix B.

Appendix A

People and colleagues

People and colleagues

List of names of people and colleagues met at the CEHM

Name	Position	Location
Dr. Jehia Abdel Hady	Director of CEHM	CEHM
Dr. Tarek Mohamed El-Araby	Manager of Air Quality lab.	CEHM
Prof. Dr. Ahmed Soliman Abd Ellah	Laboratory manager until November 4th 1999	Has left CEHM
Prof. Dr. Mohamed I. El-Anbaawy	Temporary laboratory manager	CEHM
Dr. Gehad Genidy	Ass. laboratory manager	CEHM
Hany Nabil	Former GC-expert	Has left CEHM
Sayed Badawy	New GC-expert	CEHM
Moustafa Morad		Has left CEHM
Mohammed Abd El Maugood	IC-expert	CEHM
Shereen Aly Mohamed	Resp. sample registration and reporting	CEHM
Dr. Hesham Mohamed El Araby	Resp. QA/QC	CEHM
Dr. Amany G, Taher		CEHM
Dr. Hanaa Salem		CEHM

Appendix B

Preliminary SOP for determination of light hydrocarbons in air, sampling

Determination of light hydrocarbons in air, sampling

Principle

A cleaned steel canister is filled with an air sampler by the use of a programmable air sampler. The canister is brought to a laboratory and analysed.

Sampling equipment

The sample cylinders are 6 litre “Summa” polished stainless steel canisters.

Sampling procedure

1. Can is evacuated
2. Remove swagelock-end-cap
3. Connect purge-tee and tighten
4. Programme the timer
5. Pressurize purge-tee
   Vent by opening valve B
   (minimum 10 times)
6. Open valve A - pressurize can to 15 psig
7. Pressurize can to max. pressure
8. Close valve A and switch off pump
9. Remove purge-tee and replace swagelock

Please use a pencil to fill in the label.

Please do not use force to tighten the green handle of the shut-off valve. Normal use of thumb and forefinger is sufficient!!

Cleaning of canisters before the first use

(1)evacuate to a pressure of 10^{-7} mbar 24 hours, ambient temperature.
(2)fill with 10 µl water and purified helium 24 hours, 1 bar
(3)evacuate to 1 mbar and fill with helium 5 times
(4)humidify with 10 µl water, evacuate to 1 mbar

Can is evacuated
Remove swagelock-end-cap
Connect purge-tee and tighten
Switch on pump
Pressurize purge-tee
    Vent by opening valve B
    (minimum 10 times)
Open valve A - pressurize can to 15 psig
    Vent by opening valve B
    (minimum 5 times)
Pressurize can to max. pressure (about 40 psig)
Close valve A and switch off pump

Remove purge-tee and replace swagelock

Please use a pencil to fill in the label.

Please do not use force to tighten the green handle of the shut-off valve.
Normal use of thumb and forefinger is sufficient!!

After step (1) a one-hour leak-test is performed. The canister shut-off valve is closed and no detectable increase of pressure should occur on the 10^{-7} mbar scale.

Blank runs of canisters should not show a single signal of more than 2000 µVs (30 ppt ethane or 10 ppt benzene).

From the 200 canisters we bought for the EMEP-program, 7 had a significant high level of C_6 hydrocarbons and chlorinated solvents. Those bottles were cleaned with methanol, acetone and water and cleaned as shown above. The evaporation in step (1) is performed with 70 °C instead of ambient temperature. The cleaning of a used bottle is done by 6 to 24 hours evacuation at 10^{-7} mbar and 50 ^{o}C. (Turbomolecular pump from Pfeiffer Balzers modified at NILU to allow simultaneous cleaning of 6 bottles).

Commercial supply

Steel canisters:
Prof. R. Rasmussen, Oregon Graduate Center, Biospheric Research Cooperation.

References

McClenny, W.A. et al. (1991) Canister-based metod for monitoring toxic VOCs in ambient air. *J. Air Waste Manage. Assoc.*, *41*, 1308-1318.

Pate, B. et al. (1992) Temporal stability of polar organic compounds in stainless steel canisters. *J. Air Waste Manage. Assoc.*, *42*, 460-46.

Westberg, H. et al. (1984) Analysis of individual hydrocarbon species in ambient atmospheres. In: *Identification and analysis of organic pollutants in air.* Ed. by L.H. Keith. Woburn, MA, Butterworth. pp. 323-327.

Olivier, K.D. et al. (1986) Sample integrity of trace level volatile organic compounds in ambient air stored in summa polished canisters. *Atmos. Environ., 20*, 1403-1411.

Appendix C

Preliminary SOP for determination of light hydrocarbons in air, analysis

Determination of light hydrocarbons, analysis

The analytical method described below is by gas chromatography and FID.

A brief description of the set-up and procedures are given below. The analysis is complicated and should preferably be learned by training.

Instrumentation

VOC air analyser
A drying-tube with backflush and heating option has been added between valve V3 and V4. (10 cm teflon-tube 1/4" with 20 micron steel-sinters on both ends, filled with 3 cm of K_2CO_3 on both ends and 4 cm NaOH on support in the middle.)

The first trap is a 1/4" glass-tube packed with Carbosieve, Carbotrap and Carbotrap C - the refocussing trap a 10 cm piece of coate fused silica (Poraplot U).

Gas chromatography
Al_2O_3/KCl PLOT column, 50 m, 0.32 i.d. (Chrompack).

Hewlett Packard PC based chromatographic data handling system.

Gases and materials
All gases are grade 4 or better. They are further cleaned by passage through two different 200 ml cylinders filled with activated charcoal and molecular sieve. This is sufficient for the FID gases, but not for the helium as carrier gas. Helium is further cleaned in a 1/4" steel trap filled with molecular sieve at liquid nitrogen temperature. All tubes which are in contact with the sample are premium grade stainless steel or teflon (drying tube).

Analytical Procedure

Table 1:Settings of temperatures, gases, flow-directions and gas-flows in the different steps of an analytical cycle of the thermodesorption unit.

Step	Trap 1	Gas	Direction	Flow	Trap 2	Gas	Time
I	270 °C	He	Back	20 ml	120 °C	He	26 min
II	Ambient	He	Back	20 ml	Ambient	He	60 min
III	-30	He	Back	20 ml	Ambient	He	6 min
IV	-30	Sample	Front	25 ml	Ambient	He	14 min
V	-30	Sample	Front	25 ml	-180	He	6 min
VI	-30	He	Front	5 ml	-180	He	1 min
VII	250	He + HC	Back	8 ml	-180	He + HC	8 min

The consume of liquid CO_2 is about 2 liters per sample.

A chromatogram is given in Figure 1.

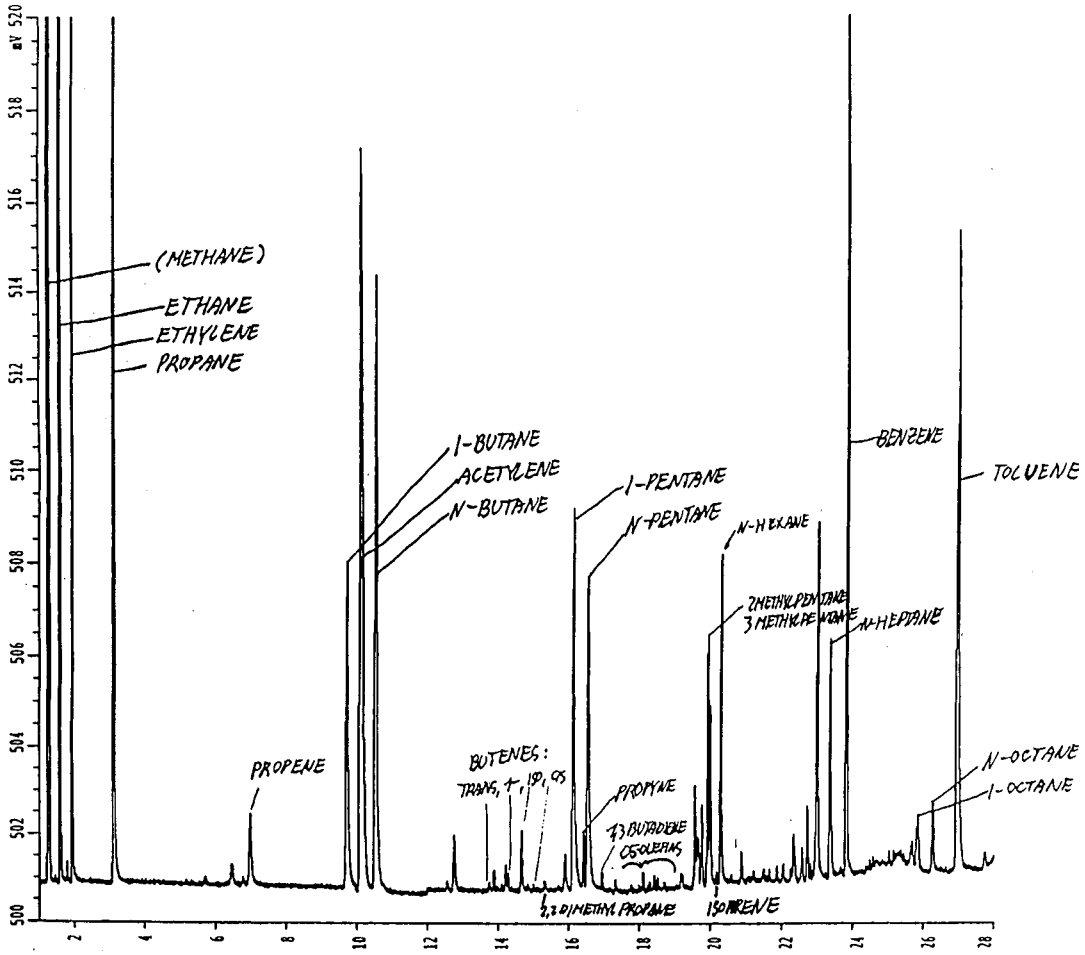

Figure 1: Chromatogram

Quality assurance

Calibration

Calibration-gas-mixtures from NIST (USA) should be used to determine the carbon-number-response for the FID.

The standard-gas-mixture is analysed with the same conditions as a sample (same pressure, flowrate, volume and time period) connected to one of the ten ports of the stream-selector. The absolute precision of the read-out of the massflow-controller is therefore not a critical point in calculating concentrations.

The standard gas is connected to port 1 of the multistream-selector and therefore always the first and thereafter every tenth injected sample.

All hydrocarbon peaks in the chromatograms are identified and integrated by hand.

For identification purposes ppm standard-gas-mixtures from Scotty or self-made standards are injected via a home-made injection system.

Maintenance
The blank values of the carrier gas are checked by direct connection to one of the ports of the multiposition-valve. A good performance of carrier-gas cleaning is of fundamental importance for a reliable analysis of the very volatile hydrocarbons.

The blank values of the instrument especially of the traps have to be controlled quite often. High boiling compounds on the traps may decompose and give higher background noise of several compounds.

A need for change of the drying-agents is indicated by bad chromatographic performance. On a routine basis the tube is renewed every week.

A record of the raw-area of the standard-runs is very useful to judge the instruments behaviour over longer time.

All gas-flows need to be checked quite often.

References

Schmidbauer, N. and Oehme, M. (1985) Analysis of light hydrocarbons (C_2–C_6) at ppt levels by high resolution gas chromatography. *J. High Res. Chrom. & Chrom. Commun., 8,* 404-406.

Schmidbauer, N. and Oehme, M. (1986) Improvement of a cryogenic preconcentration unit for C_2–C_6 hydrocarbons in ambient air at ppt levels. *J. High Res. Chrom. & Chrom. Commun., 9,* 502-505.

EMEP (1990) EMEP Workshop on measurement of hydrocarbons/VOC. Lindau, Federal Rep. of Germany, November, 6–9, 1989. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 3/90).

Appendix D

Instructions for VOC sampling

VOC sampling

Sample no:_____
Filled in at the laboratory

Station	Sampler	Sampling	
Station no.: St. name:	Installed t.o.d.: _____:_____ date:	Start ① t.o.d.: _____:_____ date:	Canister pressure at start: ③
Sampler no.: Canister no.:	Collected t.o.d.: _____:_____ date:	End ② t.o.d.: _____:_____ date:	Canister pressure at end: ④

1. Before going to the station:

- Ensure that battery has been charged and that the
- Check that the time and day of the digital timer are correct
- Check that program is OK
- Fill in date and time for start and end of sampling ①&②
- Check that all valves #1, #2 and #3 are closed
- Check that the solenoid valve works properly
  1. Select the **MANUAL** position on the timer
  2. Push the **ON/OFF** button three-four times to see if the solenoid valve reacts.
     IMPORTANT: When finished, ensure that the valve is in the **OFF** position
  3. Select the **AUTO** position on the timer

2. At the station, before sampling:

- Check the vacuum pressure
  1. Open the canister valve (#1) completely (counterclockwise)
  2. Open the pressure gauge valve (#2)
  3. Read the pressure and fill in the value ③
  4. Close the pressure gauge valve (#2) (clockwise)
- Install the sampler in the correct place
- Mount the sample tube to the sample inlet (front inlet on the left side)

3. Collecting the VOC sampler at the station after sampling

- Check the vacuum pressure
  1. Open the canister valve (#1) completely (counterclockwise)
  2. Open the pressure gauge valve (#2)
  3. Read the pressure and fill in the value ④
  4. Close the pressure gauge valve (#2) (clockwise)
- Close the canister valve (#1) completely (clockwise)
- Bring the VOC-sampler to the laboratory

Appendix E

List of equipment used

List of equipment used for the VOC method

VOC sampler:

Thermo Environmental Instruments Volatile Organic Canister Sampler model 640

Gas chromatograph

Hewlett Packard 5890 series II with FID
Software: HP Chemstation Rev. A.04.01

Purge & Trap unit:

Hewlett Packard 7695 P&T
Software: Purge & Trap Control ver. A.01.01

Appendix F

Thermo Environmental Instruments VOC sampler

Appendix G

VOC sampler model 640 instruction manual

Appendix H

VOC timer instruction manual

Appendix I

Price quote from Etico Gas

Appendix J

Memos

Norwegian Institute for Air Research (NILU)
P.O. Box 100, N-2027 Kjeller – Norway

REPORT SERIES SCIENTIFIC REPORT	REPORT NO. OR 8/2000	ISBN 82-425-1155-1 ISSN 0807-7207	
DATE	SIGN.	NO. OF PAGES 66	PRICE NOK 105,-

TITLE	PROJECT LEADER
Environmental Information and Monitoring Programme (EIMP). Air Quality Monitoring Component Mission 16 Report	Bjarne Sivertsen NILU PROJECT NO. O-96013
AUTHOR(S) Ove Hermansen and Bjarne Sivertsen	CLASSIFICATION * A CONTRACT REF.

REPORT PREPARED FOR:
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ABSTRACT
The main purpose of mission 16 was to introduce a new technique for analysis of volatile organic compounds (VOC) in air samples, and to do on the job training of the staff at Centre for Environmental Hazards Mitigation (CEHM) at the Cairo University, Giza. Due to major changes in staff at the laboratory during the visit, it was not possible to complete the training program according to the original plan. The equipment for sampling and analysis has been checqued and tested and further needs of equipment has been evaluated.

NORWEGIAN TITLE

Overvåkingsprogram for luftkvalitet i Egypt

KEYWORDS		
Air Quality	VOC	Chemical analysis

ABSTRACT (in Norwegian)

** Classification*
A Unclassified (can be ordered from NILU)
B Restricted distribution
C Classified (not to be distributed)