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Action 2: Construction of PM concentration databases

Procurement of equipments: After an extended market research, the specifications of the filter samplers to be purchased were set. The equivalent manufacturers have been contacted and a final decision is expected to be reached by the end of April 2011.

Procurement of consumable material, such as filters for PM sampling, material for sampling sites setup (tubing, valves, etc.), gases needed both for field measurement and samples analysis, as well as reagents used in chemical analysis of the collected samples. Design of new sampling heads, to be deployed with existing PM samplers, for the simultaneous collection of PM10 and PM2.5.

Calibration procedures for all sampling and analytical equipment to be deployed at the field campaigns have been completed. In addition the analytical technique that will be used for the quantification of trace metals in aerosol samples has been developed and verified. The application of Atomic Absorption Spectrometry (AAS) was examined, with flame and graphite furnace. The verification of the methodology was conducted by the use of standard reference material (Urban particulate matter, 1648, National Institute of Standards and Technology, U.S. Department of Commerce). An alternative digestion procedure was also examined, by the use again of the same standard reference material.

Development of the measurement protocol: The three beneficiaries involved in this activity (NCSR "D", AUTH and UTH) have agreed upon the final details of the measurement protocol (aerosol



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parameters to be studied, samplers to be deployed, filters material, measurement sites, duration and frequency of sampling). The first campaign is expected to commence during summer of 2011.

Recruitment of additional personnel needed for the realization of the measurement campaigns and chemical analysis of collected PM samples.

Organization of mobile laboratory measurements: The Aerosol and Particle Technology Laboratory (APTL) from the Center for Research and Technology-Hellas (CERTH) of Thessaloniki has been contacted for the mobile laboratory measurements.

NCSR "D" and AUTH have conducted a detailed literature review of research works studying PM concentration levels at the three urban areas (Athens, Thessaloniki and Volos). The historical data have been examined with respect to sampling protocols, sampling and analytical methods and data analysis. Following strict quality control procedures, the collected data have been introduced in a historical database, which is now completed. Part of the results obtained from this work has been submitted to the European Aerosol Conference 2011, which will be held in the city of Manchester, U.K. on September 2011.

The collection of historical data has been completed in accordance with the foreseen time schedule. The first milestone connected to this action (collection of historical data sets and quality control assurance) has been accomplished on time.

The 1st meeting - seminar concerning the usage of filter samplers took place in the facilities of NCSR Demokritos at July 22, 2011.



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The 2nd meeting - seminar concerning the usage of filter samplers took place in the facilities of NCSR Demokritos and at the monitoring station of N. Smurni, at July 29, 2011.

The detailed measurement program for each city is presented below:

Athens Metropolitan Area (AMA)

Sites: (1) Demokritos urban background station (member of the GAW network), in Northeast part of AMA and

(2) Nea Smyrni station of the National Monitoring Network, in the South of AMA

Measurement period:

Warm period campaign: 7/7 – 4/8/2011 and 12/9 – 2/10/2011

Cold period campaign: 16/1 – 12/2/2012 and 21/3 - 10/4/2012

Samplers: At Demokritos site:

- Custom made PM₁₀ and PM_{2.5} samplers
- Derenda LVS
- Tecora Echo PM sampler
- EC/OC field analyzer (Sunset Laboratory Inc.)
- SMPS (Custom made and TSI Inc.) for particle number size distribution
- Aethalometer (Magee Scientific) for black carbon measurements
- Nephelometer (Ecotech)
- Portable aerosol spectrometer (Grimm Technologies Inc.) for number and mass size distribution
- Meteorological sensors



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At Nea Smyrni site:

- Sequential Medium Volume Sampler, MCZ GmbH
- MicroPNS Type LVS16MCZ sequential sampler, MCZ GmbH
- PM_{10/2.5} SEQ 47/50, with 8m³- pump, Sven Leckel GmbH
- PM_{10/2.5} SEQ 47/50-CD with Peltier cooler / 8m³- pump, Sven Leckel GmbH
- Meteorological sensors

Filters: 47-mm diameter filters:

- Teflon filters (PTFE Membrane WTP range pore size: 1 µm and Zefluor Membrane, pore size: 1µm) for subsequent analysis of major and trace elements and ionic species
- Quartz filters (PALL FLEX Tissuquartz) for subsequent analysis of OC and EC and ionic species

Thessaloniki Metropolitan Area (TMA)

Sites:(1) Urban Traffic site (UT) in the commercial city centre, directly impacted by traffic emissions

(2) Urban Background (UB) site in the upper part of the city

Measurement period:

Warm period campaign: 30/6 – 1/10/2011

Cold period campaign: 10/2 – 6/4/2012

Samplers: Low volume air samplers (LVS3.2, Derenda, Berlin) equipped with PM₁₀ and PM_{2.5} inlets with a flow rate of 2.3 m³/h

Filters: 47-mm diameter filters:



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- Teflon filters (Zefluor™ membranes, Pall 2µm) for subsequent analysis of major and trace elements and ionic species
- Quartz filters (Tissuquartz, Pall) for subsequent analysis of OC and EC and ionic species

Volos Greater Area (VGA)

Sites: 1 site at the University of Thessaly, Department of Planning and Regional Development, in the city centre

Measurement period:

Warm period campaign: 5/8 – 6/9/2011

Cold period campaign: 20/2 – 17/3/2012

Samplers:

- Sequential Medium Volume Sampler, MCZ GmbH
- MicroPNS Type LVS16MCZ sequential sampler, MCZ GmbH
- PM10/2.5 SEQ 47/50, with 8m³- pump, Sven Leckel GmbH
- PM10/2.5 SEQ 47/50-CD with Peltier cooler / 8m³-pump, Sven Leckel GmbH

Filters: 47-mm diameter filters:

- Teflon filters (PTFE Membrane WTP range pore size: 1 µm and Zefluor Membrane, pore size: 1µm) for subsequent analysis of major and trace elements and ionic species
- Quartz filters (PALL FLEX Tissuquartz) for subsequent analysis of OC and EC and ionic species

The collected filters from all three urban centres have been weighed and stored in controlled environmental conditions. Thermal/optical



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analysis for the determination of organic and elemental carbon is in progress.

In addition to fixed site measurements, the mobile measurement platform (Mobilab) of the Aerosol and Particle Technology Laboratory (APTL) of CERTH has been contracted for sampling in a variety of areas, representative of specific PM sources.

- Scanning Mobility Particle Sizer (SMPS) and Optical Particle Counter (OPC) for the measurement of particles number size distribution
- Photometer for the determination of PM mass concentration
- Portable aethalometer for the determination of black carbon
- GPS system in order to monitor the vehicle's exact position over time.

During the day the vehicle was moving in preselected routes, while a GPS was continuously recording its position. Measurements were continued during night time, with the vehicle parked in areas on interest. During night time measurements, a MOUDI impactor was also employed for the gravimetric measurement of mass concentration size distribution. Mobilab measurement schedule is presented below:

AMA: 12 – 23/9/2011

TMA: 22/8 - 2/9/2011

AMA: 12 – 23/9/2011 and 30/1 – 10/2/2012

TMA: 22/8 - 2/9/2011 and 13 - 24/2/2012

Mobilab data analysis is still in progress.



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The 3rd meeting - seminar concerning the usage of filter samplers took place in the facilities of NCSR Demokritos and at the monitoring station of N. Smurni, at November 5th, 2011.

Analysis for ions, major and trace elements and elemental / organic carbon is in progress. In addition, statistical analysis of the data collected by Mobilab during the summer campaign has started and initial results have been presented during the 1st informative meeting for stakeholders.

Results from the fixed site and mobile measurement campaigns have been presented during the 1st informative meeting for stakeholders, on the 14th December 2011.

During February 2012, the winter measurement campaigns have continued in Athens, Thessaloniki and Volos.

Measurements at the two fixed sites in Athens (Demokritos and N. Smyrni stations) have stopped on the 12th of February and instrumentation has been moved to Volos. The Volos winter campaign started on the 20th of February. Mobilab was also employed in Athens during the first week of the month.

The Thessaloniki winter campaign started on the 10th of February. Mobilab was also employed for mobile measurements in the city from 13th to 24th of February, 2012.

Thermal/optical analysis of the collected filters for the determination of elemental and organic carbon is in progress.



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Ionic and metal analyses will follow.

Results from the warm and cold measurement campaigns have been submitted for presentation to the European Aerosol Conference 2012.

The winter measurement campaigns were completed by April 11th, 2012.

Analysis of filters is in progress.

Completion of the analysis of the PM₁₀ and PM_{2.5} samples collected during ACEPT-AIR campaigns, for the chemical characterization of particles in these two size fractions, has been delayed for six months. The main reason for this delay, apart from the heavy load of chemical analyses needed to be performed, was that XRF and AAS analysis for the determination of major and trace elements in PM was conducted on the same filters. XRF, which is a non-destructive technique, was performed by AUTH. Following AUTH analysis, the filters were transported to NCSR "D", where AAS analysis was conducted. These logistics were necessary in order to avoid collecting duplicate teflon filter samples for these analyses but resulted in the observed delay. Nevertheless Action 2 was finally completed in April 2013 and no significant effect is expected on the project progress by this deviation from the foreseen time-schedule.

Details on the measurement protocol followed during ACEPT-AIR field campaigns have been provided in the 1st Progress and Mid-term Report.



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By the end of this reporting period, all deliverables and milestones for this Action have been completed:

Deliverables:

D6: PM10 and PM2.5 concentration databases for the three urban areas (AMA, TMA and VGA) 9 has been included in Mid-term Report

D7: PM10 and PM2.5 chemical composition databases for the three urban areas (AMA, TMA and VGA) has been included in Progress Report II

Milestones:

M6: Collection of historical data sets and quality control assurance

M21: Completion of sampling campaign – Achieved prior to foreseen data