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Report from Workshop 2, 1998 Guangzhou, 5-13 November, 1998

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Project Leader

Air Quality Management and Planning System for Guangzhou
(NORAD Project CHN 013)

Participating Institutions:

P.R. China: GMSTC, GEPB, GRIEP, GEMC
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1 Introduction

The Sino-Norwegian cooperation project "Guangzhou Air Quality Management and Planning System" holds two workshop per year. The 2nd workshop in 1998 was held in Guangzhou during 5-13 November, 1998. It was arranged according to the agreement about this made between the partners, at the 2nd workshop in 1997 in Guangzhou.

The workshop was attended by the full Guangzhou team, and from NORCE by 5 NORCE Task Leaders and by the project leader Mr. Steinar Larssen. The week before the workshop, a team of 3 people from NILU/NORGIT worked on the installation of the AirQUIS Air Quality management System (AQMS), a prelease of Version 2.0.

Apart from the regular task work activities (see below) there had been activity during the time since the May workshop to propose/select some air pollution abatement measures that should be analyzed as part of the 1st AQMS analysis sequence (see Figures 1 and 2 in the report from Workshop 1, 1998).

The task work between the workshops concentrated on performing the 1st AQMS analysis sequence. At the time of this workshop, that work had been almost completed.

2 Program and participants

The main objectives of this workshop were to:

- report on the 1st Air Quality Management Analysis sequence that had been carried out during the autumn;
- prepare detailed work plans (DWP) for 1999;
- demonstrate the AirQUIS 2.0 Air Quality Management System software tool;
- continue the Action Plan development.

The proposed program is shown in Annex 1. It was modified somewhat during the course of the workshop. The main content was as follows:

Date	Activities
5 Nov. Thursday:	After short starting plenary, preparatory work, in groups, to finalize the analysis of the 1st AQMS sequence. Also other task work (e.g. Status report)
6 Nov. Friday	As above
8 Nov. Sunday	Evening: Transfer to LongGui Ecological training centre
9 Nov. Monday	Plenary: - Brief Task Status reports - Reporting of results from 1st AQMS sequence - Action plan: Presentation by GZ side. Discussion
10 Nov. Tuesday	Task work: - Prepare DWP 99 - Prepare for AirQUIS demonstration - - Action Plan discussion.
11 Nov. Wednesday	As above.
12 Nov. Thursday	Plenary: - Presentation of DWP 99, per task - AirQUIS demonstration - Action Plan proposal, presentation and discussion

Project Leading Group meetings were conducted on 5 November, and a concluding meeting took place on 13 November.

The list of participants is shown on the next page.

List of participants:

	Guangzhou Team	NORCE Team
Project Leaders	Wu Zhengqi	Steinar Larssen
Tasks		
1	Huang Qing Feng Jian Jianyang Pan Nan Ming Sun Qun Wang Dao Ming Yang Shu Rou Chen Nan Ling Kuang Jun Xia	Frederick Gram
2	Zhong Jieqing	Thomas Krogh
3	Fang Xingqin	Leif H. Slørdal Rune Ødegaard
4	Dong Tianming Song Weiping	Steinar Larssen
5	Weng Shifa	Leif H. Slørdal
6	Li Chiqin (6.1) He Liangwan (6.2) Su Xing (6.3)	Kristin Aunan
7	Cui Xia	Andrew Yager
8	Fan Changzhong	
9	Yu Jican	Thorleif Haugland
10	Ge Yi	Knut Aarhus
11	Yu Kaiheng Zhu Changjian Wang Boguang Sun Qun Shuang Jarong Mo Xiuzhen	Andrew Yager
12	Liu Li	Leif H. Slørdal

Message to GZ side: Please complete the list, where necessary, also with people not directly related to tasks.

3 Proceedings

3.1 Opening Plenary, 5 November

3.1.1 Opening statements

Mr. Larssen welcomed all the participants, and stated the 2 important questions to be asked at this stage of the project, with 2 out of 3 years finished:

- Is our work on schedule, according to the overall plans?
  This will be shown during the workshop
- Are we successful in our project? I.E.: Will we be able to finish successfully, answering to the main objectives of the project?
  This will depend upon the quality and timeliness of the work in each of the tasks (incl. the transfer of tools and knowledge), as well as of the project leadership being targeted in their guidance and leadership roles.

Mr. Wu in his opening address concentrated on the goal of Guangzhou authorities that Guangzhou should strive to become an "Environmental Model City" (EMC). There are certain (mainly 5) criteria which should be fulfilled to become an EMC in China, such as:

- Environmental management should be among the top 10 in China;
- It should be a sanitary model city;
- Env. Investment should be > 1.5 % of GDP;
- National Air quality guidelines must be met.

The goal of the GZ authorities is to make Guangzhou a model city within 3 years.

This goal will now constitute a major challenge for our project, particularly to develop a short term action plan that would assist GZ in reaching its goal.

According to Mr. Wu, several measures to improve the air quality in GZ has already been instigated, such as:

- unleaded gasoline;
- monitoring program for vehicle emissions;
- measures related to industrial emissions (Moving of factories);
- gasification of buses and taxis has started;
- measures for the 3rd industry: gasification.

Also, the improvement of the monitoring system is an important part of the strategy of GZ to become an environment model city.

Mr. Larssen then went through the work schedule for the next days, up until the plenary meeting on Monday 9 November, at LongGui. A number of task group meetings were scheduled (see below).

3.1.2 Plan for AirQUIS management and training at GRIEP

Then the AirQUIS training sessions were discussed. In the week before the workshop, AirQUIS 2.0 (prerelease version) had been successfully installed at GRIEP, although some difficulties were met, and solutions found.

Mr. Larssen stressed the question of management of the AirQUIS system at GRIEP. The AirQUIS system is a complicated software system comprising many modules, e.g. about emissions, wind and dispersion models. There is a need to establish a group at GRIEP for the purpose of managing and using the system. He proposed the following approach. The names of responsible persons are only indicative, and it is up to GRIEP to decide which people should be involved:

Overall responsibility:	- technical maintenance - operation (calculations) - coordination - Cui, Fang, Jian, Li ?
Module responsibility:	- Emissions module (point, area, fuel): Jian ? - Traffic module: Sun Qun ? - Wind, dispersion modules: Fang ? - Exposure module: Li Chiqin ?

The following schedule for training in the coming days was set:

Thursday :	Cui Xia (before lunch) Fang Xingqin (after lunch) Li Chiqin (before lunch) Jian Jianyang (point source and area sources) Sun Qun (traffic module)	
Friday :	Before lunch :	Fang Xingqin, Liu Li (wind/dispersion modules)
	After lunch :	Fang Xingqin, Cui Xia, Li Chiqin (exposure module).

It was later decided by Mr. Wu that Mr. Wang Daoming would also be part of the AirQUIS administration group at GRIEP.

The details of AirQUIS installation and training is given in Annex 2.

3.2 Task work and meetings during 5-6 November

The following activities took place, as a preparation for presenting the results of the 1st sequence of AQMS analysis:

3.2.1 Air Quality Assessment

Meeting of tasks 1, 3, 4, 5, 7, 8, 11.
Activity: Going through the KILDER calculation for base year (1995), and for selected abatement measures.

The calculations had been done in advance by Mr. Gram at NILU, and calculations had also been attempted by the GZ team.

Mr. Gram presented preliminary results from the emission, concentration and exposure calculations by the KILDER model system.

3.2.2 Exposure assessment

Meetings between tasks 5 and 6.1
Activity: Clarify methodology for calculating population exposure, as part of the health studies.

Several meetings between task 5 and 6-1 were held in order to clarify the method for estimating the exposure of the people being part of the interview study. Task 5 is responsible for this work. It was stressed from task 6-1 that the work must be done before the study trip of Ms. Li Zhiqin takes place, because she will need the data in order to perform the analyses from the interview study as planned.

3.2.3 Damage Assessment

Meeting of tasks 6.1 and 9
Activity: Concerning the economic valuation of the reduced health effects as they were estimated by task 6.1.

The health damage calculations had been done in advance by Mrs. K. Aunan. All the health "end-points" were not given an economic value at this stage (during the meeting). This was, however, finished after the workshop.

3.2.4 Control costs

Meeting of tasks 2, 7, 9, 11
Activity: Going through the costs of the selected control (abatement) measures

Preliminary discussions of the control options that had been selected for the 1st sequence, their feasibility, status and costs:

a) Moving factories from central GZ
   This measure has been decided.
   There exist a list of the factories in question, totally 68, but only some of them have significant air pollution emissions. These 68 have been selected, because they have the financial means to move.
   Total emissions from these factories (1995): SO_2 : 773 tons/y
   (from fuel combustion) TSP : 878 tons/y
   Smoke(?) : 189 tons/y.
   Yu Jican has done a case study on a cement factory.
   Ciu/Ye has calculated costs for 5 factories:
   - GZ 1st textile
   - GZ metallurgical moulding
   - GZ electrical instr.
   - GZ truck factory
   - GZ copper manufacturing/processing.

The costs associated with moving them is a complicated issue, and we could not go deeply into this question at this meeting.
Conclusion: Need to select more factories for case studies. Mr. Yager will lead this work, together with task 7 team, and Yu Jican, also based upon the studies Cui and Fan did at IFE in May/June. Factories could be selected from food, metals, chemicals and paper industries.

b) Fuel switch to gas in "3rd industry"
This measure is planned, not so far decided. But: New restaurants must use gas.
Example: 68,000 large-to-medium restaurants/hotels. They use heavy oil or diesel today. Task 2 has data on total fuel use in this sector.
Costs both for infrastructure strengthening (gas lines) and for the local installment (e.g. new burner), incl. possibilities for boiler improvements.
Case studies needed: Large, medium, small boiler cases.
Benefit: emission factors must be decided.

c) Gasification of buses and taxies
This measure has been decided, and is being implemented.
There are 5,000 buses in 8 districts (60% diesel)
15,000 taxies (90% gasoline).
There are 16 bus companies/depots that need to be supplied with gas lines.
There are plans to build 40 supply stations by 2001.
As of now, 2 bus lines already use gas.
Costs: It was said from GZ side that the cost to gasify a bus is 6-8,000 RMB, and 5,000RMB for a taxi. This seems awfully little.
There is a fuel price difference, which was nor quantified at the meeting.
Feasibility: It is considered feasible over a 5-year period. LPG comes partly from GZ petroleum plants, partly from import (from other parts of China).

d) Phasing-out MCs
This measure has been decided, and is being implemented.
There are 340,000 MCs in use. They are all 4-stroke (luckily!).
There are no direct costs associated with this measure.
The public transport system has enough capacity. Metro and buses can absorb the additional traffic demand. Bicycled are not promoted.
It is suggested by GZ side that this measure will result in increased traffic speed.
Problems: Secondary costs, resulting e.g. from less mobility for those who use MCs.
The measure will amplify the need for private cars, which will put a much larger demand on the road system than MCs.

e) Boilers, improved efficiency
This concerns smaller boilers (< 25 tons steam/hr), in city centre.
The time did not allow much discussion on this topic. Very detailed boiler studies are planned later.

3.2.5 Policy instruments

Meeting of tasks 10, 13 and others.
Activity: Discussion of how to implement the selected measures, and also further possible measures.

Discussion of the selected measures:

- MC phase-out, and no new licenses:

  This measure is also a specified policy instrument. So for task 10, the discussion should focus on effective implementation and enforcement and how possible behavioral responses to the ban/phase-out that may weaken its effect. Beijing has implemented a ban on all MCs in central areas. Information should be obtained on experiences from Beijing.

- Moving factories:

  This involves also improved technology, as factories will be required to fulfill new sources standards at new location.
  In preparation of the law/regulation: Discussions/negotiations are going on with each factory. One problem of moving, is the housing question for the employees and resistance against longer travels to work.
  Alternative instruments: - a direct order
  - subsidized loan (long term).
  - tax incentive: for income from sale of land or on profits the first years after moving.
  - land use planning - long term, whole GZ city.
  - right activity on right place
  - changes/improvements in urban master plan
  - careful planning of industries in new areas.
  Gvt. has already prepared selected new industrial areas. Enterprises are free to select where they want to go.

- Fuel switch, buses and taxis:

  Possible policy instruments: - mandatory requirement of switch to LPG, both new and used vehicles.
  - financial incentive system to encourage bus & taxi companies to switch to LPG. Present trial system: 50 % subsidy to taxi owners (3500 RMB).
  - tax/charge on gasoline and diesel, or a tax on all fuels but a lower rate for LPG. New local tax may not be possible, but possibly charges. Needs to be clarified.
  - voluntary agreement including the city authorities and taxi + bus companies.

- Burner efficiency:

  Choice of feasible policy instrument will depend on the scope of the measure (number of boilers/burners included in the measure). If small number: firm-specific licenses or permits could make sense. If large number: industry-wide product or stricter emission standards. If low cost, information campaigns. If higher cost, economic support such as subsidy, tax incentive, etc, could be necessary. Alternatives or supplements:

- tax on fuels. Limited scope for local authorities to introduce specific taxes, but not altogether impossible.
- voluntary agreement: only a viable alternative if limited number of enterprises

- Fuel switch - third industry:
  - Possible policy instruments:
  - Existing policy (proposed): prohibition against use of diesel/heavy fuel oil/coal and kerosene in restaurants and hotels. New sources: immediately. Existing sources: within a prescribed time.
  - Tax/charge on heavy fuel oil and diesel oil. Who should be responsible for paying the tax? Preferrably the suppliers/refineries. But must such a charge apply to all uses of these fuels in order to be practible?
  - Subsidy either of infrastructure investment, equipment or gas.
  - Voluntary agreement: probably not realistic due to high number of restaurants.

Other measures and instruments which should be investigated: i) shut down of small power plants (they are often very inefficient and displaces production from large and cleaner power plants. Another measure is strict enforcement of scrapping of old, high emission buses. Bus companies get exemption due to difficult economic situation.

3.2.6 Other activities

In-between these activities, each task discussed and prepared Status reports for plenary presentation, and also started on DWP 99 work.

3.3 Plenary meeting at LongGui, Monday 9 November

AGENDA		
0900 - 1200	Status reporting, each task, by Task team leader (10 minutes per task, incl. questions and comments).	
	Summary of 1998 status.	Mr. Larssen
1030 - 1100	Coffee-break	
1200 - 1400	Lunch	
1400 - 1630	1st AQMS sequence. Presentations of results:	
	- emissions inventory	Mr. Gram
	- air pollution concentrations	Mr. Gram
	- simulation of measures	Mr. Larssen
	- control costs	Mr.Yager
	- population exposure distributions	Mr. Gram
	- health benefits from measures	Mrs. Aunan
	- comparison of costs and benefits	Mr. Yu/Mr. Haugland
	- CONCLUSIONS	Mr. Larssen
1530 - 1600	Coffee break	
1630 - 1700	Presentation of the draft Action Plan prepared by GZ Task 13.	

The Action Plan presentation was moved to the next morning, because the previous parts of the Agenda took longer time than expected.

3.3.1 Status Reports

The Status Reports for each of the 14 tasks are included in Annex 3.

The Status reporting in the Plenary meeting should be brief and pointed, and include the following:

- Main achievements, related to:
  - training, tools transfer
  - 1st AQMS analysis sequence
  - reports
- Main (critical) delays.

Here a brief summary is given.

Task 1 Emissions inventory

During the 2nd half-year 98, the task team has largely completed its work related to the 1st AQMS analysis sequence.

The task team has continued data collection, and much effort has been put into this task. As of November 1998, the emission data collection work is to a large extent completed, but there are still some holes. Especially industrial process emissions are lacking, and must be included.

During 2nd half-year, some data has been collected on ships and air traffic, and the input emission data files for the KILDER programs have been largely completed.

A draft report on the emission inventory for GZ has been written, incl. a background report on emission factors, especially for fuel combustion in stationary sources.

Mr. Jian Jianyang took part in the exchange program this year, and stayed at NILU for 4 weeks in May-June.

Task 2 Coal combustion and pollution

- Discrepancies in the energy balance were verified in association with the Statistic Bureau in Guangzhou.
- A lot of different kinds of information needed by other tasks has been collected and distributed.
- A report entitled " Energy Consumption and Coal Smoke Pollution in Guangzhou City" has been written and is being further developed.

Task 3 Dispersion modeling

During the 2nd half-year 98, the task team has largely fulfilled its task related to the 1st AQMS analysis sequence:

NORCE side:

The KILDER model has been delivered, and the GZ team has been trained in its use. The model was used to calculate 1995 air pollution in GZ, and the effects on the pollution of the following measures:

- 50% reduction of emissions from MCs
- gasification of buses (removal of all emissions from buses)
- 50% reduction of emissions from point sources (the fuel combustion only) in 3 central districts: Dongshan, Liwan, Yuexiu.

AirQUIS 2.0 pre-release version has been installed at appropriate computer equipment at GRIEP, and task personnel has been trained.

GZ side:

Necessary meteorological and topographical data preparations and processing has been done, and a wind field library established.

Mrs. Fang Xingqin took part in the exchange program this year, and stayed at NILU for 4 weeks in May-June.

Task 4 Monitoring

- Description of existing network and collection of existing data: The 1st draft of the Air Quality in GZ 1990-1995 report has been produced, and after that, additional data, as requested by NORCE side, has been delivered by the GZ side.
- Installment of new monitors: New PM_{10} and O_3 monitors have been installed at selected stations.
- Monitoring program with passive monitors: GEMC will monitor SO_2 and NO_2 at 110 locations. To be finished by June 1999.
- Improvement of the network: This task is delayed. GEMC is working on the improvement plan after receiving input from NEPA. NILU is presently working on an evaluation of the present network, to be used as input to the improvement plan.
- QA/QC training: Mr. Berg from NILU spent 2 weeks in GZ in July for guidance on QA/QC topics. A mission report was written.

Task 5 Exposure assessment

The task team has largely completed its work related to the 1st AQMS analysis sequence during the 2nd half-year 98:

NORCE-side:

- The KILDER model has been delivered and there has been given training in the use of the KILDER model. The user documentation of the model has been delivered. The population exposure calculations based on the long term average concentrations from the KILDER model has been performed, and the results has been given to Task 6.1.
- There has been given training in the use of the AirQUIS-2.0 model, and user documentation of the model has been delivered.
- A method of how to code the addresses of the persons which were selected within the traffic area of the interview study in the spring of 1998, has been established, and a report on this method has been written.

GZ-side:

- Finishing collecting population resident distribution on community areas, and the boundary co-ordinates for these areas of the basic year (1995).
- Finished collecting building data and building population data along typical major roads. Especially, the areas of Dongfengzhong Road and Beijing Road have been investigated. These data will be put into the AirQUIS-2.0 system.

Task 6.1 Health damage assessment

- The GZ team has performed the interview study on respiratory symptoms as planned. The interviews took place in February/March 1998. Questionnaires for 4000 adults and 2000 children have been punched. In spite of some problems i.a. with obtaining the precise home and work address of some of the respondents, overall the interview study has been performed successfully so far.
- The GZ team has collected statistical data from 1995, 1996 and 1997 for the annual total number of deaths and hospital admissions in GZ (7 districts, Tianhe not included).Only annual data were available for GZ as a whole. However, daily data on deaths and hospital admissions from 4 large hospitals are collected for 1995 (not complete), 1996, and 1997. Address is lacking for some patients.
- The NORCE team has provided guidance during the course of performing the interview study and the collection of health statistics,and regarding the processing of the data material obtained. An outline of a report from the interview study has been provided.
- The NORCE team has provided estimates of the reduced health effects of the measures selected for the 1st sequence, and a report was written. An Exel spreadsheet was provided that can be used to estimate health effects, using imported exposure estimates from KILDER.

Task 6.2 Material damage assessment

- Under the guidance of the NORCE team the GZ team has carried out the field exposure tests as planned in the period January 1997 to January 1998. The test materials were carbon steel and zinc, and the field study included 10 sites. This is basis for estimating dose-response functions for these materials. Tested panels from 3 sites were brought to NILU in May 1998.
- A classification system for buildings in GZ has been developed, and the distribution of buildings in these categories has been established.
- Based on field inspections and official statistical data, the average amount of various materials has been estimated for each of the defined types of buildings in GZ.
- Collection of data on building repair and maintenance costs have been finished.
- Climate data needed as input in the dose.response functions are collected
- Tool exchange: The tool Corrcost Exel V1.0 has been transferred to the GZ team.

Task 6.3 Vegetation damage assessment

- Two reports have been written by the GZ team so far:
- From subtask 2: "The selection of plant species of air pollution resistant in Guangzhou area";
- From subtask 6: "The status report of Guangzhou acid rain pollution and effect on the vegetation Eco-environment".
- It has been agreed upon to skip subtask 5 - Vegetation damaged by heavy metal. This is due to lack of sufficient data on heavy metal pollutants, and the

evaluation that heavy metals do not represent a big problem concerning vegetation damage in Guangzhou.

- Concerning crop losses due to air pollution, it is decided that one should try to estimate the rice crop loss due to ozone, provided that some indications of possible changes in ozone level can be estimated within the project.
- Concerning forest damage on Baijun mountain, changes in the composition of species in the forest will be described. Data on forest area and wood production will be provided.
- Concerning acid rain effects, the results will include effects only on pine and crops.

Task 7 Control options

- Dr. Cui and Mr. Fan took part in a training exchange just after the workshop in Norway. The main subject in this training was insight of the energy reference system and management of control option measures.
- The participants in the training started to do case studies in 5 different sectors (food and beverage, papermaking, power plants, chemicals and ferrous metal) and continued this work back home in GZ.
- The Markal model was installed in GZ (November 1998).
- After the workshop in GZ the task has collected information about measures for the Action Plan.
- A report entitled "Guangzhou Air Pollution Investigation" was prepared by professor Huang and reviewed by the GZ and NORCE teams.
- A report was drafted by NORCE entitled "Development of Future Emissions in GZ: Growth and Control", and this report is being further developed with GZ input.

Task 8 Baseline scenario development

Mr. Fan Changzhong took part in the exchange program this year, and stayed at ECON for 2 weeks (May-June). The objective of the training program was to construct a baseline scenario.

The following working paper were further developed:

- The general economic development scenarios of GZ during 1995-2000-2010
- Main tasks and targets by sectors (industry, transport and energy)
- Spatial distribution variation of the industries & inhabitants living houses in GZ city wide during 1995-2010
- Environmental targets and indexes
- Database of the economic development status in GZ before 1995

Task 8 will complete these working papers, which will be included into one single report.

Task 9 Cost-benefit analysis

Mr. Yu Jican took part of the exchange program this year, and stayed at ECON for two weeks (May-June). The purpose of the training program was to understand

the methodology and practical issues related to a costs-benefit and a cost effectiveness analysis.
Following working papers have been made:

- Cost benefit and cost effectiveness analysis of a control measure
- Note on how to estimate the value of health impact from air pollution
-

Task 6 and task 9 has just completed the report: Health damage assessment – 1st sequence calculation – reduced health effect and the entailed economic benefit.

Task 10 Policy options

Task 10 has carried out a general assessment of the main weaknesses strengths of the *implementation and enforcement* of air pollution control policies and regulations in industry, transport and power sectors at different political-administrative levels, e.g. city level and city district level.

Another activity has been to collect and study information of command and control instruments and economic instruments for vehicle emission control in Canada, USA, Netherlands, Germany and Norway.

Furthermore, task 10 has revised, extended and updated information and reports on existing and new air pollution regulations in power sector, industry and transport sectors, including more comprehensive comparisons of Chinese and international emission standards.

The regulatory systems of individual emission permits and of total amount control has been studied in greater detail.

A first draft report on successful international policy instruments for air pollution control has been prepared including experiences in Sweden, Germany, USA, Singapore and Norway.

Task 11 Motor vehicles pollution

- Road use data have been collected.
- Task 11 determined emission factors and delivered the results to Task 1.
- Vehicle use forecasts are being developed.
- Task 11 is providing all necessary data to tasks 7, 9 and 10 for analysis.

Task 12 Air pollution forecasting

The calculation of spatial correlations between air-quality monitoring stations in Guangzhou has been completed and a report has been written.

Ratios of NO_2 to NO_x for the auto-monitoring stations have been calculated and reported.

An analysis of the dependency of air-pollution level on measured wind and stability conditions is currently being done.

The Episode dispersion model is established at the GEMC.

Problems: A meteorological pre-processor is needed to transform readily available weather forecasts into dispersion fields for use in Episode. The pre-processor must be versatile and simple, and the current version at NILU needs some modifications before it can be used. Sources for (free) prognostic meteorological data for Guangzhou must also be investigated.

3.3.2 Overall Project Status (as of November, 1998)

Based upon the Status reports presented, Mr. Larssen presented the following overall project status:

Knowledge transfer, and training

- Much has been done as part of the task work, and the exchange program.
- Mrs. Li Zhiqin will go for training in Norway in 1999, and that will complete the exchange program.

To enable a good completion of the knowledge transfer and training, it is important that the Task Status reports for 1998 contain an overview of what has been accomplished, and what should still be done.

Transfer of tools

The following tools have been transferred by now:
- Models (KILDER, ROADAIR, EPISODE for forecasting);
- AirQUIS system (pre-release of version 2.0. Final version in February 1999);
- MARKAL.

To complete this item, the Status reports must contain an overview, and a completion plan.

Air Quality Management System

- Task work has been carried out towards establishing AQMS analysis capability in GZ, and a system/organisation in GZ to continue the work. This also includes the collection of necessary data, and establishment of groups that are familiar with the work, which can be continued after the project in finished:
    - Emission inventory for GZ;
    - 1995 air quality data and meteorological data;
    - KILDER calculations/preparations for AirQUIS calculations;
    - Damage assessment methods has transferred (health and materials);
    - Energy analysis carried out / fuel use analysed;
    - Scenarios for future development has been made
    - Cost data on control options and health endpoints must be developed further,

  and very soon;
    - Integration of tasks into a system of analysis, and team organisation: This must be developed further during 1999;

- 1st sequence of analysis: Carried out successfully and almost completely, according to plan. The main purpose was:
- training in carrying out the AQMS analysis;
- simulate cost-benefit of some actual measures.
- Organisation of AQMS work at GRIEP/in GZ must be well developed before the end of the project.

Action Plan development

- A 1st version has been proposed
- This work shall be continued with high priority, according to the plans for this (see e.g. the task/time sequence figures in the Annual Report for 1997).
- This is one of the main topics in the following work during this workshop.

Monitoring System Improvement

- A large number of new instruments have been purchased, partly for funds available in this project;
- Evaluation of the present system is being carried out, and modification of the monitoring system will be implemented.
- Quality control and assessment work and guidance from NILU has started.

Critical delays

There is a general delay slight in the project. This is not critical, as we believe we will be able to finish the project successfully, according to the original project plan.

Some delays may soon become critical, seen in relation to a successful completion, if certain tasks are not carried out soon:

Task	
1	Emissions data to be input into AirQUIS. Must be completed before Spring festival (by end of January, 1999). Task 1 work.
3	AirQUIS: A fully operational version must be made available before the end of Spring festival (by end of February 1999 at the latest). NILU must deliver.
4	PM_{10} and O_3 data must be made available. Task 4 work.
5	Future population data (distribution in GZ) must be worked out. Task 1 work.
6.2	Building materials inventory must be finished early in 1999.
7	Data on costs of control measures must be developed and available early in 1999.
7, 1	Data on process emissions must be made available early in 1999.
9	Costs of health effects (for specific health "endpoints) must be developed for GZ and made available early in 1999.
11, 1	Data on Chinese emission factors for motor vehicles must be made available early in 1999.

3.3.3 Presentation of 1st AQMS sequence

The first analysis sequence using the URBAIR air quality management system concept, was to be done using the KILDER modelling system. This was decided at the Workshop in Norway in May 1998. Below a summary is given of the results of those calculations , as presented to the plenary meeting:

- *Emission inventory for base year, 1995 (Mr. Gram)*

  Table 1 shows the total emissions from 5 source categories in the data base for the GZ model area (52 × 56 km), of SO_2, NO_x and Particles. The emissions are given as kg/hour, averaged over the entire year and also as 1,000 tons/year, for 1995 (the base year).

  The table also gives the calculated contributions from each of the 5 source categories, in terms of the following indicators:

  - the highest air pollution concentration contribution calculated for each category to any grid square (2x2 km);
  - the sum of concentration contributions to all grid squares (i.e. the entire area), for each category.

Table 1: Total emissions in 1995, in the GZ emission data base, per oct. 1998. Also calculated concentration contributions, in 2×2 km grid cells.

EMISSIONS, kg/h	SO_2	NO_x	Part
Large point sources (POI 50)	12,688	3,966	11,312
Small point sources (SmPOI)	1,664	578	1,269
Domestic & commercial (Dom)	1,937	358	545
Main roads (mtraf)	140	1,873	212
Local roads (straf)	92	1,200	135
Sum	16,523	7,976	13,474

EMISSIONS, 1000 t/year	SO_2	NO_x	Part
Large point sources	111.2	34.7	99.1
Small point sources	14.6	5.1	11.1
Domestic & commercial	17.0	3.1	4.8
Main roads	1.2	16.4	1.9
Local roads	0.8	10.5	1.2
Sum	144.7	69.9	118.0

Highest concentration	ug/m3 SO_2	NO_x	Part
Large point sources	120.4	34.5	53.7
Small point sources	21.3	9.1	17.4
Domestic & commercial	40.7	22.9	11.5
Main roads	1.6	7.5	2.6
Local roads	0.8	11.3	1.3
Background	15.0	20.0	25.0
Sum	139.8	74.3	85.0

CONCENTRATIONS, sum	ug/m3		
Large point sources	8,692	3,423	8898
Small point sources	3,288	1,150	2,405
Domestic & commercial	206	679	1,034
Main roads	284	3,807	524
Local roads	247	2,185	247
Sum	12,717	11,244	13,108

- *Air Pollution concentrations, calculated for 1995 (Mr. Gram)*

  The calculated concentration distributions in the model area, all sources added, are shown on figures on the next pages. The calculations are based upon the emissions and stack data contained in the database. Some of the calculated maxima (e.g. in the south-west for SO_2 and in the south for particles) may indicate that stack data for some sources may be erroneous (e.g. too low stack heights given).

  The KILDER model system was used, which calculated average concentrations in 2×2 km grid cells. Concentrations, and the resulting hot spot exposure near streets and roads, are not calculated with KILDER. This can be done by the AirQUIS system in the later calculations.

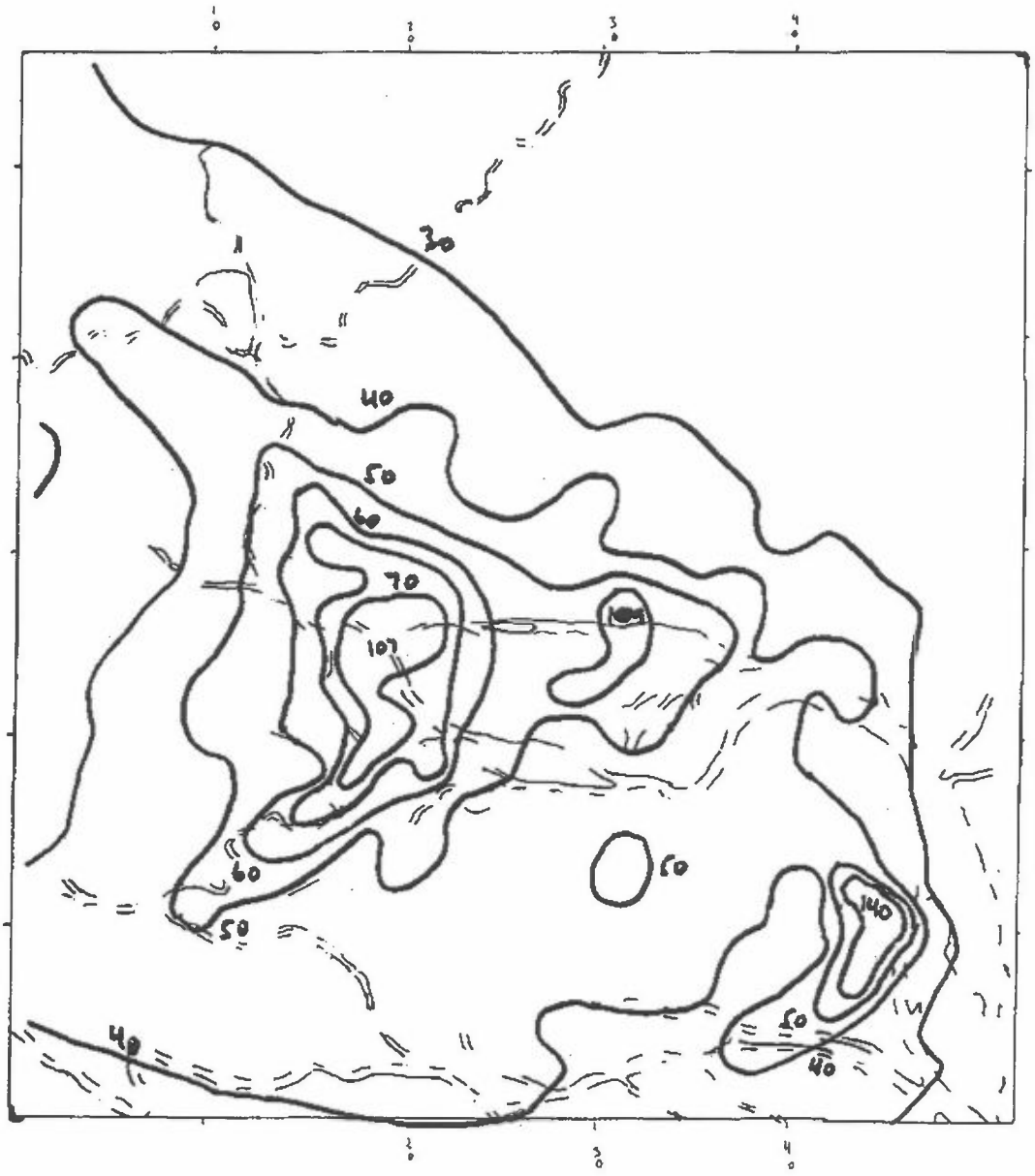

Figure 1: Isolines for SO_2 (based upon average calculated conc. in 2x2 km^2 grid cells). Sum traffic, point sources and other fuel use.

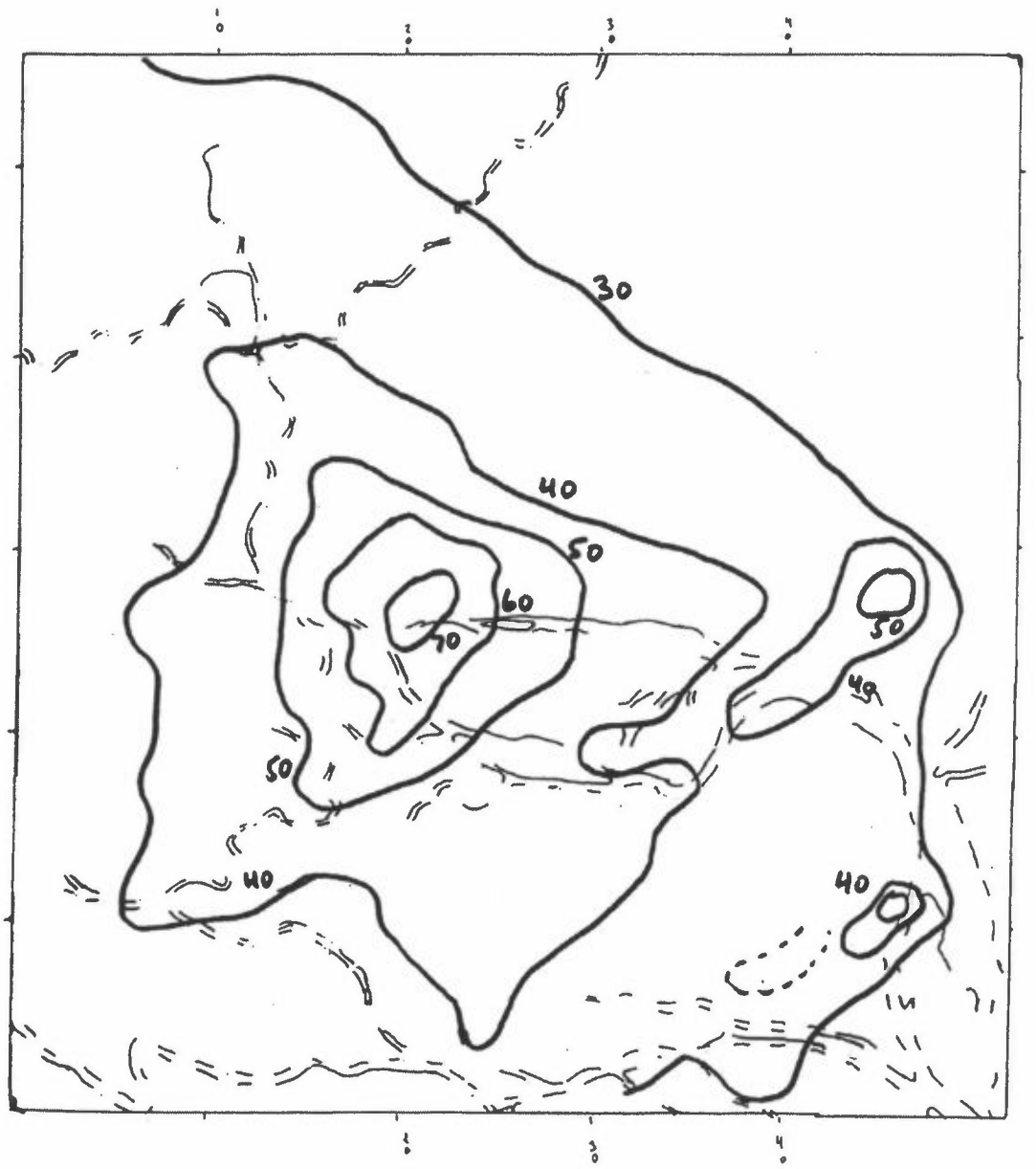

Figure 2: Isolines for NO_x (based upon average calculated conc. in 2×2 km^2 grid cells). Sum traffic, point sources and other fuel use.

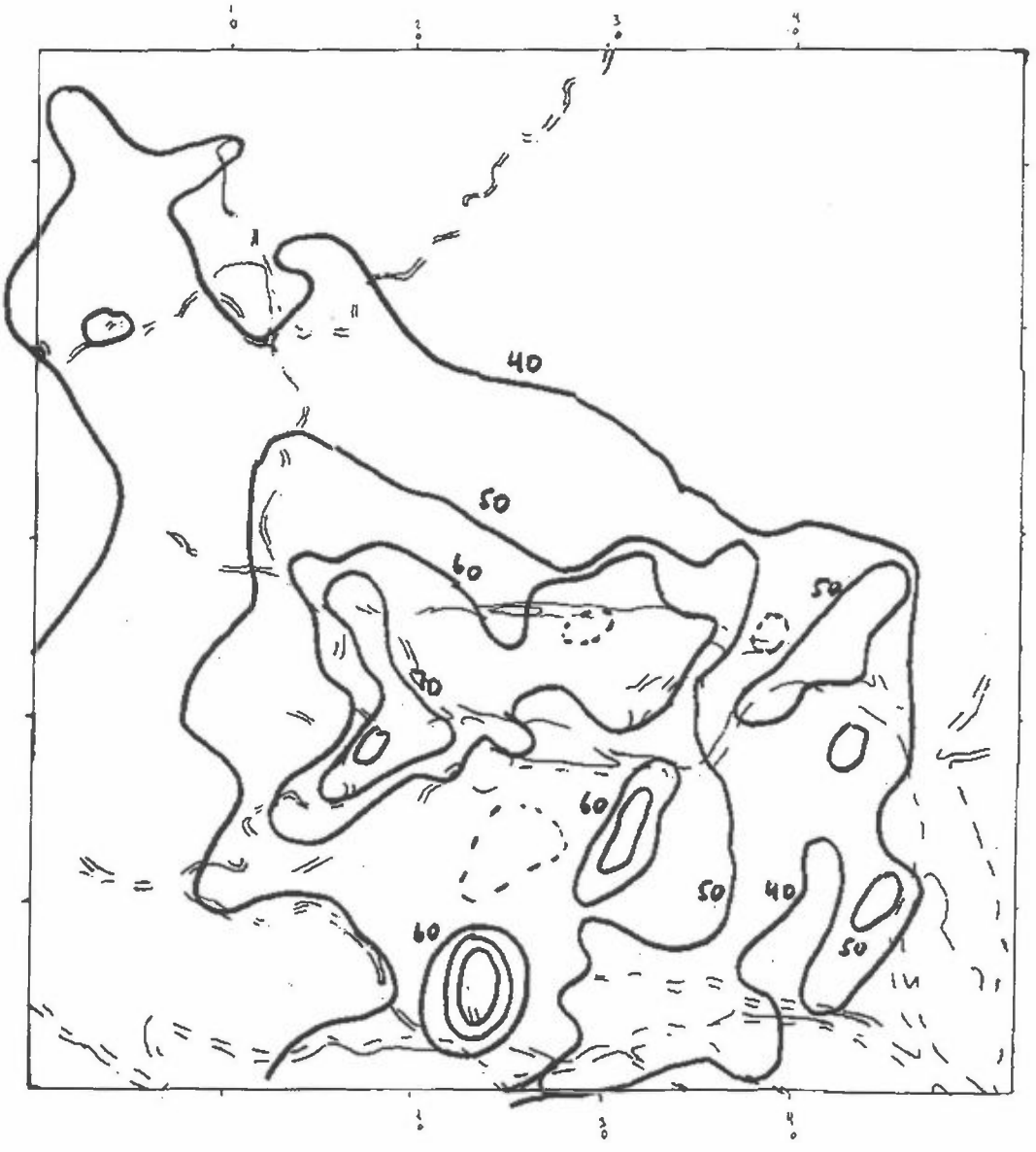

Figure 3: Isolines for particles (based upon average calculated conc. in 2×2 km² grid cells). Sum traffic, point sources and other fuel use.

- *Simulation of some selected measures (Mr. Larssen)*

  The 5 measures that had been selected before the workshop, by GZ side after input from NORCE, to be used for the 1st sequence, were as follows:

  - Phasing-out of motorcycles
  - Gasification of buses
  - Moving of factories from central disrticts of GZ
  - Improving burner efficiency
  - Gasification of 3rd industry.

  For the purpose of demonstrating the effects of such measures on the air quality of GZ, we chose to do the following simulations:

  1. Motorcycles : Reduction of MC emissions by 50%.
  2. Gasification of buses : Zero emissions from all buses.
  3. Moving of factories : Zero emissions from fuel combustion from all small-to-medium (area) industrial sources in Liwan, Yuexiu and Dongshan districts.

- *Population exposure distributions (Mr. Gram)*

  In the exposure calculations by the KILDER system the number of people living in grid cells where the calculated concentrations where above selected limits were added up, to give cumulative exposure/concentration curves. The results were presented for 1995, and for the simulated measures mentioned on the previous page. The resulting population exposure distributions are shown on the next pages, for each of 14 districts, and for GZ model area as a whole (see Table 2, Table 3 and Table 4).

- *Health benefits from measures (Mrs. Aunan)*

  Task 6 used the population exposure estimates from Task 3 and 5 to estimate the reduced health damage due to implementation of the following three measures: 1) Removing point sources from three districts (Dongshan, Liwan and Yuexiu) giving 50% reduction of emissions; 2) 50% reduction of emissions from motorcycles; 3) Fuel switch to gas for buses.

  Relatively little effect on population exposure was seen from the two last measures, as opposed to the first one. One important reason for this is that street-level hot-spot exposure has not yet been calculated. The possibility to do this will be provided by AirQUIS.

  The health damage was estimated in physical units by Task 6 (see Table 5) in economic units by Task 9, (see Table 6).

  At this stage the estimates should be regarded more as a demonstration of the methodology than as final estimates, because of the considerable uncertainties involved. This is discussed in a joint report from Task 6 and 9 "Health damage assessment – 1st sequence calculations - Health improvements and the entailed economic benefit" (January 1999).

Table 2: Cumulative population exposure distributions for SO_2 (number of people exposed above given concentration), in each district, and totally, calculated upon the emission data base and the KILDER calculations described above.

Limit ug/m3	Dongshan	Liwan	Yuexiu	Haizhu	Tianhe	Fangcun	Baiyun	Huangpu	Central GZ	Panyu	Zengcheng	Foshan	Nanhai	Shunde	Total
15	575,590	530,795	457,462	734,459	412,382	159,339	721,810	179,242	3,771,079	553,735	36,600	376,892	497,525	316,750	5,552,602
20	575,590	530,795	457,462	734,459	412,382	159,339	551,110	176,554	3,597,691	553,735	0	376,892	497,525	316,750	5,342,613
25	575,590	530,795	457,462	734,459	396,300	159,339	443,470	117,045	3,414,460	547,790	0	376,892	497,525	316,750	5,153,437
30	575,590	530,795	457,462	734,459	338,156	159,339	283,540	61,480	3,140,821	520,615	0	376,892	421,302	306,663	4,766,313
35	538,753	530,795	457,462	734,459	204,130	159,339	166,840	49,829	2,841,607	405,113	0	247,586	325,510	185,611	4,005,446
40	208,363	530,795	447,398	721,239	106,807	159,339	122,130	15,235	2,311,306	151,172	0	0	181,299	40,349	2,684,139
45	34,535	438,968	228,273	536,890	63,094	154,241	66,230	896	1,523,127	61,998	0	0	91,678	8,068	1,684,881
50	0	23,355	0	99,882	37,939	136,076	22,090	0	319,342	36,520	0	0	38,112	2,016	395,995
55	0	23,355	0	84,463	13,196	89,549	18,430	0	228,993	19,534	0	0	23,692	0	272,220
60	0	0	0	72,713	13,196	54,494	8,250	0	148,653	8,493	0	0	16,482	0	173,628
65	0	0	0	72,713	13,196	32,983	0	0	118,892	8,493	0	0	4,120	0	131,505
70	0	0	0	72,713	13,196	27,725	0	0	113,634	8,493	0	0	4,120	0	126,247
75	0	0	0	0	13,196	4,780	0	0	17,976	8,493	0	0	4,120	0	30,589
80	0	0	0	0	13,196	0	0	0	13,196	8,493	0	0	0	0	21,689
85	0	0	0	0	13,196	0	0	0	13,196	5,096	0	0	0	0	18,292
90	0	0	0	0	13,196	0	0	0	13,196	5,096	0	0	0	0	18,292
95	0	0	0	0	13,196	0	0	0	13,196	5,096	0	0	0	0	18,292
100	0	0	0	0	0	0	0	0	0	5,096	0	0	0	0	5,096
105	0	0	0	0	0	0	0	0	0	5,096	0	0	0	0	5,096
110	0	0	0	0	0	0	0	0	0	5,096	0	0	0	0	5,096
115	0	0	0	0	0	0	0	0	0	5,096	0	0	0	0	5,096
120	0	0	0	0	0	0	0	0	0	5,096	0	0	0	0	5,096
125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 3: Cumulative population exposure distributions for NO_x (number of people exposed above given concentration), in each district, and totally, calculated upon the emission data base and the KILDER calculations described above.

Limit ug/m3	Dongshan	Liwan	Yuexiu	Haizhu	Tianhe	Fangcun	Baiyun	Huangpu	Central GZ	Panyu	Zengcheng	Foshanshiq	Nanhai	Shunde	Total
20	575590	530795	457462	734459	412382	159339	721810	179242	3771079	553735	36600	376892	497525	316750	5552602
25	575590	530795	457462	734459	412382	159339	595250	176554	3641831	553735	2196	376892	497525	316750	5388949
30	575590	530795	457462	734459	406609	159339	456110	123318	3443682	497684	0	376892	497525	316750	5132553
35	575590	530795	457462	734459	329909	159339	344210	102706	3234470	323580	0	369831	440874	250172	4618947
40	575590	530795	457462	733725	233824	159339	241690	48036	2980461	142679	0	159760	317271	62541	3662729
45	575590	530795	457462	710226	157533	159339	181110	39434	2811489	25479	0	0	195722	1008	3033710
50	538753	530795	457462	676443	58146	159339	143690	7170	2571798	8493	0	0	84468	0	2664770
55	538753	530795	457462	558929	19794	148186	129550	7170	2390639	5096	0	0	17511	0	2413256
60	358018	523364	447398	506048	0	128748	97610	0	2061186	0	0	0	10301	0	2071493
65	52954	469223	439164	305539	0	83336	83700	0	1433916	0	0	0	0	0	1433920
70	34535	247351	193964	155707	0	29478	16590	0	677625	0	0	0	0	0	677628
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
165	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 4: Cumulative population exposure distributions for particles (number of people exposed above given concentration), in each district, and totally, calculated upon the emission data base and the KILDER calculations described above.

Limit ug/m3	Dongshan	Liwan	Yuexiu	Haizhu	Tianhe	Fangcun	Baiyun	Huangpu	Central GZ	Panyu	Zengcheng	Foshanshiq	Nanhai	Shunde	Total
25	575590	530795	457462	734459	412382	159339	721810	179242	3771079	553735	36600	376892	497525	316750	5552602
30	575590	530795	457462	734459	412382	159339	562810	176554	3609391	553735	0	376892	497525	316750	5354313
35	575590	530795	457462	734459	397949	159339	447870	118837	3422301	546941	0	376892	497525	316750	5160429
40	575590	530795	457462	734459	346816	159339	302800	92847	3200108	466263	0	376892	455294	316750	4809997
45	553718	530795	457462	734459	225162	159339	191700	65961	2918596	363500	0	308488	330659	226969	4148231
50	538753	530795	457462	720505	92372	159339	145950	39074	2684250	182593	0	1765	229714	137190	3235530
55	337871	523364	447398	716833	78764	159339	111010	17925	2392504	93418	0	0	114340	46400	2646679
60	34535	469223	228273	545703	51959	148186	65160	896	1543935	25478	0	0	38112	13111	1620646
65	34535	270706	193964	174799	18144	128748	32670	896	854462	15287	0	0	21632	6050	897437
70	0	23355	0	76384	4948	86841	16080	896	208504	10191	0	0	21632	2016	242345
75	0	0	0	72713	0	49236	5380	0	127329	6794	0	0	4120	2016	140260
80	0	0	0	72713	0	22945	0	0	95658	4246	0	0	4120	1008	105033
85	0	0	0	0	0	0	0	0	0	1698	0	0	0	0	1698
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
165	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 5: Estimated reduced health effects obtained from implementing abatement measures in GZ.

	Central	Low	High
Number of deaths	70	47	94
Hospital admissions (cases)*	455	0	1189
Respiratory hospital admissions (cases)**	140	81	186
Outpatient visits (cases)*	11215	6746	15684
Emergency room visits (cases)	2736	1490	3993
Restricted activity days (person days)	669434	470350	1051303
Lower respiratory infection/child asthma (cases)***	268	163	373
Asthma attacks	30363	15182	254269
Chronic bronchitis****	710	361	1071
Respiratory symptoms (cases) (mill.)	2.13	1.06	3.19

* *From SO_2 functions*
** *NB:subfraction of HA*
*** *Task 9: Assume 6 months duration of disease (uncertain, no references given)*
**** *Task 9: Assume 5-10 y duration of disease*

Table 6: Estimates of economic benefit regarding reduced health impact (million Yuan).

	Central	Low	High
Death	43.4	29.2	583
Hospital admissions	3.8	0.0	9.9
Respiratory hospital admissions	0.7	0.4	1,0
Outpatient visits	-	-	-
Emergency room visits	0.3	0.2	0.5
Restricted activity days (person days)	16.1	11.3	25.2
Lower respiratory infection/child asthma	0.03	0.02	0.04
Asthma attacks	0.4	0.2	3.5
Chronic bronchitis	49	25	74
Respiratory symptoms	17	8.5	26
Total	131	75	723

- *Costs of measures (Mr. Yager)*

For stationary emission sources, there are five categories of measures to be addressed. These are:

1. reduced fuel use through energy efficiency improvements;
2. improving fuel quality through either pollutant removal or fuel switch;
3. improved combustion conditions through boiler rehabilitation or burner replacement;
4. removal of pollutant from the stack gases through end-of-pipe technologies;
5. process modifications or technology changes.

The measures under categories 2, 3 and 4 above add cost to the production of goods in a factory, for example. And the benefit is reduced emissions. However, measures under category 1 above reduce the cost of production of goods in a factory as well as reduce emissions because of reduced fuel use. These efficiency improvements should always be considered before measures in the other categories. If measures under category 1 are implemented first, then any measures under categories 2, 3 and 4 will have lower costs.

The following table (Table 7) indicates various measures that can be implemented in different industrial sub-sectors. It is necessary to conduct an energy audit analysis of a number of factories to determine the costs and enegry reduction benefits of these measures. This can be quickly done with the assistance of a qualified local energy audit engineer.

Table 7: Energy savings related measures in some selected industrial sectors.

Industry	Paper Products	Ferrous Metal	Food and Beverage	Chemical Fibre	Etc....
Measures					
Boiler maintenance	*		*	*	
Variable speed motors	*		*	*	
Burner replacement	*		*		
Steam system			*	*	
Compressed air	*	*	*	*	
Waste heat recovery	*	*	*	*	
Lighting	*		*	*	
Fuel switch	*		*		
Combined Heat and Power		*		*	
INVESTMENT					
PAYBACK					
Annual energy saving					
Annual emission saving					

- *Comparison of costs and benefits (Mr. Yu, Mr. Haugland)*

At this stage it has not been possible to provide all the data on effects of measures and their associated cost that are required to do a full cost benefit analysis. Methodological issues related to the compilation of such data were discussed. The emphasis was put on estimates for costs on moving factories and the ban on use of motorcycles (MC). These two measures are the most complex to estimate.

Moving factories for example need to take into consideration the following costs and income:

Income/cost category	*New location*	*Old location*
Income from production	I_n	I_o
Costs of production	C_n	C_o
Moving costs	M	
Costs of land	L_n	L_o

When these are estimated the abatement costs of the measure can be calculated as::

$$AC= M+(C_n-C_o)+(L_n+L_o)-(I_n+I_o)$$

For the ban on MC the main challenge is to estimate the environmental effects of the measures, i.e. what sort of transport mode is chosen in absence of MC, if any, and what is the impact on pollution? An approach for dealing with this must be discussed and agreed upon.

3.3.4 Conclusions from the 1st AQMS sequence exercise (Mr. Larssen)

Although all work related to the 1st sequence has not been carried out fully, we can conclude the following:

- We have demonstrated an analysis of proiritising abatement measures for urban air quality in GZ, based upon cost-benefit analysis.
- Due to time constraints and spatial separation between the GZ and NORCE teams, much of the work was done by NORCE, but some contributions came from the GZ task teams.
  The most important is that the demonstration has been done, and that it is understood by all collaborators in the project, and by the project leadership and also the GZ environmental authorities.
- It is important that in the coming days, the task teams discuss the methodologies and results, and try to repeat some calculations.
- This 1st sequence of analysis should only be considered as a demonstration, since some important effects are so far not considered.
- Example: Street-level exposure not considered.
- Health benefits of abatement measures may be substantial.
- Control cost work must be developed further in this project. This development must occur fast.
- Organisation within the GZ team is necessary to carry out such calculations for different measures next year, and to have an organisation that can carry the work forward in the future.

3.3.5 Action Plan: Presentation and discussion of 1st draft from GZ side

The draft Action Plan document:

The Guangzhou side had prepared for discussion, according to plans, a first draft of an Action Plan document. This interesting document had the following main contents (itemised):

Part I The social, economic and environmental situation of GZ, and prognosis for future development

Part II Strategic objectives for improving the air quality of GZ

Targets and Strategies for "objective" year (2001)
Targets and Strategies for "tendency year" (2010).

Part III Action Plan of controlling air pollution in GZ

Measures for 2001 were listed under the following topics:
- City planning (e.g. re. functions of city central and other areas, new industrial zones, etc.
- Construction projects (e.g. move airport, subway lines, inner ring road, etc.
- Environment management (with list of policies and objectives, existing and to be developed).

For 2010 a systematic approach to analysis of actions was set up, under the following topics:

- Industries: electric, construction materials, petrochemical, minerals, food processing, plastics processing, rubber processing, other.
- communication and transportation: motor vehicles, trains, ships, air planes.
- 3rd industry: catering, hotels.
- domestic energy: LPG, coal, electricity.
- agriculture.
- natural sources.

Part IV Costs and benefits

Part V Policy instruments

Part VI Clean Production Technology

The document was based upon the general AQMS concept of our project: To prioritise measures according to an analysis of and comparison between the costs and the benefits associated with each proposed measure. The analysis sequence in described above.

In this first draft, all chapters had not yet been written, but it is a basis for the further work on the Action Plans.

The presentation of the document:

Mr. Wu gave a presentation of the draft document.

In his presentation, it became clear that it was very important for the Guangzhou side that the work on action plans would concentrate first on the year 2001. This is because of the large emphasis the city authorities is placing in becoming an environmental model city, and preferably within 2001. They put a great emphasis on the use of our methodology NOW, as a basis for the 2001 Action Plan development. It is very important to be able to meet set AQ targets within a certain budget, and thus our concept of AQMS based upon cost-benefit analysis is necessary.

Several near future activities which are to take place in GZ may depend upon GZ reaching certain environmental targets.

Significant World bank funds are being used for construction of airport, inner ring road, etc. The results of analysis emanating from our project would give GZ government objective reasons for utilising these funds fully, and may be more efficiently in terms of reaching certain environmental targets at least cost.

Discussion:

By their draft document, a first version of a systematic approach to the development of Action plans for GZ has been established.

We will do our best in assisting the GZ side in using the AQMS analysis methodology of our project. The assistance will be based upon the use by the GZ side of the tools, methods and knowledge that has been transferred from NORCE during the 2 first years of the project, a work which is still going on.

Due to the urgency of doing the first analysis (for 2001), and with a view to the status of the knowledge transfer and the state of application of these methods by the GZ side, it was established that the basic concepts of the analysis and prioritising of measures for the two years would be as follows:

- 2001 :	Main objective	:	To meet air quality targets (national standards)
	Basic method	:	Prioritising based upon cost-effectiveness analysis, i.e. analysis of the least-cost package for reducing the air pollution exposure to below the standards. In this method, effects of air pollution will not be analysed.
- 2010 :	Main objective	:	More generally to reduce the effects of air pollution to an acceptable level.
	Basic method	:	Analysis of costs and benefits of selected measures, based upon the analysis of effects, and their monetary value. Prioritising of measures according to cost-benefit analysis. Calculation of least cost packages for reaching certain targets in terms of environmental quality.

3.4 Plenary meeting at GRIEP, Thursday 12 November, 1999

AGENDA		
0900 - 1200	Detailed work plans, each task, by Task team leader (10 minutes per task, incl. questions and comments).	
	Summary of 1999 Work Plan Finalisation plan of the project	Mr. Larssen
1030 - 1100	Coffee-break	
1200 - 1400	Lunch	
1400 - 1530	AirQUIS demonstration	Dr. Ciu Xia Mrs. Fang Xingqin Mr. Rune Ødegård
1530 - 1600	Coffee-break	
1600 - 1700	Action Plan, discussion about next steps	Mr. Larssen
1700	Closing of the workshop	

3.4.1 Work Plan for 1999

1999 is the last year of the 3-year project. During the 2 first years there was a concentration on the following:

- transfer of methodologies, tools and instrumentation, and training through the exchange program and through the task work, where the GZ and NORCE teams work together.
- collection of the data needed for an objective air quality management process, and action plan development based upon cost-benefit analysis.

Most of this work has been finished, although some parts of it need to be completed.

In 1999 the work must concentrate on the development of the Action Plans.
The main objectives for the work in 1999 is shown below.

1999 WORK PLAN

MAIN OBJECTIVES
First priority: • Develop action plan related to 2001. Further objectives: • Finalise all knowledge / tools transfer incl. documentation (in technical reports) • Finalise data collection, the first "batch" • Develop Action Plan related to 2010 • Improve the monitoring system • Finalise the all task work • Final reporting

Based upon this , the work plan for 1999 can be divided in several parts:

1.	Make AirQUIS operative at GRIEP	: by January 1999 (end of February latest)
2.	Completion of data collection	: January - March
3.	Action Plan 2001 development	: January - May
4.	Completion of training program	: January - October
5.	Completion of task work, incl. reporting	: by October
6.	Action Plan 2010 development	: March - November
7.	Final reporting to NORAD / MOST	: by March 2000.

Detailed Work Plans (DWP) for each task are given in Annex 4.

Details regarding each of the above points are:

1. Make AirQUIS operative at GRIEP

A prerelease version of AirQUIS 2.0 was installed at GRIEP in November 1998, and selected persons given training. The prerelease version is suitable for the input of the necessary data (emissions, meteorology etc.) for the later model calculations. A final version of AirQUIS 2.0 will be installed before the end of February 1999.

2. Completion of data collection

In several of the tasks completion of data collection is necessary. This is detailed in each of the DWPs (see Annex 4).

3. Action Plan 2001 development

The task-time sequence of this development is shown below:

TASK	TASK#	RESP	TIME
Activity scenario, 2001. Changes, baseline, 1995 - 2001			
- Population, energy, industry	8	GZ	Dec. 98
- Vehicles, traffic	11	GZ	Dec. 98
Emissions into AirQUIS			
- 1995	1	GZ	Jan. 99
- 2001 (change factors)	1	GZ	Jan 99
Action Plan, 2001: Selected measures	13	GZ/NORCE	Early Jan. 99
AirQUIS, complete version	3	NORCE	Feb. 99
Air quality data, time series, to Task 3 for model validation	4	GZ	Feb. 99
Validation of model	3	GZ	Early March 99
Control options: Details related to the selected measures	2,7,11	GZ/NORCE	Feb. 99
Costs of control options	2,7,9,11	GZ/NORCE	March 99
Costs, health "endpoints"	6.1,9	GZ (NORCE)	March 99
Simulation of effects on air quality of the selected measures - Population exposure distribution, percentage of population above AQ standards	3	GZ	March-April 99
Health benefits of measures	6.1,9	GZ/NORCE	April 99
Material damage, first estimation of benefits of measures	6.2	GZ/NORCE	April 99
Vegetation damage, first estimation of benefits of measures	6.3	GZ/NORCE	April 99
Cost-effectiveness calculations	9	GZ/NORCE	April 99
Workshop to discuss and finalise the Action Plan 2001	13, all	GZ/NORCE	1st week, May 99

4. Completion of the training program

This concerns several of the tasks. Details are given in the DWPs (see Annex 4).

5. Completion of task work, incl. reporting

Details are given in DWPs. Several reports are planned in each of the tasks. The present list of task reports is given in Annex 3.

6. Action Plan 2010 development

This work should start during Spring 1999, by developing further the List of selected measures used as basis for the Action Plan 2001. The further detailed plan for the work must be made by the Workshop in May 1999.

7. Final reporting to NORAD / MOST:

The final reports to NORAD / MOST shall be delivered before March 2000.
The contents of the final reporting, and the time schedule for this, should be discussed during the workshop in may 1999.

3.4.2 AirQUIS Demonstration

The capabilities of the AirQUIS-2.0 system were demonstrated. As a result of the intense training before and during the workshop, the demonstration was carried out completely by GZ personnel, i.e. Mrs. Fang Xingqin and Dr. Cu Xia.

3.4.3 Action Plan, further discussions

Mr. Larssen presented a view of some available abatement measures, and their potential for improving the air quality in GZ.

The starting point was a comparison between the air quality targets (the national standards, class 2 areas), and the present AQ in GZ:

Compound	Averaging time	Target, class 2 (mg/m^3)	Air Quality in GZ 1995
SO_2	Annual 24-hour	0.060 0.150	0.075 (max value) 0.200 - 0.300
NO_x	Annual 24 - hour	0.100 0.150	0.134 (max value 0.240) 0.300 - 0.800 (1.6 at GEMC !)
TSP	24-hour	0.300	0.600 - 1.400

There is a need for a large improvement in the air quality to reach the targets.

The table below shows the measures mentioned by Mr. Larssen as having potential for significant air pollution reduction.

Measure	2001	2010
SO_2		
Low-sulphur coal and oil	X	XX
Gasification, 3rd industry	X	XX
Reduce PP emissions in GZ	X	XX
- especially on high pollution days	X	
NO_x		
Diesel bus, gasification	XX	New buses, TWC
Gasoline uses		New buses, TWC
Gasoline cars		New cars, TWC

Measure	2001	2010
Diesel cars		New
Trolley buses	X	XX
Motorcycles	No new licences	
Limit traffic substantially	X	XX
TSP		
Cleaning of streets	XX	
Clean transport of materials on trucks	XX	
Clean construction (keeping construction sites clean)	XX	
Cleaning equipment on PP	X	XX
Improve burners/boilers	X	
Gasification, 3rd industry	X	XX
Cleaner coal	XX	XX
Ban on refuse burning	X	

XX means larger potential than X
TWC: Three-way catalyst.

As a conclusion of this presentation and discussion afterwards, we made the following plan for immediately continuing the first steps in the development of the 2001 action Plan:

Action Plan 2001 **Development process**	
1. The 1st selection proposed at the workshop 12 November 1998 to be evaluated and amended, and sent to Guangzhou task 13	By 15 December
2. GZ side to comment and completed, and send to NORCE side for final comments.	By 10 January
3. More commenting rounds may be necessary, but the final list of selected measures must be ready by end of January, at the latest.	By 31 January
4. GZ side will continue the work on the Action Plan document, with a view to the contents list of the document proposed by NORCE side during the meeting at GRIEP on 11 November.	By 31 January (updated draft, background part)
An updated version of the outline, and the background part of the document should be ready for commenting by NORCE side before the end of January. NORCE will be ready to assist in the writing of the updated draft, when requested by GZ side. The rest of the chapters of the document will be written after January.	

4 Minutes from meetings

4.1 Project Leading Group Meeting, 5 and 13 November at GRIEP

		5 Nov.	13 Nov.
In attendance:	Mr. Wu	x	x
	Mr. Yu Kaiheng	x	x
	Mr. Li Xiangang, GEMC		x
	Ms. Liu	x	x
	Ms. Su Xing	x	x
	Ms. Feng Lin, GEPB		x
	Mr. Steinar Larssen	x	x
	Mr. Andy Yager	x	x

1. Project Reporting

a) Workshop REPORT

The contents will include the following.

- Summary
- Status for 1998 (to be drafted by NORCE and then comments provided by GRIEP)
- Detailed work plan for 1999 (to be drafted by NORCE and then comments provided by GRIEP)
- Workshop report to include description of training and software provided to GRIEP.
- Action plan

b) Annual report to NORAD and SSTC (MOST)

The contents will include the following.

- Summary of WS report
- Economic report for 1998
- Budget for 1999
- Agreement between GRIEP and NORCE for 1999 Activities
- Achievement report

2. Agreement for 1999 Activities

(to be signed between GRIEP and NORCE; STL to draft by 10.06.98 for review by GRIEP and for signing on 13.06.98)

- Workshops (The Spring workshop will focus on the action plan. Tentative WS dates during 3.05.99-7.05.99. The last workshop should be combined with the UNDP project workshop in GZ in November 1999. The last workshop to follow UNDP workshop.

- Exchange: Ms. Li will stay in Norway for 6 weeks during 1999. Dates to be decided.

- Budget for 1999: As per original budget plan adjusted to include 1998 surplus.

- Activities to be focussed toward achieving planned outputs.

- Agreement regarding AIRQUIS (see point 7 below).

3. Project Status

Mr. Wu expressed that the project is proceeding according to the work plan. However, he also expressed mainly two concerns:

1. Need to improve the air monitoring.
2. Action Plan. He is concerned whether there is sufficient scientific basis upon which to base the scenarios for 2001 and 2010. There is a lack of capability at GRIEP to do cost/benefit analysis. Task 7 and 9 require more support from the Norwegian side. GRIEP will add personnel to these tasks in order to strengthen their capacity to perform this work. Mr. Wu will provide more details via e-mail after he has reallocated personnel to tasks 3, 7 and 9.

Re Chongqing and SEPA action plans, GRIEP will visit and obtain more details about these activities.

During the next workshop, GRIEP expects that the achievements will be concrete and lead to clear actions.

NORCE believes it will be useful that NORCE specialists from Task 7 and Task 9 (and including Dr. Hu Tao) visit GRIEP early in 1999 to support these tasks. GRIEP agrees that this will be useful.

GRIEP has a good working relationship with the Chongqing environment research institute, and Mr. Wu plans to visit them to obtain information.

4. Action Plan

GRIEP to give an English translation to NORCE by 9.11.98.

The action plan indicates that GZ will be a model (environmental) city in China.

GRIEP agrees that the draft action plan for the 2001 scenario should be completed before the May 1999 workshop and that it should be a focal point of the workshop. Achievement of this goal will require a clear time schedule for each task. The detailed work plans should address activities required to complete the action plan for 2001 in addition to their other activities. NORCE will provide specific suggestions to GRIEP for revision of the action plan outline.

5. Transfer of Funds to GRIEP for 1998

The following amounts will be transferred from the Norwegian side.

- NOK 30,000 for collection of data for exposure assessment (from NORAD to SSTC, then to GSTC).

- NOK 50,000 for workshop expenses (from NORCE to GRIEP).

6. Invoicing

NORCE 4th quarter invoice to be sent to NORAD by December 10, 1998. GRIEP to be prepared to review/approve NORCE invoice within one week of receipt of the invoice from NORCE.

GRIEP asked that NORCE be aware to minimise direct costs (refer to NOK 7000 in postage incurred by trainees in Norway).

7. AIRQUIS

GRIEP repeated the request during the AIRQUIS presentation on November 12, 1998, that the AirQUIS software should include ozone (i.e. photo-chemistry). This will require a Unix work station at GRIEP.

8. Cooperation with UNDP

NORCE emphasized the need to co-ordinate efforts in the two related projects in GZ now: Our project and the UNDP project of NO_x emission reduction.

Two international workshops/seminars to be held next year. Workshops on our project and the UNDP project should be combined, if possible.

9. Miscellaneous

GRIEP had no further comments to the May 1998 Workshop report.

10. Detailed Work Plan and project finalisation

Mr. Larssen will prepare a clear plan for 1999.

Status reports must be completed for each task and submitted to Mr. Larssen by December 1,1998.

Detailed work plans will be completed by December 20, 1998. Then Mr. Larssen will prepare an integrated work plan to ensure successful project finalisation.

4.2 Meeting about AirQUIS, 13 November 1998 at GRIEP

Participants: Mr. Larssen, Mr. Yu, Mrs. Fang, Mr. Sloerdal, Mr. Oedegaard, Mr. Wang.

At this meeting the following points were discussed.

1. Administration of the AirQUIS-2.0 system at GRIEP.
2. Maintenance contract
3. Oracle license and support
4. Support of the HP hardware (the server and the client that was shipped from Norway)
5. ArcView.

Mr. Larssen also wanted to discuss with GEMC personnel about AirQUIS-2.0 at GEMC, but since there were no people from GEMC present this was not discussed.

1. Administration of the AirQUIS-2.0 system at GRIEP.

Mr. Larssen wanted to know which persons would have the main responsibility of the AirQUIS-2.0 system at GRIEP, and also responsibilities for various modules, such as indicated on the transparency about this that Mr. Larssen showed in plenary meeting (emissions, traffic, point sources, dispersion, etc.) Mr. Yu answered that he had to discuss this with Mr. Wu before he could give an answer. He only pointed out that Mr. Wang Daoming would be one of the persons in this group.

Mr.. Yu accepted that they should decide on this by the 1st of December 1998.

2. Maintenance contract

Mr. Larssen suggested that a maintenance and/or updating contract between GRIEP and NILU about future versions of the AirQUIS system, should be written. The two sides should try to decide on these matters by the next workshop, in May 1999.

3. Oracle license and support

Mr. Larssen informed that GRIEP has to buy one ORACLE 7 license. The present ORACLE version which is installed in the AirQUIS-2.0 system at GRIEP is only a demo version and it will not be legal to use this in the future. Mr. Larssen said that the costs of this license was not included in the original project plan, and that GRIEP therefore had to pay for this license. Mr. Yu disagreed and said that this costs in his opinion should be paid by the Norwegian side. This has to be discussed further in the project leading group.

4. Support of the HP hardware

Mr. Yu did not know exactly how many years the guarantee period lasted for, but believed that it was about 3 years. GZ side must check this up.

Mr. Oedegaard informed about the new network card that was installed in the server in Norway. The HP-expert that already has been at GRIEP and repaired the server, knows about this. He said that this was of no problem for HP and their continuous support of the computers. Mrs. Fang wanted Mr. Oedegaard to send her the software of the network drive.

Mr. Oedegaard informed that he would leave the Hub that he brought with him from Norway. No payment for this equipment was required, but if it broke down, GRIEP would have to pay for the new one. Mr. Yu agreed on this.

5. ArcView.

Mr. Oedegaard highly recommended that GRIEP buy ArcView. The cost of this is approximately 10 000 – 15 000 NOK. Such a license will potentially save a lop of working time, when working on input data and "shapes" for AirQUIS.

Mr. Yu said that they would consider this.

4.3 Meeting about Task 7 (control options) capacity at GRIEP, 11 November 1998

Present: Mr. Wu, Mr. Yu, Dr. Cui, Mrs. Liu
Mr. S. Larssen, Mr. A. Yager, Mr. T. Krogh, Mr. T Haugland

This meeting was called as a result of the realization that Task 7 (Control Options) needs to be strengthened. This concern was also raised in the Project Leading Group meeting.

NORCE made a suggestion that Prof. Huang and Mr. Jian Jianyang be directly connected to Task 7.

Mr. Wu. GRIEP concluded the following:

- Mr. Cui should now concentrate on Task 7 work. This means that he should leave the AirQUIS administration task. Mr. Cui will act as an advisor on the AirQUIS system.
- Task 7, 8 and 9 must co-operate closely
- Mr. Wu will try to get Prof. Huang, who is now retired connected with the Task 7 work.
- GRIEP has no industrial engineers on the staff. Such engineers must be hired from outside, as consultants.

4.4 Meeting about Action Plans, 11 Nov. 1998 at GRIEP

Present: Mr. Wu, Mr. Yu, Mrs. Huang (GEMC), Mr. Fan, Mrs Liu
Mr. S. Larssen, Mr. T. haugland, Mr. Hu Tao

The credibility of the Action Plans to be developed will depend upon that we will be able to clearly demonstrate:

- the scientific basis of the prioritization of the measures,
- how environmental targets can be reached with minimum costs/investments.

It is of the utmost importance that an Action Plan for 2001 can be developed in time to provide input to the policy process. If we will not be able to give this input in time, our research may not have an effect.

The work in 1999 must be prioritized according to the needs related to Action Plan development. To ensure that input to Action Plan development can be provided, priority in the first part of 1999 must be given to the following tasks:

- Input data into AirQUIS, so that benefits of measures can be calculated;
- Costs of control options;
- Clarification of policy options.

The economic analysis is very important, to show the economic benefits of specific investments.

5 Agreement between the Guangzhou and NORCE partners on some items under the 1999 program

During the meetings in the Technical Leading Group (TLG) on 5 and 13 November 1998 at GRIEP, the Guangzhou and NORCE partners agreed on the following topics related to the work plan for 1999:

1. Workshops 1999

Workshop 1, 1999:

Place: Guangzhou/LongGui
Period: 1st week of May.
Participants

- from NORCE side : On the workshop budget: Project Leader, and 3 task leaders (from NILU, IFE and ECON, according to the Project plan).
  On task budget: It is anticipated that more task leaders will participate.
- from Guangzhou side : Project Leader, Task leaders, and all other involved task groups members, as necessary. Representatives of GSTC, GEPB and Municipal government.

Program: To concentrate on Action Plan, as well as status and problems on all relevant tasks.

Workshop 2, 1999
Place: Guangzhou/LongGui
Time: Early in November, to be held together with the planned workshop on the UNDP project on NOx control in Guangzhou.

Participants:

- from NORCE side : On workshop budget: Project Leader, and 5 task leaders (from IFE, ECON and CICERO, according to the Project plan).
- from Guangzhou side : As for the May workshop.

Program: Concentrate on Final version of the Action Plan, as well as the finalization of the project.

The participation in the workshops from NORCE may change according to need, but keeping the total number of participants on the workshop budget the same, namely 10.

2. Exchange, 1999

To complete the Exchange program, Mrs. Li Chiqin, GZ Leader of Task 6.1, will have training in Norway for 6 weeks. Hosts will be CICERO (main host) and NILU.
The period of the stay will be decided within Task 6.1, in cooperation with the project leadership on the Guangzhou side.

The rest of the funds for exchange and training that has been transferred to Guangzhou side from the 1997 and 1998 project budgets (total funds were NOK 90,000) should be used to cover her expenses for travel to Norway and back, and for her subsistence in Norway. According to the Economic status overview of the Exchange program (which was sent to the Guangzhou side together with the invoice for 2nd quarter 1998), there is still approximately NOK 40,000 left of the training funds transferred to the Chinese side. Expenses for Li Chiqin which exceeds the NOK 40,000 amount, will be covered by NORCE side, according to the same rates for subsistence as used for the other trainees.

3. AirQUIS and EPISODE model transfer

AirQUIS: The complete AirQUIS version 2 will be transferred as soon as testing of the model is finished, and all known shortcomings ("bugs") corrected. The current estimate of when it will be available is February.

EPISODE: The EPISODE model delivered as part of AirQUIS, and for forecasting purposes to task 12, is delivered as a PC version to suit the available computer equipment at GRIEP and GEMC. The PCs are not powerful enough to do calculations on urban scale of photochemical pollutants. Also, dry deposition is not included in the present version, because it is not important on urban scale for pollutants like SO_2, NO_x and combustion particles. A version of EPISODE which includes photochemistry and dry deposition can in principle be delivered by NILU to be run on a UNIX platform. NILU will discuss the possibility of transferring such a model version (exe-version) to GRIEP and the requirements for such a delivery, and send a note about this to GRIEP before 30 January 1999.

4. Budget for 1999

The 1999 budget is stated in the Project Plan (Final Version of February 1997, page 35). This is shown below.

In addition to this, the rest of the 1998 budget which might not be used in 1998, will be available for use also in 1999.

Also in addition, the rest of the funds for equipment purchase (NOK 32,000) must be used in 1999.

Task	1999 Budget NORCE side	Guangzhou, from NORAD	Guangzhou side
1 Emissions	0		
2 Energy/Coal	45		
3 Dispersion	0		
4 Monitoring	0		
5 Exposure	0		
6 Damage	265		100
7 Control options	310		200
8 Scenarios	0		200
9 Cost-benefit	560		200
10 Policy instruments	245		150
11 Motor vehicles	45		100
12 Forecasting	100		300
13 Project administration	325		100
Workshops	500	50	50
Exchange	65		
Total	2,460	50	1,400

The distribution of funds between the different tasks may change, dependent upon the agreed contents of the Detailed Work Plans for 1999.

As has already been agreed, there will be a redistribution of funds, from all tasks to the Exchange task, because of overexpenditure of that task during 1997 and 1998. The redistribution will amount to about 4.25% of the total funds for all 3years for each task separately.

GRIEP, Guangzhou, 13 November, 1998

Mr. Wu Zhengqi
(Signature, for GZ side)

Mr. Steinar Larssen
(Signature, NORCE side)

Appendix 1

Workshop Programme Proposal

NILU/STL/ O-97009/ 26 October, 1998

NORAD CHN PROJECT 013:
Guangzhou Air Quality Planning and Management System

PROPOSAL

TOPICS IN THE PROGRAM FOR 2ND WORKSHOP, 1998

Thursday 5 Nov. :

1. Short plenary (0900-1030) to meet and clarify workshop program(?).

2. Preparatory work on 1st sequence (to be presented and discussed in Plenary, on 9 Nov (?)

   Groups:
   - Air quality assessment: Tasks 1,3,5: KILDER training, calculations and discussions.
   - Damage assessment: Task 6 (and 5): Training, discussions on calculations.
   - Control options/costs: Tasks 2,7,8,9,11 (and Task 6 and 13):
     Training, discussions on options, costs, cost/benefit.
     This discussion will also bring input to the Action Plan work in the coming days.
   - Policy measures: Tasks 10,13. Also preparations for the Action Plan discussions.

3. Other Task work, e.g to prepare Status reports for 2nd half of 1998, and Detailed Work Plans for 1999.

Friday 6 Nov. :

1. Same as on Thursday
2. Project Leading Group Meeting.

Monday 9 Nov. : Plenary meeting:

1. Status reporting, each task. VERY brief (main points, mainly reporting of the points which do NOT follow the plan.). Presentation in English. Each task team decides who will present.
2. 1st sequence results. Presentation and discussion.

Tuesday 10 Nov. :

1. Task work, incl. DWP 99 work
2. Preparations for AirQUIS demonstration, in Plenary on Thursday 11 Nov.
3. Action Plan discussions, Tasks 9, 10, 11, 13 and others.

Wednesday 10 Nov.: Same as on Tuesday.

Thursday 11 Nov. : 1. Presentation of DWP 99 for each task.
VERY brief (main points).
2. AirQUIS demonstration.
3. Action Plan presentation and discussion.

Friday 12 Nov. : Project Leading group meeting.

Appendix 2

Status Report: Installation of AirQUIS-2.0 at GRIEP and training of project personnel

Status Report: Installation of AirQUIS-2.0 at GRIEP and training of project personnel

Installation of ENSIS 2.0 (AirQUIS) in Norway

Hardware Installation

The following equipment was shipped from China National Scientific Instruments and Materials Import/Export Corporation (CSIMC) to NILU for installation and testing purposes.

HP NetServer LH II:

- The Network card was replaced. The reason for this replacement was that the server contained a network card without any drivers.
- During installation and testing of the server, a problem with the SCSI-controller (type: IBM, installed in China) was detected. The problem was detected during booting with the following warning message:

  "

  IBM RAID Adapter BIOS Version 1.29 – 21 Dec 95

  RAID Firmware Version 2.43
  WARNING: 1 logical drive is critical
  WARNING: SCSI drive at channel 1 bay 1 is defunct
  "

  Despite this warning, the server functioned stably with no apparent problems during the two weeks period of installation and testing in Norway.

HP kayak:

- No apparent problems were detected with this computer during the installation and testing period in Norway. The response time of the login procedure and the opening of new projects were not particularly long.

Software Installation

HP NetServer LH II:

- Microsoft Windows NT Server version 4.0
- **Demo** version of ORACLE 7.3 Server
- INTERSOLVE 2.11 32-BIT Oracle 7 ODBC-driver
- ENSIS 2.0 (modules: Basic, AirQUIS)

HP kayak:

- Microsoft Windows NT Workstation version 4.0
- **Demo** version of ORACLE 7.3 Client
- INTERSOLVE 2.11 32-BIT Oracle 7 ODBC-driver
- ENSIS 2.0 (modules: Basic, AirQUIS)

Import of Guangzhou Data and Setup of Project Specifications

- Converting of shape co-ordinates
- Map Data (Railroads, Rivers, Roads)
- ENSIS Themes (Geographical data like: Adm. Regions, Stacks, Road Network, Met. Stations, Grid Definitions)
- Traffic Emission Data
- Industry Emission Data (only some illustrative examples have been imported so far).
- Met. Data for the period of January 1995.
- Topography Data (1 km x 1 km, large and small model grid)
- Population Data (2 km x 2 km large model grid and 1 km x 1 km small model grid)

Testing the AirQUIS 2.0 application for the Guangzhou Project

- Important concepts and modules were tested.

Installation of ENSIS 2.0 (AirQUIS) at GRIEP

The ENSIS system is installed in a separate network at GRIEP in Guangzhou. The network consists of one server and three clients. All clients run Windows NT 4.0 operating system, ORACLE 7.3 client software and AirQuis system. The ORACLE software is a demo version and must be upgraded.

HP NetServer LH II,	project computer	Server
HP-kayak,	project computer	Client
EPIC,	GRIEP computer	Client
EPIC_1,	GRIEP computer	Client

All software is installed and the ENSIS database is running correctly on the server and clients.

HP NetServer LH II :

During installation the server was unstable. A local HP representative examined the server and a memory configuration problem was fixed. The HP representative also found that one of the disks was damaged, and he recommended that this disk should be replaced. Despite this disk problem the server is now stable.

HP kayak.

ORACLE client and AirQUIS software were installed.
Problems: Long response time on login to AirQUIS and on opening of new projects. However, the computer showed no apparent slowness as soon as a project was opened. The local HP representative should have a look at the computer to sort out the problems regarding login- and opening of new projects.

EPIC: OK

Runs Chines version of Windows NT 4.0. This NT version sometimes outputs a mixture of English and Chines characters.
The computer should be upgraded to 64 Mb memory.
ORACLE client and Airquis software were installed.

EPIC_1: OK

Identical comment as for the EPIC computer.

Met. Data from GEMC

GEMC has received the import format specification, and will deliver data on that format. However their database is not running for the moment so it could take some time before the data are sent. The data will be delivered as Excel files on diskette.

Training

Training of computer staff

The following topics where covered:

Installation of ORACLE client.
Installation of ENSIS client.
Import / export of ORACLE users with data.
ENSIS User Database Administrator.
Create users
Edit user profile (privileges/datasets/projects)
Edit data sets

Training of task personnel

Day 1: Introduction to the system. General concepts and the map system (GIS).

Day 2: Measurement database, Statistics on time series and introduction to the Import functionality.

Day 3: Introduction to the dataset (line, point and area) concept.

Day 4: Introduction to the different models. Running the emission- and the wind model. Description of the population exposure model.

Day 5: A general description of the wind- and the dispersion model. Running the dispersion model.

Day 6: Import functionality concerning traffic-, industry- and area data. Advanced use of the emission model.

Day 7: Advanced use of the wind-, dispersion- and exposure model.

Day 8: Import functionality, how to create new templates. Export functionality, with emphasise on receptor point data set.

Day 9: The User Database Administrator Tool: create new user and edit existing users; how to add / replace shape themes. Import and Export AirQUIS projects applying the ORACLE tools.

Preparation and Demonstration

1. Advanced use of the map system (GIS)
2. Advanced use of the measurement database
3. The Wind Rose
4. The Wind Field model
5. The Emission model
6. The Dispersion model
7. The Exposure model
8. Displaying the results from the model runs, both in table format and geographical presentation applying the map system
9. Brief introduction to the Report Generator

Appendix 3

Status reports for 1998

Task 1 Emission Inventory

Status Report

Main achievement in 1998

. Training

In April 1998, Mr. Jian jianyang took training courses about KILDER module in NORWAY.

Tools

At this phase (before 1999), KILDER module as a main tool for us.

Some modification has been done on KILDER module according to the condition in GZ. The latest version was received at the end of October.

Work related to Air Quality Management, 1st sequence the work of task1 in 1998 can be divided into two phases:

The first phase

According to the work plan of 1998, the investigation work of the first phase had been finished before March, and presented the related results to the project office on 2nd April, as following:

1. Some basic information and input files and the emission factors in Chinese and English versions.
2. Database on industry source.
3. Fuel consumption data on point source.
4. Population date.
5. The calculation result of population distribution.
6. Traffic data of main roads.
7. Traffic composition.

The second phase

Main work includes:

1. Establish the input files for KILDER module.
2. Collect further data on the other sources, such as ship , plane and so on, and the data on time variation.

Main result

1. Accomplish the investigation work on emission factors, and present the detail background report.
2. Establish the database on ships, plane.
3. Establish the database on the cleaning devices.
4. Edit the report on pollution investigation of different sources in GZ preliminary.

Reports (the following reports had been presented to project office)

1. The background report on emission factor of different fuels in Chinese and English versions.
2. The investigation reports on pollution sources in GZ area.
   So far the work of task 1 had been finished according to the work plan basically.
   Because of some modification on KILDER module, after the workshop, task 1 should to use the final version of KILDER module to finish the calculation and the emission inventory for GZ for the year 1995.

Task 2 Energy Consumption and Smoke Pollution

Status Report

Report on work progress before November of 1998

1. Work target

Make work target of 1998 to finish the collection, arrangement, process and induction of data about energy consumption and smoke pollution. Finished the phase report on energy consumption and smoke pollution of Guangzhou on the basis of cooperation with task1, 7 and 8 to research and collect material and transmitted achievement concerned to task 7.

The situation of finished work before November of 1998

By Guangzhou

- Classification and distribution of energy resource and its consumption
- Finished induction of the material and data concerned of Guangzhou's energy consumption fiducial year in main industry.
- Finished induction of material about major pollutant emission.
- Finished overall induction and analysis of energy consumption of major pollutant source and data of smoke pollution.
- Finished forecast of Guangzhou's energy demand

By Norway

- Two parties, China and Norway, made analysis and research for the currently collected data about energy consumption and smoke pollution and communicated their ideas of how to process, arrange and induce their data with each other. They reached the same opinion basically. Checked and sanctioned form of energy balance of Guangzhou and supply instruction about energy consumption input data to model MARKAL.

- Studied and discussed the writing of the phase report on Guangzhou's energy consumption and smoke pollution with Chinese. At the same time, they communicated their ideas to the problem and data collection, which are concerned by both of them, with each other for many tines.

2. Work Achievement

According to the detailed work plan of 1998, the members of this task team have finished the work of the first and second subsidiary task. Because the data base provided by task 1 were made some change and replenishment, this task team also changed, replenished and perfected the previous data which is mainly about pollution source.

On the basis of that, finished the writing of the phase report on Guangzhou's energy consumption and smoke pollution research. The main content of the report includes three sections and was divided into three units to discuss.

Unit one The General Situation of Guangzhou's Energy

Unit two The Forecast of Guangzhou's Energy Demand

Unit three The Current Situation Analysis of Guangzhou's Smoke Pollution

Please read the detail in the appendix.

Task 3: Dispersion Modeling
Status Report

Main achievements during May 1998 – November 1998

NORCE-side:

- The KILDER model has been delivered.
- Project personnel has been trained in the use of the different KILDER programs.
- The long term average concentration calculations of NO_x, SO_2 and PM_{10} for 1995 has been performed using the KILDER model.
- By use of the KILDER model the effects of three abatement measures have been calculated. These measures were:
  1. 50% reduction of emissions from motorcycles.
  2. Gasification of busses, i.e. removal of emissions from busses.
  3. 50 % reduction of emissions from point sources within the three central districts: Dongshan, Liwan and Yuexiu.

- A HP NetServer and a HP client computer have been installed in a separate network at GRIEP to serve as platforms for the AirQUIS-2.0 model system.
- A pre-release of the AirQUIS-2.0 integrated model system has been installed at GRIEP.
- Project personnel has been trained in the use of the AirQUIS-2.0 system. Instructions on how to improve the Guangzhou database have been given.

GZ-side:

- The programe to calculate the stability classes (using the cloud cover data) has been made
- The meteorological input data file of 1995 has been prepared for the KILDER dispersion module by using the KILDER meteorological module
- Much work has been done on the wind field library establishment.
- Topographical data files for large grid and small grid has been finished.

Reports:

- The User Documentation manual for the KILDER programs has been delivered.
- Technical reports describing how the topographical and meteorological data has been produced for application in the models (in Chinese).
- A technical report describing the installation of the AirQUIS-2.0 system.
- Two copies of the User Documentation manual for the AirQUIS-2.0 system.
- A mission report from Mrs. Fang's stay at NILU in June 1998 .
- Status Report for 1998.
- Detailed Work Plan for 1999.

Main Delays:

- The dispersion calculations by the KILDER model, has not been run by the GZ part due to lack of emission input data.
- Since some Quality Assurance work still is to be performed on the AirQUIS-2.0 system, the final release date of the product is postponed until February 1999.

Sin. -Nor. Cooperation Projection: Air Quality Management and Planning System for Guangzhou

Material for the Second Guangzhou Meeting in 1998

Task 4 Monitoring

Status Report

The Schedule Report is based on the Detailed Work Plan (DWP) of Task 4 for 1998.

The summary of DWP of Task 4 for 1998 is followed:

1.	Desicription of existing network	
	1.1 Air quality data to NILU	March'98
	1.2 Air quality report	June '98
2.	Improvement plan for the network	
	2.1 Proposal from GZ team	June'98
	2.2 Evaluation by NILU	June and Sept.'98
	2.3 Final plan for new network	Oct.-Dec.'98
3.	Establish new station/monitors	
	3.1 Purchase, operation	April'98
	3.2 Guidance from NILU	June and Sept.'98
4.	Data to other tasks	
	4.1 1995data to Task 3	Finished
	4.2 1997/98 data to Task 6	To be done

1. Work performed April – October '98

1.1 Detailed description of the existing network

According to the requirement of NILU, Guangzhou team has submitted to NILU the followed data in the form and the graph:

- .1995 NO_2 annual average value of 6 auto-monitor stations;
- .1991-1995 NO_2 annual average value of 6 auto-monitor stations;
- . 13-19, 1995 Dec. NO_X, CO, TSP hourly value of 6 auto-monitor stations.

1.2 Improvement plan for the network

After GEMC made a general technical proposal to NEPA on a new monitoring system for Guangzhou, GEMC is studying the improvement plan of the new monitoring system on the basis of NEPA opinion. It will be defined the number of stations, the position of station, and monitoring items, QA/QC etc. At the same time, GEMC is expecting that NILU makes the evaluation and proposal of improvement plan of the network.

1.3 Install new equipment

PM_{10} and O_3 was installed at GEMC station, GRIEP station, Longgui station (background station), and O_3 was installed at Luhu station. Now, all equipment is running-in.

1.4 QA/QC training

According to' 98 DWP and '98 the first workshop arrangement, Thor Christian Berg visited GZ/GEMC for 2 week in June. He discussed QA/QC (Data Quality Procedures) of GZ air auto-monitoring system with GZ team, and guidance and training GZ team QA/QC.

1.5 Data to other tasks

According to requests, data have been delivered to task 3, task 6.2, task 6.3. And expecting specific requirement, data will be delivered to task 6.2.

2. Question and solved measure

According to the requirement of GZ Environment Management, GZ Air Auto-monitoring System must be improved. The followed factors must be considered, the area of the city has been expanded, the function of the districts has been adjusted. It's accepted NEPA opinion, and it's approved by NEPA. So the improvement plan for the network will be delayed, in order to be used for environment management, and to guide establishing new network.

Task 5 Exposure calculations

Status Report

Norce-side:

- The KILDER model has been delivered.
- There has been given training in the use of the KILDER model, and user documentation of the model has been delivered.
- The population exposure calculations based on the long term average concentrations from the KILDER model has been performed, and the results has been given to Task 6.1.
- A pre-release of the AirQUIS-2.0 model has been delivered.
- There has been given training in the use of the AirQUIS-2.0 model, and user documentation of the model has been delivered.
- A method of how to code the addresses of the persons which were selected within the traffic area of the interview study in the spring of 1998, has been established, and a report on this method will be written.

GZ-side:

- Finishing collecting population resident distribution on community areas, and the boundary co-ordinates for these areas of the basic year (1995).

- After the training, we have learned how to use the KILDER model.
- After the training with the Exposure module of the AirQUIS-2.0 model, we now know how to use this part of the AirQUIS-2.0 system.
- Finished collecting building data and building population data along typical major roads. Especially, the areas of Dongfengzhong Road and Beijing Road have been investigated. These data will be put into the AirQUIS-2.0 system.

Problems and proposed solutions

Norce-side:

- Since there were some delay in the deliverance of the emission data, the concentration and therefore the exposure calculations with the KILDER model were also delayed. The calculations have now been performed.
- Since the AirQUIS-2.0 version that has been installed at GRIEP is a pre-release version of the model system, a final release version will be delivered by February 1999.

GZ-side:

- Because of the lack of input data (from task 1 and task 3), task 5 has been delayed. The end of 1998 or early 1999 will finish the calculations of the emissions and the air concentrations.
- During the second workshop in Nov. 1998, we have learned how to run the new version of the KILDER model. The concentration and exposure results from this model were calculated by the Norce-side just before the workshop started, and therefore the Task summary report for the 1st sequence has not yet been written.
- Because we do not know all the details about how to use the AirQUIS-2.0 model at the moment, Task 5 personnel need further training in the use of this modeling system.

Task 6-1 Health Damage Assessment

Status Report

1. Work performed before October '98

According to the detailed work plan for 1998 (DWP for 1998), the work performed up till now cover three major aspects: 1) performing the interview study in winter (Feb.~Mar.,1998) and entering data electronically input; 2) collecting health statistics for Guangzhou; 3) Additionally we have calculated the possible reduced health effects of some selected abatement measures using external dose-response function (so-called 1st sequence calculation).

NORCE part - guidance and transfer of tools

Norwegian experts, Dr. Jocelyne (NILU) and Kristin Aunan (CICERO) have provided Guangzhou team some materials on air pollution damage on health. Also they have been regularly in contact with the Guanghzou team by e-mails and have provided a lot of valuable guidance and suggestions to GZ team so that the study can be performed in a right way.

Related to the AQMS analysis sequence:

The NORCE team has been responsible for calculating the reduced health damage due to some abatement measures selected in the so-called 1st sequence, which was based on the KILDER model. A proposed calculation procedure in the form of an Excel spreadsheet was provided by the NORCE team to the GZ team during the workshop in November. Additionally, a first draft of a report on external dose-response functions was made, which is to be finalized in cooperation with the GZ team within the workshop in May 1999.

Guangzhou part

Guangzhou group focused efforts on data collection from the beginning until now in 1998. The needed data is collected from two paths. Both parts are necessary in the study of Task 6:

1) Collecting information about the various symptoms of disease and reduced well-being for which no existing statistics are available. This has been done by an interview study in Guangzhou;
2) Collcting statistics of deaths and respiratory hospital admission from Guangzhou Municipal Public Health Bureau (GMPHB) and several large hospitals.

1) Performing the interview study in winter (Feb.~Mar.,1998) and data input

In Guangzhou, the team of Task 6-1 successfully performed an interview study in February and March in 1998 cooperating with Guangzhou Statistical Information Industry Centre (GSIIC) which affiliated to Guangzhou Statistical Bureau (GSB). GZ team was responsible for printing and providing interview questionnaire and manual (Chinese version), specifying the detailed requirement of the interview study and supervising the study step by step. The GSIIC is responsible for the implementation of the interview study. The detailed work was as following:

a. Translating and modifying questionnaires so that the questionnaires are more suitable in Guangzhou;
b. Training interviewers;
c. Performing a pilot interview study for training the interviewer;
d. Propagating the interview study by the way of local television station and newspaper;
e. Printing questionnaire (over 4500 for adults and over 3000 for children);

f. Performing the interview study formally

Time: from Feb.23th to Mar. 31st, 1998
Interview method: Interviewers went to the individual's home and interviewed orally.
Sample size (Study population): at least 4000 adults selected randomly from the 4 areas and

about 2000 children

Age group: 1) 18~30 y; 2) 31~40 y; 3) 41~50 y; 4) 51~65 y
Study area: (4 areas) control area, traffic area, new industrial area and old industrial area (detailed places are showed on the maps)

g. Checking questionnaires sent back and establishing data structure
h. Coding and entering data electronically for the interview study and checking data.
Data from 4000 adult questionnaires and 2020 children questionnaires are punched into data file. There are 576 parameters existing for per adult questionnaire and 341 parameters for per children questionnaire. About one tenth of punched data was checked.
i. Checking data for the one tenth of questionnaires selected randomly.

All the code of answer of the interview questionnaire are entered into the following files:

1. data file for adult questionnaire (code part):
2. data file for children questionnaire (code part):
3. data file for adult questionnaire (Chinese word part, such as addresses or medical used):
4. data file for children questionnaire (Chinese word part):

File 1 and 2 were saved as SPSS files with an extension .sav .
File 3 and 4 were saved as Excel files. (No Chinese version for SPSS)
The detailed SPSS dictionary are given by two files for file 1 and 2 respectively, while the detailed Excel dictionary are given by another two files for file 3 and 4 respectively.

Problems regarding the interview study

1. 1.Some parents did not want to continue their child's questionnaire because of the long time of interview.
2. Some addresses in a small part of the questionnaires were not recorded very detailed because of two reasons: a. Some people being interviewed was not willing to tell their detailed home address or work address; b. Some interviewer failed to record addresses carefully.

2) Collecting health statistics for Guangzhou

The aim for collecting health statistics is to perform the analyses by establishing dose-response functions for GZ and to assess the benefit of emission reduction, which serve as a basis of Task 9.

GZ team has contacted Statistics Section, Guangzhou Municipal Public Health Bureau (GMPHB) many times and finally obtain their approval to obtain annual statistics data and collect daily data from 4 hospitals in Guangzhou.

Annual statistical data

Annual statistical data of 1995, 1996 and 1997 are provided by the Statistics Section, Guangzhou Municipal Public Health Bureau. The data include:

1. Total annual number of deaths and total number of hospital admissions from 7 districts in Guangzhou;
2. Annual number of deaths and hospital admissions from 25 hospitals which are large ones above district level in Guangzhou. The 25 hospitals are those from which there are annual statistics record available in GMPHB. The representativeness of the data from the 25 hospitals are also available.

Problems related to collecting data from GMPHB

1. No monthly or daily data which would meet our need are available in GMPHB.
2. Only data from 7 district is available in the statistic section of GMPHB because no data from new district, *Tianhe* district is recorded by the sections.

Daily data from 4 large hospitals

Daily death and hospital admission (HA) for 1995, 1996 and 1997 are collected from 4 large hospitals including date in, date out(or death date), age, gender, cause, address

The ICD code of collected daily data includes :
Total mortality or hospital admission (except accident and violence);
Lung cancer cases(ICD 162, ICD 231.1~231.2);
Respiratory diseases(ICD 460~519);
Cardiovascular diseases, including:
Heart disease: ICD 390~398, 402, 404, 410, 411~416, 420~429;
Cerebrovascular disease: ICD 430~439;
Hypertensive disease: ICD 401, 403, 405

Problems related to the collection of daily data

1. The daily data for 1995 is not complete.
2. A part of addresses of patients are not recorded. For these cases, even the district in which the patient lives is not available. But no obvious statistical bias exist.

Format of data: Statistics data has been saved as Excel file

2. Problems and proposed resolution

1) Capacity and other problems

Since GZ team is lacking in work experience on research of health damage, GZ team hope NORCE experts could provide more guidance on dose-response functions analysis.

2) Coordination with other task group

It is important that Task 3and 5 how to estimate the exposure for the 4000 adults and 2020 children accurately and efficiently for establishing D-R functions. The method of data conversion and address coding for the interview study was thoroughly discussed at the workshop in November 1998 and the division of responsibility of each group was agreed between Task 3, Task 5 and Task 6.

Also, it was decided at the workshop in November that Airquis data (from task 3) will be used to estimate daily concentration level (PM_{10} and SO_2) at the district level (for 1996 and 1997), to be used for the dose-response analysis on mortality and hospital admissions.

3. Training

Li zhiqin of GRIEP was expected to Norway for a training for 6 weeks during from April to May this year according to the plan for 1998. But the plan is postponed to 1999 because of the delay of establishment of Airquis model.

4. Status on the report planned from task

The work has started regarding the two reports from the interview study and the study of mortality /hospital admissions. Jocelyne Clench-Aas has provided detailed guidance concerning the report writing.

The work concerning a report on external dose-response functions (from other places in China and in other countries) has also started.

Task 6-2 Damage Assessment for Materials

Status Report

Results

- Definition of classification and distribution for buildings in Guangzhou
  To set up the GRID(250m□250km) system for calculation of buildings, define the building types in each GRID and calculating the distribution in Guangzhou.

  Classification:
  A: Old buildings, 1-5 floors
  B: Old buildings, more than 5 floors
  C: New buildings, 5-10 floors,
  D: New buildings, more than 10 floors
  E: Commercial and institutions, old buildings
  F: Commercial and institutions, new buildings
  G: Industry buildings
  H: Farmhouse buildings
  I: Monuments
  J: blank, no buildings

Distribution:

Classification	A	B	C	D	E	F	G	H	I
Distribution(%)	11.7	6.7	36.0	9.5	4.4	12.6	14.8	2.7	16.0

- **Carrying out the field exposure test plan**

Test time: one year (from January 1997 to January 1998)

Test places: 10 sites in Guangzhou (most of them in the auto-monitoring sites)

Test materials: Carbon steel and Zinc

Redrawn from the test sites, the test speciams were pickled, dried and weighted in the laboratory. We had got the data of weight lost and drawn their changed trend figure for each test specimen. Eighteen test specimens in 3 sites were brought to NILU for pickling.

- **Definition of dose-response equations**

According to the result of field test, to compare with the existing international dose-response and lifetime equations of materials caused by pollution damage, We have defined the dose-response and lifetime equations of materials in Guangzhou area.

- **Calculation of material amount**

  Based on the buildings field inspection results and the materials data from the departments concerned (GHAB: Guangzhou Housing Administration Bureau and GCC: Guangzhou Construction commission), we have calculated the average materials amount for each type of buildings in Guangzhou.

- **Collection of data of buildings repair and matainance cost**

  According to the data from GHAB and GCC, we have finished the Collection of data of buildings repair and matainance cost

- **Collection and calculation of climate data**

  Based on the climate data of recent years of Guangzhou, to Calculate the climate parameters like: Amount of rain
  PH value of rain
  TOW

Tool exchange

- The tested panels in 3 sites had been brought to NILU in May 1998.
- The tool of Corrcost Excel V1.0 had been taken to Chinese side in November 1998.

Problems

- Because the data of SO_2 and NO_X modeling concentration in each GRIDs have not been available, calculation and evaluation on damage economical lost for materials have not been finished.
- We want to know how to consider the materials damage that is not caused by pollution (non-pollution damage). Definition of corrosion costs in ambient air is difficult for us.
- It is necessary to demonstrate the result of average materials amount of new commercial buildings.

Task 6-3 Vegetation Damage Assessment
Status Report

- **Work performed before Nov. of 1998**

According to the project plan, Norwegian side should provide the basic knowledge and tools on damage assessment. And the cost evaluated method should be suggested too. Two research reports have been provided from Norwegian side this year.

Guangzhou side has performed a lot of works, including investigation, information collection and the field survey. Afterwards, on this basic, monitoring sites selection, sampling, experiments in lab were conducted. Data calculation, statistics and analysis are in progress now.

In addition, Two reports have been finished and have been delivery to Project Office:

1. Subtask 2: "The selection of plant species of air pollution resistant in Guangzhou area"
2. Subtask 6: "The status report of Guangzhou acid rain pollution and effect on the vegetation Eco-environment"

- **Subtask description in detail:**

1. Vegetation assessment of urban area

1.1 Finishing investigation, background information collection and analysis.
   a. Collecting air quality data from the six sub-stations. Four monitoring sites have been selected after compared. These are: lu hu(clean site), ji xiang lu, xilaixi and ti yu xi stations.
   b. Collecting information from the South China Institute of Botany, the Forest Department of Guangzhou Government and so on.
   c. Literature collection.

1.2 Field survey and ecological monitoring site selecting.
1.3 Sampling performed.
1.4 Experiment in the lab.
1.5 Data analysis

2. Choosing anti-pollutant plants

1.1 Finishing investigation and information collection.
1.2 Field survey to understand the vegetation damage.
1.3 Both Chinese and English report have been finished.

3. Crop damage assessment

3.1 Earlier of this year, the detailed requirements were proposed by task 9 in the meeting of two tasks of Guangzhou side, and the main solution ways have been discussed.

3.2 We visited the related professors and experts of the South China Agriculture University to try to know more about the relationships between air pollutants and crop productions, and the related examples searching.
3.3 Based on the requirement from task 9, the information and examples have been searched

4. Forest damage assessment on Baiyun mountain

4.1 Earlier of this year, the importance of this subtask to task 9 was understood by a meeting with task 9. Searching the related methods of information collection.
4.2 Collecting data of the forest distribution, area and wood production from the Forest Bureau of Guangzhou and the Forest Department of Guangzhou Government
4.3 Field survey, then sampling in the three monitoring sites.
4.4 Experiment in the lab and data analysis.
4.5 Air pollutant data of Baiyun mountain collection and analysis.

5. Vegetation damaged by heavy metal

5.1 Searching literature and collecting the area distributions of heavy metal in Guangzhou
5.2 Investigation from the South China Institute of Botany, the South China Agriculture University and the Forest Department of Guangzhou Government

6. Vegetation damaged by acid rain

6.1 The analysis regarding to the chemical pollution status and develop trend of acid rain in Guangzhou has been performed.
6.2 'Status report of Guangzhou acid rain pollution and effect on the vegetation Eco-environment' has been finished.
6.3 A lot research results of the effect of acid rain on vegetation.
6.4 Sulfur analysis of leaves of some kinds of plants distributing in Guangzhou urban city and Baiyun Mountain.
6.5 Collecting data of forest distribution, area and wood production etc. in Guangzhou.
6.6 'The assessment of vegetation damage by acid rain' report is being prepared.

- **Problem**

1. According to the detailed work plan of 1998, field survey and sampling should be conducted during March-June. Unfortunately, There was a continually shower rain during March to July here, so these two works had to be delayed to August and September.
2. So far, there is not any air pollutant concentration distribution data provided from task 3. The assessment of vegetation damage can not be performed.
3. Regarding the crop damage assessment, still no qualified example could be found. After discussing with task 9 of Guangzhou side, we will only try to assess the effect of Ozone on rice, the major kind of crop in Guangzhou.

4. The forest composition is being changed on Baiyun Mountain. Each forest ecological index changes year by year. The plan of forest improvement often changes as well. So it is difficult to assess the forest damage. What we can do is just to compare the forest before 1993 to the plan of improvement.
5. Regarding to the subtask 6, only pine and crops criteria can be collected. Therefore, only pine and crops damage can be evaluated.
6. Heavy metal in the air is not important to Guangzhou through a lot of information collection and investigation. And no air heavy metal pollutant data can be obtained. After discussing with the Norwegian side, we suggest to delete this subtask.

Task 7: Control Options

Status Report

1. Work performed January 1997-November 1998

GZ part:
According to the detailed work plan in 1997 and 1998 , on Jan 1997 to Nov 1998 we finished the research content consists of several sub-tasks, which are:

1. Checked the discrepancies with the Task2 and Statistics Bureau. They admitted some mistakes, but indicated that the totals were correct.
2. Finished some data for Status of technologies in use today , the data were included:
   - Power and steam production; installed capacity, type of fuel, operating hours per year, age(number of years since production start) and technical level. Emission rates of relevant pollutants.
   - Industry; consumption of fuel by type and amount, efficiency, age and technical level. Emission rates and some emission factors of relevant pollutants.
   - Commercial/service sector; Where relevant also efficiency for the different devices. Emission rates of relevant pollutants.
3. Collected some data for Status & Development of economic activity and air pollution with Task 8 . Task2,Task 8 will assist Task 7 establishing these projections of activities that generate air pollution or consume energy.
4. Finished the first options for emission abatement . These options are relevant about the first version of control options, and put out the following 5 control measures on the base of the existing "Guangzhou City Environmental Protection Plan" and "Guanghzou City Green-mountain , Clean-water and Blue-sky Plan", these measures will be forwarded to the relative tasks for economic and policy analyses:
   * factories removed from the central Guangzhou (68)
   * gasification of the third industry in the central Guangzhou(newly-built, expanded and rebuilt projects should be all gasified, existing oil-fuelled industries should be changed to gas-fuled)

  * gasification and electrification of public transit system (all, inwhich ... % gas, ...% electricity)
  * limit the development of motorcycle in urban area, and phase out at the speed of 5-10% annually.

- increase the buring efficiency of the boiler (for selection)

Collected Cost data are relevant for both;:
-Investment cost
-Variable and fixed operating and maintenance costs

5. Prepared and set up some database on the base year 1995 for Markal model.

The Markal training was continued. The GZ counterpart received copies of the "User's guide for Markal" and "Markal User's Manual". The participants used the example given in the paper to see how this in treated in Markal.

6. Dr. Cui and Mr. Fan trained for the MARKAL Model and prepared for running the model with the NORCE experts from June 9th-26th in 1998 in IFE . MARKAL model training in IFE is:
   - the interface and database of MARKAL Model
   - the energy flow chart of Guangzhou (preparing for running MARKAL Model)
   - estimating the treatment efficiency of industry , such as food , making paper , chemical industry and black metal
   - classifying the industrial boiler according to the fuel (coal or oil)consumption
   - install MARKAL Model demo(ANSWER) on our portable computer.
   - Case studies in 5 industry sectors(Power generation, papermaking, chemical, ferrous metal and food & beverage).
7. Transfer of tools: The MARKAL model(GAMS) is purchased.
8. Finished a air pollution control report (in Chinese).

Problems and proposed solutions

GZ part

- Since Task 7 is an important subtask , it is concerned with engineering and energy technology , model and computer knowledge. As time and professional knowledge are limited, we need some new technical energy experts and engineers. .We hope Task 13 to give Task 7 assistance.
- There is still some missing information from task 1 offering data, especially about the third industry , the technology levels and transport.. We will discuss this with the leader of Task 1 and Task 11.
- Some data were collected very difficulty, especially about investment cost.

Modification to the detailed Work Plan

- ANSWER is not ordered. ANSWER was developed to provide a modern Windows-based interface for MARKAL modelers. ANSWER represents another step forward from the original and technically complex main frame version of the model, through the significant enhancement achieved by the PC based MARKAL Users Support System (MUSS), to this modern Windows-based PC version. These ongoing enhancements have enabled the MARKAL model to become more readily accessible and usable to the energy policy and systems analyst.

GZ part
No.

Task 8 Baseline Scenario Development

Status Report

1. The General Situation of tasks Progress

Generally the work progress of task 8 is good, and almost all of the works required by the Detail Workplan for 1998 have be completed.

2. Performed works

- Take part in the training course regarding Baseline Scenario in Norway
- Perfect the reports finished before
- Construct the tentative baseline scenario
- Begin to construct the trend and target scenario

3. Achieved results

- Based on the training work, task 8 has clearly understood the methodology on how to construct the baseline scenario. During and after the training work task 8 has written a ten-page reports about the methodology.
- Based on the available data task 8 had written five big tentative reports. In the second half year of 1998, task 8 perfected some of the reports. And hope to provide those reports to other task groups.
- Based on the emission factors provided by task 7 task 8 has constructed a tentative baseline emission scenario.

4. The Critical Delays

Task 8 has no critical work delay. Nevertheless, in order to timely construct the trend task 8 hope other task groups are able to provide the trend emission factors as soon as possible.

Task 9 Cost-benefit Analysis

Status Report

The Status Report of Task 9 before November 1998

1. The objective

The objectives of task 9 in 1998 are following two parts

(1) Value the health damage, vegetation damage and material damage.
(2) Try do a case study of cost benefit analysis in order to master the methods.

2. The work done before the November 1998

GZ side:

(1) Collect data of mean GDP of GZ in 1995,cost of emergence medicine and so on. Almost finished.
(2) Collect the cost dada of material. This work have been partly done by task6.2.
(3) Write a report of valuation of health damage. Finished. Wrote a report.
(4) Write a report of valuation of vegetation damage. Finished. Wrote a report.
(5) Write a report of valuation of material damage. Not finished.
(6) A case study. . Finished. Wrote a report.
(7) Training course

Mr Yu jican have gone to ECON to have training course from May to June. He has mastered the methods with Noweigen experts help.

NORCE side:

(1) All the work above be finished under advice of NORCE
(2) ECON have prepared the training course for Mr.Yu jican.

3. Problem

GZ side	No
NORCE side	No

4.Change of DWP

GZ side	No
NORCE side	No

5. Main work for next 6 month

(1) Do cost benefit analysis of three measures
(2) Value the health damage, vegetation damage, and materials damage.

TASK 10 Status Report

According to the DWP for 1998,the main focus have been n assessment for implementation and enforcement of air pollution control policies and regulations in industry, transport and power sectors. The main objective for this work has been to identify major strength and weaknesses of implementation and enforcement of regulations.

This has covered enforcement and reform initiatives aiming tat improved enforcement on three different levels:

-National level
-city level
-city district level

Concrete analysis include, for example, Guangzhou Power Plant and its major emission treatment facilities, the permit system and total amount control, and the plan for future desulfurisation.

Task10(Gunagzhou side) have collected and studied information of command and control instruments and economic instruments for vehicle emission control in Canada,USA,Netherlands, Germany and Norway. Anther achievement had been to revise, extend and new air pollution, regulation in power sector, industry and transport sectors, including more comprehensive, comparisons of Chinese and international emission standards.

Ms.Gee also joined a survey of the integrating environmental policies with other sectoral policies. In sum we believe this work has provided a good background for next years' work on policy sugestions.5 report have been prepared in draft form:

(1) Enforcement of air pollution regulations(Chinese)Air pollution control policy trends(English+Chinese)
(2) SO2 and acid rain policy trends(English+Chinese)
(3) Policy suggestions on traffic pollution control(Chinese)
(4) Successful international experiences in air pollution control(English)

Several of these reports should be useful for other tasks such as7,9,11 and 13.

Our main concern for next year is that necessary input from other tasks may come rather late in the year leaving little time for a through policy analysis.

TASK 11 Motor Vehicle Emission Control

Status Report

What have been done before November, 1998

10. According to planned arrangement, task 11 has finished in collecting the data of in-using vehicle's amount before November 1998 in Guangzhou and have formed its regular report.

11. Have confirmed the vehicle's emission factors of Guangzhou with Task 1, its primary calculated method based on MOBILE5 Model, and TASK 11 is forming the detailed report of its calculated result.

12. Due to no better method found by us, we have forecast the development of vehicle's amount in Guangzhou in the future just on the base of the growing rate of GDP and Population in Guangzhou. Although the forecast result showed good relativity of 99%, we have thought it was too great. It showed us the vehicle's amount in 2000 will be up to 2 million! So now we are still trying to find some more reasonable method to forecast the in-using vehicle's amount in the future.

13. Have done the investigation of Guangzhou's road system, and collected the networks map of vehicle road system in 1995 and 2000, include vehicle's amount, V/C and speed, etc.

14. Have done some analysis and framework design to the vehicle's controlling of Guangzhou, but just get some simple result, and hope to cooperate with other tasks such as task 7,9,10 and get their supplementary.

Problems

1. Task 11 is great complex, furthermore it is one of the urgent problems need to be solved in present Guangzhou. Now we are scare of members to do many detailed works, some good research contents had to be abolished due to lack cost and members. Such as Dynomometer Test, Tunnel Test, etc.

2. Because task 11 has relationship with other tasks, it will have to enhance the cooperation with other tasks to finish itself task in the future.

3. As well known, most part of task 11 have to depend on the result of other tasks except itself research contend, such as Policies and regulars and vehicle emission's effect on plants, etc. But according to present situation, as if total progress lagged behind the original plan, so it made some effect on our program. That's why we hope more cooperation with other tasks in the future.

Task12: Air Pollution Forecasting

Status Report

1. Established the database of air quality concentration from 1991 to 1995.(supplied by auto-monitoring network)
2. Established the database of air quality concentration from 1991 to 1995.(supplied by manu-monitoring network)
3. There have 6 substations in our exiting auto-monitoring network, we calculated the spatial correlation between every two substations, and the ratio of NO2 and NOx.

   *There has report about this calculated results.
4. Based on the Meteor-condition in GZ, we studied the locations of our measurement sites (6 substations in auto-monitoring system and 37 sites in auto-monitoring system). In these sites, we chose 14 groups, each group included one auto-station and one manu-station. We also calculated the spatial correlation between two station in same group. daily data used in this section. *There have report about the result.
5. Got some synoptic chart fron Meteor-Office in GZ, studied the air pollution concentration level and spatial distribution in different synoptic-scale meteor-condition.
6. Analyzed the historical Meteor-data and measurement data, studied the meteor-factor how to affect the pollution concentration level and spatial distribution in GZ. The factor included :wind sped. Wind direction, stability.

Problems

1. We have done some work of statistics, but some results were not good as we want, maybe we can find another way to analyze these data.

2. Episode model have been transferred from Norway side, but we haven't the meteor-preprocessor for Episode model, it's a problem for running the model singly.

Suggestions

Norway side prepare a meteor-preprocessor for Episode model.

Appendix 4

Detailed work plans for 1999

Task 1 : Emission Inventory

Detailed Work Plan for 1999

- **Main work**

The task work in 1998 is finishing (or presenting) the emission inventory for GZ for the year of 1995, then the work in 1999 can be divided into three parts.

.The first

Based on the calculation results and emission inventory for the year of 1995, to compile the technical report and project report.

. The second

To estimate the future emission for 2001/2010 based upon data feedback form other tasks, including future population, future industry and traffic emissions.

. The third

A series of data file will be finished to serve AIRQUIS system and emissions calculation.

- **Tool**

In this phases the main tool is KILDER module & AIRQUIS system.

- **Coordination with other tasks**

Future emission factors from task 7 and task 11 before 15th December of 1998.

Future data and the scenarios from project office to calculation future emissions before 15th December of 1998.

- **Time schedule**

Work	• month	
The first part	June 1999	preliminary report
	November 1999	•present
The second part	January 1999	present
The third part	January 1999	present

- **Report and responsible persons:**

The reports include the following three reports and one project report:

*Population distribution in GZ 1995: Yang Shu Rou□Chen Yan Ling
*Fuel use and emission of industry source: Jian Jian yang□Kuang Jun Xia
*Traffic source emissions in GZ 1995: Pan Nan Ming□Shun Qun□□
Wang Dao Ming

*Project report

Air pollution emissions in GZ 1995: Huang Qing Feng

Task 2 Energy Consumption and Smoke Pollution

Detailed Work Plan of 1999

A. Target

According to the work plan made before and the general requirement of the project, the members of this task team finished most work of subsidiary task 1 and 2 in 1998. The members of the task 2 will have to finish basically collection and induction of all material and data and hand the achievement concerned to task 7 in the first half year of 1999. The detailed work plan of 1999 reads as follows:

B. Specific Work Task

1. The members of the subsidiary task 2 will have to finish collection and induction of the material and data concerning energy consumption and current utilization situation and make the development forecast of the year of 2001 and 2010.

   The work will be finished through collecting the material concerning energy balance and pollutants emission. The material and data mentioned above will need to be further detailed, replenished and perfected in 1999.

2. The members of the subsidiary task 3 will select representative trades and typical boilers burning coal in factories concerned as case analysis on the basis of establishment of the data about energy balance and providing the data about technology of coal burning and future control program. They will output the data collected, arranged and induced from the case analysis to the task 7.

3. The members of this task team will finish the writing of the final report on the basis of finishing the phase report of the study of Guangzhou's energy consumption and smoke pollution.

C. Work Progress and Achievement Report

Serial number of subsidiary task	The persons in charge	assistants	beginning	ending	Achievement report
2	Jieqing Zhong Kangmin Li	Daoming Wang Hao Chen	1/1999	4/1999	Investment report of typical case about power plants and industrial boilers burning coal
3	Jieqing Zhong Kangmin Li	Daoming Wang Hao Chen	5/1999	8/1999	Research report of Guangzhou's energy consumption and smoke pollution

Supply Data or Information with Task Team Concerned

Serial number	Assort with task team concerned	The data to be handed	Handing time(year and month)
2, 3	Task 1, 7and 8	Read the subsidiary task 2 and 3	5/1999

Task 3 - Dispersion modelling
Detailed Work Plan for 1999

Objective

The main objective of task 3 in 1999 is to digest the emission data for various conditions from task 1, collect and prepare the needed meteorological data, calculate the pollutant concentrations for various conditions for other tasks mainly using AirQUIS system. The calculation conditions include: for basis year 1995, for objective year 2001 and various measures in 2001, for objective year 2010 and various measures in 2010. Moreover, it seems very necessary to calculate the concentrations for 1996 and some period of 1997-1998, for the purpose of helping task 6-1 people to establish the local dose-response relationship.

Detailed Work Plan

Input/Output	From	To	When	**Resp.**	**Questions and comments**
a) Emission data for 1995 KILDER.	1		GZ: Jan. 99	GZ	Components: (NO_x, SO_2, PM_{10})
b) Measured Ozone data	4		Started	GZ	The measurements started June 1998.
c) Annual mean conc. in grid for 1995 using KILDER.		5	GZ: Jan.99 Norce: Done	GZ	Components: (SO_2, NO_x, PM_{10})
d) Emission data for AirQUIS 2.0 for 1995	1		Jan. 99	GZ	Components: (NO_x,SO_2, PM_{10})
e) Concentration calc. for 1995, with AirQUIS-2.0		5	Feb/March 99	GZ	Components: (Hourly NO_x , SO_2, and daily PM_{10}) Hourly meteorological data.
f) Model validation calculations (hourly/daily) for 1995			Feb/March 99	GZ	Components: (NO_x, SO_2, PM_{10})
g) Emission data for 2001 and various measures 2001.	1		Feb. 99	GZ/Norce	Components: (NO_x, SO_2, PM_{10})
h) Concentration calc. for 2001 and various measures 2001		5, 6.1, 6.2	March/April 99	GZ	As requested by other tasks
i) Emission data for AirQUIS 2.0 for 1996, 1997, 1998	1		March/April 99	GZ	Components: (NO_x, SO_2, PM_{10})
j) Daily concentrations in districts (mortality and hospital admission study) for 1996 and 1997		6.1	April 99	GZ	Components: (NO_x, SO_2, PM_{10}) We need meteorological data for 1996 and 1997.
k) Daily concentrations in receptor points (Sep. 1997–March 1998) for their interview study		6.1	April 99	GZ	We need met. data for Sep.97- March 98?
l) Emission data for 2010 and various measures 2001	1		April 99	GZ/Norce	Components: (NO_x, SO_2, PM_{10})
m) Conc. calc. for 2010 and various measures 2010		5, 6.2, 6.3	May 99	GZ	As requested by other tasks
n) Reports			Oct. 99	GZ/Norce	

Task 4 Monitoring

Detained Work Plan for 1999

The summary of status and continued work plan for 1999 is:

1 Improvement plan for the network	
1.1 Proposed from GZ team	1999/3
1.2 Evaluation and suggestion by NILU	1999/6
1.3 The plan report for new network	1999/10
2 QA/QC training	1999/4
3 Data to other tasks (e.g. task 3 / task 6)	
3.1 historical data	to be done
3.2 on line data	to be done
4 Finishing technical report	
4.1 Description report of existing network	1999/10
4.2 The plan report for new network	1999/10

Task 5 Exposure

Detailed Work Plan for 1999

Objective

The objective of this task in 1999 is to estimate the population exposure in Guangzhou area (baseline scenario, trend scenario and target scenario). With KILDER model to calculate exposure and finish collecting coding work and population distribution of interviewed people within the model grid, for Task 6.1.

According to the established work plan, we have to complete the following task in 1999:

Detailed Work Plan TASK 5

Input/Output	From	To	When	Resp.	Questions and comments
a) Annual mean concentration for 1995 from KILDER.	3		Nor: Done GZ: Jan. 99	GZ	Components: NO_x, SO_2 and PM_{10}
b) Annual mean concentration for 1995, combined with population, giving the number of people in conc. Intervals (in grid), using KILDER		6.1	Nor: Done GZ: Jan. 99	GZ	
c) The road links of all the roads considered in the interview study of Task 6.1 has to be defined within the AirQUIS system	1		Middle of Dec. 98	GZ	Should be less than 10 roads.
d) Coding Interview study Receptor points and population distribution of the interviewed persons.		6.1	Jan/Feb. 99	GZ	Produce three Excel input files. (One for AirQUIS and two for Task 6.1).
e) Obtain population distribution 2001.	1 and 8		Feb. 99	GZ	
f) Obtain hourly /daily conc. data for 1995 (AirQUIS-2.0).	3		Feb/march 99	GZ	Hourly NO_x , SO_2, and daily PM_{10}
g) Exposure calculations for 1995 (AirQUIS-2.0).		6.1	March 99	GZ	As requested by other tasks.
h) Conc. data for 2001 and various measures for 2001 (AirQUIS-2.0).	3		March /April 99	GZ	Hourly NO_x , SO_2, and daily PM_{10}
i) Exposure calc. for 2001 and for various measures for 2001 (AirQUIS-2.0).		6.1	April 99	GZ	As requested by other tasks.
j) Obtain population distribution 2010.	1 and 8		April 99	GZ	
k) Conc. data for 2010 and for various measures for 2010 (AirQUIS-2.0).	3		May 99	GZ	Hourly NO_x , SO_2, and daily PM_{10}
l) Exposure calc. for 2010 and for various measures for 2010 (AirQUIS-2.0).		6.1	May 99	GZ	As requested by other tasks.

Besides the work we have done in the previous months, we still have certain part to accomplish.

1. Apply emission data (as given by Task 1) and the concentration data from Task 3 to calculate 1995 annual average population exposure by the use of the KILDER model.

2. Further training of the Chinese staff in the use of the AIRQUIS model. Since the AirQUIS-2.0 version now is installed at GRIEP, this training will take place at this institution.

3. Calculate the amount of static exposure to people in grid squares and along typical major roads for 1995, using the AIRQUIS exposure model. NILU should take part in this calculation on an advisory level.

4. Estimate the population exposure results, which are needed by other tasks, as a part of the Air Quality Abatement Strategy Development for the city of Guangzhou. This can be done for different scenarios and years, provided that the concentration data and population data are made available by other tasks.

5. To serve the needs of Task 6.1, Task 5 will perform the following work:

   The addresses for all participants of the interview study of Task 6.1 will be coded in the grid system. In addition the positions (x- and y-coordinate in meters within the modeling domain) of a selected number of receptor points (approximately 80 points) should be written into a EXEL file as defined during the Workshop in November 1998. Moreover, an EXEL file connecting the interviewed people living in the traffic area of the interview study of Task 6.1 should be created. The format of this file has also been defined during the workshop, and it should contain one line for each person living in the traffic area (approximately 1000 persons).

6. Write a total Report, including descriptions of activities, progress and results for the work that is done during the project period.

D. Organization, Time Schedule and Results

Sub Task	Sub Task Name	Personnel GRIEP	Personnel NILU	Products	Time limit
1	AIRQUIS training	Mr. Weng, Zhang, Wang, Mrs.Li	Mr. Slordal	User manual for the AirQUIS-2.0 model	End of 1999
2	KILDER exposure calculation	Mr. Weng, Zhang, Wang, Mrs.Li	Mr. Gram	Results and Result report	Feb. 1999
3	AIRQUIS exposure calculations	Mr. Weng, Zhang, Wang, Mrs.Li	Mr. Slordal	Results and Result report	Sep. 1999
4	Work for Task 6.1	Mr. Weng, Zhang, Wang, Mrs.Li	Mr. Slordal	Exel files of coded positions of the interviewed people, and grid distributions of these people.	Feb. 1999
5	Report	Mr. Weng, Zhang, Wang, Mrs.Li	Mr. Slordal	Report	End of Oct. 99

E. Co-ordination with Other Tasks

Task 5 needs concentration data from task 3. This includes the first estimate from the KILDER model, and the concentration results from the AirQUIS model.

Also, population data is needed for the scenario years. Task 1 and Task 8 will provide these.

For the work that will be performed for Task 6.1, Task 5 will need population data (the years of 1996, 1997 and 1998) from Task 1 and concentration data from Task 3. Also, the addresses from the interview study must be provided by Task 6.1. In addition Task 1 must supply the information on the roads where used in the interview study, so that these can be input into the AirQUIS road network system.

Task 6-1 Health Damage Assessment
Detailed Work Plan for 1999

1. Objective

The objective of this task is to assess damage to health in Guangzhou due to air pollution using dose-response functions in such a way that the benefit of reduced damage due to emission reductions can be calculated in cooperation with Task 9.

The objectives of the work to be done in 1999 are:

- To analyze the results from the interview study aiming at screening the prevalence of respiratory health symptoms in adults and children in Guangzhou. The study gives a lot of information about the respiratory health of Guangzhou citizens and will be the basis for estimation of dose-response functions for these symptoms.
- To analyze the collected data on crude mortality rates and number of hospital admissions related to a number of end-points that are regarded as relevant in the context of air pollution epidemiology. Dose-response functions may be found also from these investigations.
- To review Chinese literature on air pollution epidemiology. Dose-response functions available in this literature and from other internationally published studies will be used in the estimation of possible reductions in health effects that may be obtained from a) the 2001 Action plan and b) the 2010 Action plan.

2. Description of each subtask

Overall tasks of Task 6-1 are distributed into 4 major subtasks in 1999:

Subtask 1) Interview study (epidemiological study)
The collected data will serve as basis for answering i.a. the following questions:

- What is the prevalence of the various respiratory symptoms and chronic diseases that were recorded in the interview study?
- What dose-response functions may be derived from the data? (Task 5 will provide the data that are needed to estimate exposure level for the people that were interviewed).

The analysis of dose-response relationship will be done during the training period of Li Zhiqin in Norway.

A report will be made from this part of the study. Preliminary title: ***"Health effects from air pollution in GZ – respiratory symptoms and diseases. Results from an interview study"***

Content (preliminary):

- Methods used in planning and performing the interview study
- Results: 1) Frequency of symptoms and diseases in GZ. 2) Established dose-response functions

Subtask 2) Health statistics for Guangzhou
The collected data will serve as basis for answering i.a. the following questions:

- What is the present rate of annual deaths in the various population groups?
- What is the present frequency of hospital admissions for the various ICD9 disease groups and population groups?
- What dose-response functions may be derived from the data? (Task 3 will provide concentration data on a district level for 1996 and 1997 for this purpose)

In addition to the collected data, the GZ team will try get information about epidemics during the study period.

The analysis of dose-response relationship will be done during the training period of Li Zhiqin in Norway. Some preparatory statistical analysis and data descriptions will be made before the training period.

A report will be made from this part of the study. Preliminary title: ***"Health effects from air pollution in GZ – mortality and hospital admissions"***

Content (preliminary):

- Methods used for collecting and analyzing health statistics
- Results : 1) Mortality rates and HA rates in GZ. 2)Established dose-response functions

Subtask 3) Reviewing dose-response functions from Chinese and international studies

This task concerns the follow-up on the work on external dose-response functions that was started in 1998. More effort will be made to investigate what is available of Chinese studies in this field. The results from this part of the study will be reported together with the report from the 2. sequence calculations (see below).

Subtask 4) 2. sequence calculations

This subtask includes calculations of reduced health damage due to implementation of abatement measures by use of dose-response functions from GZ (from and from international studies for two scenario periods:

- 2001 Action plan
- 2010 Action plan

A report on the results from this will be made.

5) Status reports

Two status reports will be written and submitted during the period of two workshops in 1999.

4. Overview of subtask, organization, time schedule and products

Subtask	Responsible	Output	Time limit
1. Interview study	Li Zhiqin		
- Report on the procedure for planning and performing the interview study	Li Zhiqin	Technical report (or chapter in final report from the interview study)	January
- Data description: Sorting data, making crosstables etc.	Li Zhiqin	Data files to be used in Norway for the dose-response analysis (training period)	March
- Training in Norway: Dose-response analysis	Li Zhiqin (guidance by Jocelyne Clench-Aas and Alena Bartonova)	Dose-response functions and prevalence rates for the various symptoms	? Depends on the Airquis output
- Report on the result from the interview study	LZ, JCA	Report	As above
2. Health statistics from GZ	Chenyang (GEMC)		
- Report on the procedure for collecting health statistics	Li Zhiqin and Chenyang	Technical report (or chapter in final report from the ecological study)	January
- Basic statistical analysis	Chenyang	Data files to use in Norway for the dose-response analysis (training for Li Zhiqin)	March
- Training in Norway (Li Zhiqin): Dose-response analysis	Li Zhiqin (guidance by Jocelyne Clench-Aas and Alena Bartonova)	Dose-response functions, and statistical data on mortality rates and hospital admission rates	?
- Report on the results of the study	Li Zhiqin and Chenyang	Report	August
3. External dose-response functions	Kristin Aunan and Li Zhiqin		
- Write a report reviewing the relevant dose-response literature from China and internationally - Report the 1. Sequence calculations	Kristin Aunan and Li Zhiqin	Technical report	February Dec. –98
4. 2nd sequence			
- Apply the dose-response functions from GZ (and external functions if required) in the calculation of benefits from the given action plan	Kristin Aunan and Li Zhiqin	Estimated reduced health effects of abatement measures Technical report	August

4. Coordination with other tasks

The detail may be seen from the following table:

Input needed	Time limit	Task 6 sub-task	Output
	January		*To Task 9:* Data from the interview study that regard medicine use, income and salary, and willingness to pay will be provided to *Task 9**
From Task 5: (1) The addresses for all participants of the interview study of Task 6-1 should be coded in the grid system and be punched into a Excel file. In addition the positions for the peoples selected in traffic area should be written into an Excel file.	January	1	*To Task 3:* Excel file containing addresses code will be the basis for Task 3 to calculate the pollution level
(2)Based on the concentration data from Task 3, Task 5 should provide Task 6 the exposure of the interviewed persons in the period Sept. 1997 to March 31st 1998. Excel file shall contain the following: For each person (ID): Daily mean and maximum of PM_{10} at home and at workplace; hourly mean at home and at workplace; hourly mean of NO_2 (?) and SO_2 at home and at workplace	Before April	1	*To Task 6-1*
From Task 3: Concerntraton level of the interviewed persons in the period Sept. 1997 to March 31st 1998. Daily mean and maximum of PM_{10} at home and at workplace; hourly mean at home and at workplace; hourly mean of NO_2 (?) and SO_2 at home and at workplace	Before April January	1	*To Task 6-1 subtask 4*
From Task 3: Concentration levels in the 8 districts in 1995, 1996 and 1997: PM_{10} , NO_2 and SO_2:	Before April	2.	*To Task 6-1 subtask 4*
From Task 5: Population exposure in GZ (total) in baseline year and scenario years. PM_{10}, SO_2, and NO_2 (?).		4.	*To task 9:* List of health end-points so that Task 9 can prepare estimates of the economic unit value.
2001 Action plan 2010 Action plan	March August		Estimated reduced health effects of abatement, 2001/2010

* ***NB:*** These issues were included in the study on request from Task 9. Task 9 is responsible for coding and analyzing the data from this part of the interview study.

5. Budget

GZ (not finally decided yet)

Task	Person-weeks
Interview study	16
Health statistic GZ	16
External dose-response functions	4
2. sequence	8
SUM	44

NORCE: Preliminary!

Task	*5.1.1.1.1.1.1 Man-hours*
5.1.1.1.1.2 Interview study	70
Health statistic GZ	30
External dose-response functions	30
2. sequence	40
Administration and coordination	30
SUM	200
Workshop GZ	1 person: travel, per diem + work hours (50.000 NOK)

Task 6-2 Material Damagement Assessment

Detail Work Plan for 1999

Objectives

According to the result of field test, to examine and modify the existing international dose-response and lifetime equations of materials caused by pollution damage and define the dose-response and lifetime equations of materials in Guangzhou area; Based on the calculation of amount of building materials exposed in Guangzhou and the GRID concentration of air pollutants (SO_2, O3, H^+ in precipitation) from dispersion modeling group, to estimate the pollution damage and evaluate its economic loss for building materials in Guangzhou area.

Detailed task description

The tasks have already been finished in 1998

- To finish the one year field test in 10 sites(panels pickled and weighted)
- To determinate the dose-respond equations and lifetime equations for materials.
- To implement the calculation on materials amount distribution in the GRID system

- To finish collection of data of building materials price and worker salary for building repair and maintenance in Guangzhou.
- To fulfil the collection of climate data.

The work will be finished in 1999

- Sub-task 1: to present to three technical reports:
  Report of the field test
  Report of the materials distribution of materials in Guangzhou
  Report on materials lifetime and building maintenance cost in Guangzhou
- Sub-task 2: to calculate the pollution damage and evaluate its economic loss for materials.
  Depends on the output of Task 3.
- Sub-task 3: to finish the work report of 1998.
- Sub-task 4: To finish total report.

Time schedule, responsible person and the work load demanded (Guangzhou Side)

No.	Date	Task	Participant	Work load (Person.hour)
1	12/98	To calculate the total amount of materials in Guangzhou and send it to NILU. To send the pollution data to NILU.	He Liangwan, Luo Jiahai	80
2	1/99	To finish the field test exposure report and the materials calculation report.	He Liangwan, Luo Jiahai ,Tian Kai	140
3	2-4/99	To finish the report of materials lifetime and building maintenance cost Based on the GRID concentration data (from Task3), to calculate and evaluate the damage economical lose for materials in Guangzhou.	He Liangwan, Luo Jiahai ,Tian Kai	100
4	5-6/99	To prepare the second year work report	He Liangwan, Luo Jiahai ,Tian Kai	42
5	6-8/99	To prepare total report	He Liangwan, Luo Jiahai ,Tian Kai	42
6	9-11/99	Present to total report	He Liangwan, Luo Jiahai ,Tian Kai	140

Time schedule, responsible person and the worktime demanded (Norwegian Side)

Date	Task	Worktime	Responsible person
12/98	Demonstration of the dose-respond and lifetime equation for Guangzhou.	3 days	J.F. Henriksen
2-4/99	Contribution to the work report of 1998	3 days	J.F. Henriksen
11/98	Contribution to total report	2 days	J.F. Henriksen

Coordination with other tasks

- With Task 3
  To calculate the damage of materials and evaluate the economic cost in Guangzhou , Task 3 need to provide the data of SO_2, NOx and $[H^+]$ in rain modeling GRID concentration. A deadline for it is necessary.
- With Task 4
  In order to define the dose-response equation in Guangzhou, the air pollution data in each test sites in 1997 such as yearly concentration of SO_2, NOx, $[H^+]$ in precipitation must be available now, so coordination with Task 4 is necessary. The data had just been sent to NILU on 27 November 1998.
- With Task 7 and Task 3
  In order to work out the cost-benefit analysis for the materials damage, We also need the GRIDs concentration of SO2□NO_X□H^+ in rain data after carry out the control measures in the action plan(4 measures).

Task 6-3 Vegetation Damage Assessment

Detailed Work Plan for 1999

- **Objective**

Complete the rest subtask reports based on the synthetic analysis of the collected data and information. The reports shall be written in Chinese and English. And transfer to the related tasks.

- **Subtask description and time schedule:**

1. Vegetation assessment of urban area
   - 1.1 Data analysis, statistic and sort out. Jan.
   - 1.2 Collect air pollutant concentration and distribution data of Guangzhou. Feb.
   - 1.3 Compile and translate report March

3. Crop damage assessment
   - 3.1 Sort out the collected information — Jan.
   - 3.2 Collect Ozone concentration distribution data of Guangzhou. — Feb.
   - 3.3 Compile and translate report — March

4. Forest damage assessment on Baiyun mountain
   - 4.1 Improve the information collected from survey — Jan.
   - 4.2 Collect air pollutant concentration and distribution data of Guangzhou. — Feb.
   - 4.3 Data analysis and statistic — Feb.
   - 4.4 Compile and translate report — March

6. Vegetation damaged by acid rain
   - 6.1 Try to collect the soil character information of Guangzhou — Jan.
   - 6.2 Compile the report based on the status report — Feb.
   - 6.3 Translate in English — March

- **Subtask, schedule and responsibility**

subtask	Subtask 1	Subtask 3	Subtask 4	Subtask 6
responsibility	Su Xing	Su Xing	Hu Di-Qin	Hu Di-Qin
schedule	March, 1999	March, 1999	March, 1999	March, 1999

- **Related to other tasks**

1. We need the air pollutant concentration and distribution data of Guangzhou. They shall be provided by task 3 as soon as possible to evaluate the damage.
2. Ozone concentration and distribution data need to be provided by task 4. Then the rice damage assessment can be performed.
3. The reports will be transferred to task 9.

Task 7: Control Options

Detailed Work Plan for 1999

GZ part:

1. Going on collection of traffic data existing technologies that are main souces for current air pollution in Guangzhou . For transport technologies the necessary will be provided from Task 11 and Task 1.
2. Task2 and Task 8 will assist Task 7 establishing these projections.
   -Projections of activities that generates airs pollution or consume energy
   -For all sectors and end-uses
   -Time horizon; up to 15-25 years

3. Establishment of an energy system model for GZ and surrounding regions
   Based on the decision of which model to use, establish a model structure of base year reference energy system. The starting point for this is the energy balance of supply, transformation and end-use of energy in the current situation.
   Implement data for current technologies and future options in the model.
   Calibrate model
4. Identification of cost efficient control options for emission abatement
   The emission levels (abatement effect)are input to the loop;dispersion-exposue-darmage assessment,and subsequently input to cost-benefit calculations.
   The costs of the option are direct input to cost-benefit calculations.
5. Write report of results.

Time schedule, time consumption and relation to other tasks

Sub-tasks	RESEARCH CONTENT	Time	Person-weeks	Relations of task
1	The starting point for the task is to collect and analyze the current and the historical emissions of different pollutants by transport by geographic location, and by type of energy carrier.	1998.11~1999.3	15	T1,T2,T11
2	This part involves collection of data for existing and planing technologies that are sources for current air pollution in Guangzhou.	1998.11~1999.4	20	T1,T2,T8
3	Establishment of an energy system model for Guangzhou. and surrounding regions	1999.3~1999.12	35	
4	Collection of data for control options for reducing emissions	1998.12~1999.6	45	T9,T1
5	Data on emissions factors for technologies to be included in the baseline	1999.4~1997.6	5	T8
6	Write report of results	1999.6~1999.12	10	
Total		1998.11~1999.12	130	

Task 8 Baseline Scenario Development

Detailed Work P{lan for 1999

Objective

The objective for 1999 is to finish all of the work required by general task. Based on the work completed in 1997 and 1998, the task 8 will publish a *baseline scenario* 1995-2010, a *trend scenario* 1995-2010 and possibly a *target scenario* 1995-2010.

Task description 1999

1. Design and discuss the *baseline scenario* based on the equations emissions year t = activity indicator year t*energy intensity 1995*emission coefficient 1995.
2. Design and discuss the *trend scenario* based on the equations emissions year t = activity indicator year t*«trend» energy intensity year t*«trend» emission coefficient.
3. If possible, design and discuss the *target scenario* based on the equations emissions year t = activity indicator year t*«target» energy intensity year t* «target» emission coefficient year t.
4. If necessary, assists the general task group to construct the action plan.
5. Assist task 1 to construct the emission inventory(2001 and 2010)
6. Transfer some data to other tasks.

Time schedule

Subtask	Participants	Relevant task groups	Jan-Feb	Mar-Apr	May-Jun	Jul-Aug	Sept-Oct
1	Mr. Fan Mrs. Huang Dr. Cui Dr. Vennemo	7,11,2	X	X			
2	Mr. Fan Dr. Cui	7,11,2		X	X		
3	Mr. Fan Mrs. Huang Dr. Cui Dr. Vennemo	13,7,11,2			X	X	
4	Mr. Fan Mrs. Huang Dr. Cui Dr. Vennemo	13			X	X	X
5	Mr. Fan Dr. Vennemo	1	X	X			
6	Mr. Fan Dr. Vennemo	5,7,etc.	X	X	X		

Resources and costs

Person.weeks

Subtask	1	2	3	4	5	6	Total
GRIEP	8	16	4	4	2	2	36
NORCE							

The assistance needed from other task groups

These are the contact points that task 8 needs to carry out its work:

1. Contact task 2/7/11 about the consumption of energy per sector.
2. Task 2/7 provides MARKAL results on trend energy intensities and trend emission coefficients.

The assistance provided to other tasks by task 8

1. Task 8 provides a baseline scenario, trend scenario and target scenario for task 1 to utilise.
2. Task 8 provides a baseline scenario, trend scenario and target scenario for task 13 to utilise.
3. Task 8 provides activity indicators to task 7.

Task 9 Cost/Benefit Analysis
Detail Work Plan for 1999

Objectives

The objectives of task 9 in 1998 are following two parts:

(1)Value the health damage, vegetation damage and material damage.

(2) Finish the cost benefit analysis of each measure that task 7 present.

(1) Write a general report, finish all the work that the whole project demand.

The main work in 1999:

GZ side:

(1) Collect data of mean of cost of medicine and so on.

(2) Write a draft report of valuation of health damage according to the dose response in GZ

(3) Write a draft report of valuation of vegetation damage.

(4) Write a draft report of valuation of material damage.

(5) Do three case study. • Cost benefit analysis of moving factories. •Cost benefit analysis of motor cycle control. •Cost benefit analysis of third industry air pollution control.

NORCE side:

All the work above will be finished under advice of NORCE.

Time schedule

For subtask(2), (3), (4) is relevant to task 6.1, 6.2, 6.3.we need data from them.

For task (5)we will finish all the work before May 1999.

TASK10 WORK PLAN -1999

Task 10 will follow two tracks in 1999.

The first track is to suggest and analyse policy proposals for three main sectors(power plants, industry and transport)based upon our previous evaluation of both the existing policies, regulations and the implementation and enforcement of these policies and regulations in Guangzhou. This will be done more independently of other tasks than our second track(see below).

This part will also include proposals based upon studies of successful international experiences which have been studied in 1998,f.example traffic pollution management in singapore, land use planning in the Netherlands, tradeable emission quotas in the USA, pollution charges in Sweden or direct emissions regulations in several such as Germany, Norway, etc.. These systems should be evaluated for a Chinese context.

The second track is to analyse how the concrete control options coming out from task9 and 7, and those that may defined at an earlier stage as components of GZ AQMS action plan, could be translated into concrete policies. These policy proposals should be aimed at facilitating the realization of the control options. Criteria for discussion and selection of policy instruments should first of all be effectiveness(these probability that a specified emissions reduction will be achieved) and cost-effectiveness(that target emissions reduction are achieved at least cost), practical and political feasibility, but also other criteria should be considered, such as income distribution aspects and administrative costs.

Policy instrument which will be considered and analysed will be among the main categories: command and control, economic instruments, voluntary agreements, information.

The results of the policy analysis of task ten will serve first and primarily as input to the action plan.

The outputs of the task work of 1999 will be in the form of two kinds of kinds of reports: First, a report containing recommendations of policy reforms based upon a more overall analysis of the exisiting system of policies and use of policy instruments in GZ. Second, one or more reports containing policy recommendations on a specified list of actions that are identified as suitable and prioritized for the action plan and additional options that are eventually identified in analysis of task9.

The progress of the work of task 10 in 199 will depend partly on the progress of task7 and 9, partly on how quick a list of prioritized actions/control options are identified for the action plan, and consequently it will be difficult to determine deadlines for specific sub-task. The progress of work and deadlines needs to be discussed with these tasks.

Task 11 Motor Vehicle Emission and Photochemical Pollution

Detailed Work Plan for 1999

The workplan in 1999

1. Complete the report about vehicle emission factors, including the introduction of MOBILE5,the basic parameters in MOBILE5 and the destination of basic emission factors which suitable for GZ.
2. Establish the database of vehicle volume in the main roads of GZ in 2000. The work will be based on a vehicle road network map of GZ which has been obtained.
3. Review exiting reports such as GZ traffic plan,city plan,the ninth-five year development plan and project of traffic administration in the central area to determine the vehicular development trends, volume and basic character in the future in GZ.
4. Study forecast models of vehicle development trend both in the national and international cities,especially to the Shanghai model. Select a suitable forecast model for GZ.
5. Forecast the vehicle volume in urban area,four counties and the whole city in 2000 and 2010 and consider the effect of new strategies such as not licensing MC and the reform of ownership of public minivans and cars.
6. Prepare a report for a vehicle emission pollutant control program in cooperation with other concerned tasks.
7. Determine the cost to convert taxis, buses to LPG.

Task 11 has finished a report on the ownership amount of vehicles from 1949 to 1996 all over GZ. We'll finish other four Sub-reports and a summary report after the workshop ,including:

- A report on the current state of vehicle emission factors and its development in the future in GZ.
- A report on the development and forecast of vehicle amount in the future. The two sub-reports will be available by the end of 1998.
- A report on GZ traffic network and traffic volume of every main road and their forecast in the future will be completed in March 1999.
- To integrate with all strategies including regulations and policies, we will provide a report on the basic framework of vehicle emission controlling.
- At last a general report on the research of GZ vehicle emissions controlling will be completed by the end of 1999.

Task12: Air Pollution Forecasting

Detail Work Plan for 1999

GZ Side : Liuli

We have got the EPISODE model from Norway side, based on that model, here is the detail work plan for 1999:

Objectives

Establishing a air pollution forecasting system for GZ, the Episode model will be used in this system..

Detail work plan

Subtask 1: Running the model and training in the task group Time :the rest of 1998

1.1 Start to run the Episode model, prepare the input files for the model,.

1.2 Everyone of the task group should accept the training about the Episode model and AIRQUIS system

Subtask2: Evaluation the model before adjusting Time :Jan.-Feb,1999

2.1 Put into the historical meteor-data(1991-1995) into the model, evaluate the calculated results before adjusting the model.

2.1 Study the parameter we could change in the model, give a plan to adjust this parameters.

Subtask3:Adjusting and testing the model Time: March-April,99

3.1 Testing the value of this parameters in different conditions.

Subtask4:Modifying the results by statistic result Time :May,1999

4.1 Using the statistic results from historical data, find a method to modify the calculated results from the Episode model.

Subtask5:Testing period Time :June-Aug, 99

5.1 Put the Meteor-data and measurement data (from March to August ,1999) into the Episode model, this model have been adjusted. it will be a testing period for this forecasting model.

5.2 Definiteing the last valve of the parameters.

Subtask6:Prepare for the forecasting to public Time :Sept,1999

6.1 Choose a proper form, give the forecasting to public.

Coordination with other task:

Task1: The Emission data for Episode model

Task4: The Meteor-data from auto-station.(should be supplied before May,1999)

Task?: The meteor-data from GZ meteoro-department (March-August,1999)

Description of the subtask:

Subtask	Responsible	Time	W×P
Subtask1	Liuli,Fuchun	the rest of 1998	4×3
Subtask2	Liuli,Fuchun	Jan.-Feb.,1999	6×2
Subtask3	Liuli	March-April,1999	6×2
Subtask4	Fuchun	May, 1999	4×2
Subtask5	Liuli	June-August,1999	8×2
Subtask6	Liuli,Fuchun	Sept.,1999	4×1

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ABSTRACT

** Kategorier:*
A Åpen - kan bestilles fra NILU
B Begrenset distribusjon
C Kan ikke utleveres