

DRAFT 2007-0115 v 10
For inclusion in contract

TERMS OF REFERENCE

FOR
A SHORT-TERM CONSULTANT
DEPLOYED UNDER THE DANISH-SOUTH AFRICAN
URBAN ENVIRONMENT MANAGEMENT PROGRAMME

WITHIN THE
City of JOHANNESBURG
Department: Environmental Management

Review of Procedures,
Recommendations,
Implementation and Capacity
Building of
EMIT and ADMS-Urban for

Emissions Inventory Compilation
and Atmospheric Dispersion
Modelling for
The City of Johannesburg

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The purpose of this document is to provide the Terms of Reference for a consultant from Cambridge Environmental Research Consultants Ltd. (CERC) to provide customized consulting and support to the City of Johannesburg for the implementation of EMIT and ADMS-Urban.

1. Information summary

<p>1. <i>Title</i></p> <p>Review of Procedures, Recommendations, Implementation and Capacity Building of EMIT and ADMS-Urban for Emissions Inventory and Atmospheric Dispersion Modelling for The City of Johannesburg</p>
<p>2. <i>Client</i></p> <p>The Urban Environment Management Programme PSC Secretariat, Department of Environment and Tourism Programme Advisor: Bo Leth-Espensen + 27 (0) 12 310 3228 ble@deat.gov.za</p>
<p>3. <i>Management of this project</i></p> <p>The City of Johannesburg; Department of Environmental Management; PO Box 30733, Braamfontein, 2017, South Africa. Margot Richardson: Senior Atmospheric Scientist T: +27 11 407 6749 / m: +27 82 379 6209; MargotR@Joburg.org.za CERC: Tricia Gilmour: Principal Consultant T: +44 1223 357773 / fax: +44 1223 357492, Tricia@cerc.co.uk</p>
<p>4. <i>The specific problem:</i></p> <p>The City of Johannesburg purchased air quality management software, with the understanding that there would be local support for it. However, in 2006 there are no local experts. Hence the need for assistance from the software developers, Cambridge Environmental Research Consultants Ltd.</p>
<p>5. <i>Main outputs to be delivered</i></p> <ol style="list-style-type: none"> 1 A team of 5 staff members trained in the use of the EMIT and ADMS-Urban software packages, including gathering of data and calculating source emissions, in order to update an emissions inventory database. 2 A technical detailed summary report providing <ul style="list-style-type: none"> • A review of available and missing emissions data; • Recommendations of where and how to source missing emissions data; • Recommendations of how to organise work, including data assimilation within the development of an emissions inventory and in an ADMS-Urban study • Recommendations of how to undertake data quality assurance; • A review of scenario studies and dispersion modelling projects undertaken to date – in EMIT and in ADMS-Urban; • Recommendations of the process involved in the verification of ADMS-Urban output results with air quality monitoring data; • Recommendations on how to develop EMIT and ADMS-Urban scenarios for the future, based on projected city growth and development. • Recommendations based on the data available and review of methodologies, for the improvement of the current emissions inventory database.

6. *Perspective*

Johannesburg ranks high in air pollution as well as population density. Reliable modelling, including the provision, management and reporting of data is essential in the municipality's management of air quality as well as specific cases of permits and of city development.

The City of Johannesburg has the hardware and software for this air quality modelling work, but not technical capacity and know-how to fully utilise the system. The need is to acquire services from a UK expert to provide training (including written training material) of the software packages EMIT and ADMS-Urban, as well as recommendations/improvements on proceeding with current work.

7. *Indicators of successful accomplishment*

Overall:

- The city staff is capable of managing the data collection, data management and of other relevant uses of the software packages EMIT and ADMS-Urban.

Specific:

- Current data and reports are recognized by scientific institutions and public authorities
- Current and upcoming data and reports inform Johannesburg's decisions, planning and strategies
- The Johannesburg administration is capable of producing reliable air pollution scenarios to aid in the development of special plans and strategies to tackle air pollution.

8. *INPUTs* (summary of budget frames)

UEM

- Consultant (days): $3+10+2+5+2+4 = 26$ days
(Prep + first visit + written detailed summary in UK + second visit + written detailed summary in UK + travel)
Travel and logistics, etc for consultant.

City of Johannesburg

- Staff days as indicated in budget frames.
- Other expenses:
 - Provision of a venue, computers and equipment for the training
 - All other costs to meetings, site visits, etc. for the consultant to do and present the work
 - All printing costs

9. *Dates*

- First visit: 5-19 February 2007 – or as soon as possible thereafter.
- Second visit: 6-10 August 2007 – 6 months after the end of visit 1 or as soon as possible thereafter.

End: Must be 1 month after the completion of visit 2 and no later than 30 October 2007

10. *Submission of all outputs*

No later than 4 weeks after visit 2 to Margot Richardson; MargotR@Joburg.org.za

2. Project Budget Frames

Consultant days and staff days

	UEM Cons.	City of Johannesburg	5 staff members. Each will as a mi- nimum be assign- ed to w-days as indicated
	Work - days	Staff – days	
Preparation	3	5+	Preparation
Visit 1	10	5x4 + 5x2	Week 1 -Training: assimilation of data and calculation of emissions; EMIT and ADMS-Urban training. Week 2 –Recom- mendations and review of City of Johannesburg air quality work.
Written detailed summary, UK	2		
Visit 2	5	5x3	Review of training for all staff; follow-up of work carried out since visit 1.
Written detailed summary, UK	2		
Travel	4	0	
TOTAL	26	45+	

The total number of 26 consultant working days cannot be exceeded

Other expenses

	UEM	C. of Johannesburg
All expenses, salary, p. Diem, transport etc. as specified in contract between UEMP and consultant	X	
All necessary hardware and software for the consultant to carry out the assignment, effectively and in collaboration with the assigned staff: i. e. venue, computers, printers, etc.		X
All other travel expenses		X
All printing costs		X
All costs related to meetings, etc. in the city administration for the consultant to do and to present the work		X

3. Introduction and Background

The City of Johannesburg is in the possession of equipment, hardware and software for Air Quality monitoring and modeling, but the staff needs the appropriate training.

In anticipation of the requirements of the National Environmental Management: Air Quality Act, the City of Johannesburg began formulating and developing an Air Quality Management Plan during 2002, and has had a Council-approved air quality management plan (AQMP) since 2003. The implementation of this plan includes the development of an overall Air Quality Management System, including the population of an inventory of air pollution emissions (emissions inventory - EI) and, later, atmospheric dispersion modeling.

To this end the City of Johannesburg purchased, from WSP Walmsley, a UK-developed, urban-scale dispersion model (ADMS-Urban), and compatible emissions inventory (EMIT) software, during 2003. At the time, the agent (WSP Walmsley) for distributing the software in South Africa was also responsible for supporting the products. Shortly after procuring the software, the City of Johannesburg employed Abel Sakhau, from WSP Walmsley, to populate the EI software and operate the dispersion model. Abel was trained by CERC. An additional person, Margot Richardson, was employed to assist Abel with the model. However, Abel's resignation from the City in January 2006 has implications for progress to be made with the model, since there is no further support for Johannesburg officials through WSP Walmsley.

EMIT and ADMS-Urban are software programmes developed to facilitate the development of an emissions inventory and, subsequently, conduct atmospheric dispersion modeling. They have the potential to provide decision makers with the necessary information required to make development and planning decisions, particularly where disadvantaged communities are concerned. For example, EMIT will be populated with the current household fuel usage situation and dispersion modeling undertaken. Thereafter, a scenario where an electrification programme has been implemented, for example, will be input into the model and the dispersion model run again, to demonstrate the air quality benefits from such a project. A tool such as this provides spatially resolved information about the best location in which to implement projects – those communities most adversely affected by the current situation.

During 2006, the University of Johannesburg was appointed to assist with some of the issues hindering progress with the model, related specifically to software interfaces between the City of Johannesburg's Transportation Planning and Management model, emme/2, Johannesburg's GIS data which was not importable into ADMS-Urban, and the processing of Census 2001 data for domestic energy use to be incorporated into EMIT.

While significant progress has been made on all three datasets, further support and assistance from CERC is necessary in order to ensure modeling output is scientifically meaningful. It is essential that the methodologies employed to process data sets be scrutinized and evaluated by a third party, most appropriately a consultant from CERC who works with emissions inventory and modeling data on a day-to-day basis.

An informal discussion was held with a consultant from CERC during November 2006, where the necessity for customized consulting to the City of Johannesburg was discussed, and a mechanism to make it happen was to be explored by the City.

4. Objectives

The overall objective of this project is to provide the City of Johannesburg with the ability to do in-house reliable air pollution modeling and management, which is scientifically credible and, as such, can be directly used as a platform for decisions and planning.

The direct objective is to provide recommendations to be able to update a database of emissions and develop the current air quality modeling work; also train a team of in-house officials so that they are capable of development and maintenance of air quality work in terms of emissions inventory compilation and air dispersion modeling. The city has procured the software EMIT and ADMS-Urban which have the technical potential for this undertaking.

The project will lead to an improved emissions inventory for the city, a first-level verification of the inputs to the ADMS-Urban model, recommendations for improvements and the necessary transfer of skills to Johannesburg officials

5. Main Outputs

The main outputs (deliverables) from the project will be

- 1 A team of 5 City of Johannesburg staff members trained in the use of the EMIT and ADMS-Urban software packages, as well as gathering of emissions data and calculating emissions to update an emissions inventory database.
- 2 A detailed summary report. The report will refer to materials handed out or used during the course. In total this will make the city able to take the work further. It includes – but is not limited to - the following
 - A review of available and missing emissions data, quantity and quality and an assessment of the credibility, completeness, etc of the reports and other information, which is generated by the system, and which can be generated by the system on this basis.
 - Recommendations and prioritisation for further completion of where and how to source missing data
 - Recommendations of how to organise the work with the provision, management and modelling of data
 - Recommendations for the undertaking of quality assurance
 - A review of scenario studies and dispersion modelling work undertaken to date – using EMIT and ADMS-Urban
 - Recommendations for the process involved in the verification of ADMS-Urban modelled results with air quality monitoring data
 - Recommendations for the development of scenarios of the future, based on projected city growth and development.
 - Recommendations, based on data available and review of data processing methodologies for the improvement of the current database

6. Other Outputs

In total the assignment will produce the following outputs

1. *An inception note* with the consultants overall perception of these Terms of Reference, and a draft working plan for the 15 working days (in Johannesburg), based on these Terms of Reference, in particular the outputs and the list of activities (section 7)
2. *A note with the training programme* for 5 staff members listing the items to be covered in 4 to 5 training days. Annexes to this note should be the written materials needed for the training.
3. *A note with the outline* of the technical summary report based on the description above (section 5.2) specifying the content of the bullet points.
4. *Training programme of first visit successfully conducted* (5.1)
5. *A draft technical summary report, visit 1* (5.2)
6. *The technical summary report, visit 1* (5.2)
7. *A note / statement regarding the current database* (1-3 pages) stating assets, shortcomings and a prioritised list of improvements for future use. (can be included in 5)
8. *Note with assignments* for the working programme, for the interim period (max one page per staff member) + draft programme for reinforcement and training in week 3.
9. *A note with the outline* of the technical summary report based on the description above (section 5.2) specifying the content of the bullet points.
10. *Training programme of second visit successfully conducted* (5.1)
11. *A draft technical summary report, visit 2* (5.2)
12. *The technical summary report, visit 2* (5.2)
13. *A draft completion note (1-2 pages)* for the project manager to submit to the UEM secretariat
14. *A draft press release* for the UEM or City of Johannesburg to publish to the media or on a web site home page.

7. Activities

In essence the assignment will comprise the following activities. In the inception note the consultant will refine these for endorsement of the manager.

Preparation (3 days)

To be sent to the City of Johannesburg / the project manager 7 days before departure

- a. Output 1
- b. Output 2
- c. Output 3

Visit no. 1 (10 days)

Week no. 1 - TRAINING: compiling emissions inventories and calculating source emissions, EMIT and ADMS-Urban training

- d. Day 1: Compiling emissions inventories and calculating source emissions
- e. Days 2-3: Staff training in using EMIT
- f. Days 4-5: Staff training in using ADMS-Urban

Week no. 2 – INVESTIGATION, REVIEW AND RECOMMENDATIONS

- g. Review of available data (general sources in an emissions inventory, as well as grids and traffic data) and current work (completeness, current data analysis methodologies, data management including archiving, updating and tracing of data,

- data assumptions and verification to estimate confidence in the ADMS-Urban model output;
- h. Review of meteorological data and processing;
 - i. Analysis of missing information and suggestions of where to source data – e.g. rural background data;
 - j. Traffic data – categorizing the vehicle fleet; applying the vehicle fleet to the road network; estimating traffic volumes on the road network and developing and assigning temporal profiles etc.
 - k. Organization of work and quality assurance (QA) of emissions calculations and compilation of sources in the emissions inventory – how to track and organize data and projects;
 - l. Review ADMS-Urban modelling carried out to date, recommendations for way forward, refining input/output and focusing modelling objectives;
 - m. EMIT – assessment of the current use by the City of Johannesburg including the emissions inventory in EMIT + analysis of current missing data and suggestions for improvement.
 - n. Instruction on the use of EMIT to calculate emissions for traffic – emission factor (EF) datasets (most appropriate EF datasets for South Africa);
 - o. Advice on the City of Johannesburg’s use of EMIT to propose/set-up low emissions zones in the city, and general emission scenario testing;
 - p. Advice on the use of EMIT to calculate grided sources for input into ADMS-Urban
 - q. ADMS-Urban modelling: advice on the current use of meteorology data to calculate ADMS-Urban model output (short-term and long-term results);
 - r. Advice on the use of background data and chemistry in the ADMS-Urban model;
 - s. Advice on chemistry in general in the ADMS-Urban model;
 - t. Advice on ADMS-Urban model scenarios;
 - u. Future work recommendations derived from the above, including the consideration of
 - Factoring “up” emissions for future years for different source groups (e.g. traffic)
 - Suggestions of where to obtain projected growth factors for future years;
 - Use of meteorology and background data (chemistry) for future years;
 - How to model a road traffic junction
 - Time-varying files (industry, boilers, seasonal wind-blown dust from mine dumps)
 - Estimating traffic emissions and modeling queues of traffic
 - Source apportionment calculations (examples)
 - v. Advice for future work organization with regard to the ADMS-Urban air quality modeling, including staff assignments in relation to this
 - w. ADMS-Urban model output verification with air quality monitoring data (specifying monitoring stations as receptors)
 - x. Detailed summary write-up in the UK by CERC consultant (2 days)

Visit no. 2 (6 months after the completion of visit no. 1)**Week no. 3**

- y. Review detailed summary notes for visit 1; review work to date in the interim since visit 1. Produce list of needs for enforcement and training
- z. Further check up and reinforcement of training needs and future work
- aa. Corrections for outputs 5 + 6 as pertinent + completion of outputs 10-12
- bb. Detailed summary write-up in the UK by CERC consultant (2 days)

8. Scope of work

The consultant will refer to the project manager and liaise closely with the manager, as indicated in these Terms of Reference. The manager will provide pertinent information so that the project aims and objectives can be achieved.

For each task, both the UEM expert and officials from the City of Johannesburg will be responsible for participation. The training in week 1 will include all 5 relevant City of Johannesburg staff. Staff members will be included in week 2, depending on relevance with regard to the work carried out in week 2. The training in week 1 should feed into week 2, and further into week 3.

Outputs in writing (detailed summary notes) will be furnished as draft versions from the consultant and the project manager will be responsible for the final versions, which will be public documents (i. e. available to other partners in the UEM-programme).

9. Inputs

Consultant will provide:

- Specialist background on the use of an urban-scale dispersion model (ADMS-Urban), and compatible emissions inventory (EMIT) software,
- Printed training material for in-situ training, as well as detailed summary notes written after each visit to the City of Johannesburg; also provided in electronic form relevant to the assignment.
- All necessary word processing equipment (and other IT) for writing of the detailed summaries etc.
- Software requirements for EMIT training (*To be finally settled between the City of Johannesburg and Cambridge Environmental Research Consultants Ltd.*)

The City of Johannesburg will provide

- Hardware and software in fully operational condition from *before visit 1*
- Background information, as available and pertinent
- Staff time as indicated in the budgets
- All practical arrangements in connection with the assessments and the training, including the equipment suitable for the training of a team of five people.
- Training venue, including computer hardware and printed material for delegates

10. Management

Manager of the project will be

Margot Richardson: Senior Atmospheric Scientist, City of Johannesburg

T: +27 11 407 6749 / m: +27 82 379 6209; MargotR@Joburg.org.za

Resource persons:

Other resource persons in Johannesburg Administration + staff to be trained are

- Xolile Mabusela
- Gideon Slabbert (tbc)
- Lerato Enoch Liphoto
- Bhutana Mhlanga (tbc)

This is a total of 5 staff members, each of which have already knowledge and experience of the subject matter in Johannesburg, and each of which will be entrusted with these tasks and responsibilities in the future.

The project manager will convene the group in relation to the project and provide the staff with the necessary arrangements, documents, hardware and software for effective training.

Consultant of the project will be

Dr. Patricia Gilmour, Principal Consultant

Cambridge Environmental Research Consultants Ltd.

3 King's Parade, Cambridge CB2 1SJ, UK

Tel: +44 (0)1223 357773 | Fax: +44 (0)1223 357492

Tricia.Gilmour@cerc.co.uk - <http://www.cerc.co.uk/>

11. Reporting

The written outputs will serve also as formal reporting and be made available to the City of Johannesburg and the UEM-PSC Secretariat. The consultant will submit detailed summary document *drafts* and the project manager will submit *final* document reports to the city as pertinent and the UEM-secretariat.

Final reports are public documents. They will be published (for example on a website and in print) and may be used as an example for knowledge sharing with other cities of South Africa. The documents will be public by the end of the project; and may also be so beforehand (if agreed between the consultant and the manager).

The manager is responsible for the reporting to the PSC Secretariat (as described in the UEM-Manual for STTA projects).

All written outputs are delivered electronically.

12. Financial Management

This follows the procedures outlined in the contract of the assignment.

13. List of Annexes

A. Motivation and UEM-checklist (Why this project fits into the UEM-programme)

Annex 1

Motivation and relevance to the Urban Environment Management Programme.

The City of Johannesburg is the largest urban center in South Africa, displaying some of the largest segments of poverty-stricken populations, as well as some of the countries most severe air pollution problems. The city planning is dynamic and moves very fast.

The City has a Council-approved air quality management plan, in line with the requirements of the National Environmental Management Act and the Air Quality Act (AQA). The AQMP forms part of the City's Integrated Development Plan (IDP).

In line with the thematic focus areas of the Urban Environmental Management Programme, EMIT and ADMS-Urban allows for the integration of air quality management with all planning functions of City – township development, poverty alleviation programme implementation (e.g. Eskom's electrification programme), transportation and mobility planning etc.

In addition, through scenario studies and air pollution modeling, positive/negative impacts of air pollution on poor and disadvantaged communities can be identified.

Due to the legacy of the past environmental planning and other policies, the poor communities are the most negatively affected by pollution in the city, and thus vulnerable to environmental hazards.

In this way poor and previously disadvantaged residents within the area of jurisdiction of the City of Johannesburg are major beneficiaries of the project.