

REPORT : SEMINAR ON MESOCLIMATE AIR POLLUTION RELATED RESEARCH IN THE EASTERN TRANSVAAL HIGHVELD

C W Louw

(Foundation for Research Development, CSIR, Pretoria)

Introduction

A seminar on mesoclimate air pollution related research in the Eastern Transvaal Highveld (ETH) was held on 3 September 1985 at UNISA, Pretoria under the auspices of the National Programme for Weather, Climate and Atmosphere Research (NPWCAR). It was attended by some 200 participants, representing government departments, industries, universities, research institutes, local authorities as well as various organisations with an interest in atmospheric pollution.

The seminar can be considered as the first public report session on results emanating from a co-operative mesoclimate air pollution related research programme in the ETH which was initiated during the early part of 1983 by the FRD, CSIR at request of the Department of National Health and Population Development (DNHPD), Department of Environment Affairs and the Department of Constitutional Development and Planning. The programme is managed, monitored and regularly reviewed by a steering committee operating under the auspices of the NPWCAR. Its main goal is the development of a predictive capability regarding the situation that will eventually arise in the ETH with future developments so that the necessary preventative and regulatory measures could be taken to adequately protect the inhabitants and the environment.

The papers presented at the seminar covered a wide spectrum of topics including pollution sources, regulatory aspects, monitoring of pollution, dispersion modelling and impacts on the environment. The proceedings were concluded with an open discussion session lead by Dr D van As (Atomic Energy Corporation of SA), assisted by a team of panel members consisting of Dr P J Aucamp (DNHPD), Prof R F Fuggle (University of Cape Town), Dr H G V Küstner (DNHPD), Prof P D Tyson (University of the Witwatersrand) and Dr G P N Venter (CSIR).

The purpose of this report is to give a brief account of the main findings presented at the abovementioned seminar as well as to reflect the essence of the views and opinions presented during the open discussion session.

Pollution Budget

From the presentations it was quite clear that a substantial amount of information has been obtained on the sources and levels of pollution in the ETH. For example, firstly, an emission inventory of pollution sources has been completed and a very useful data base compiled for the control authorities. Secondly, the first quantitative data has been obtained of sulphur dioxide emissions from smouldering coal

dumps which are regarded as important low level pollution sources. Thirdly, extensive data on sulphur dioxide, sulphates and nitrates (the precursors of 'acid rain') as well as trace element ground level concentrations is now available. In the case of sulphur dioxide very brief periods of high concentrations did occur but in general the levels were well below the accepted international health standard (World Health Organisation). Likewise, the concentration of sulphates was usually below the accepted ambient air quality standard (California, USA) although relatively high concentrations were sometimes recorded in the close environments of certain 'low level' industrial sources. Also, indications of acid precipitation ('acid rain') have been found but this needs further extensive and very careful observations. In this regard attention should be given to the measurement of wet as well as dry deposition as this information will be needed as inputs for the development of realistic physical-chemical models.

It was pointed out that there is a need for observations on the occurrence of organic compounds, (particularly carcinogenic type substances) in the vicinity of smouldering coal dumps, industries and townships. Furthermore, it was regarded essential that 'baseline' pollution data, i.e. pollution levels in relatively undeveloped areas, also be obtained in order to allow a realistic assessment of the air pollution situation in the ETH.

With regard to control measures it was encouraging to note that the present Mines and Works Act is being amended to also control smoke and gaseous pollution from coal discard dumps. In addition, it was learnt that the DNHPD has set a requirement that the availability of control equipment be maintained at a level of 96% per month and that this will be strictly monitored and enforced. In cases where this requirement cannot be met the relevant production unit has to be taken off line.

Plume and Dispersion Climatology

A useful understanding has been developed of the inversion structure of the ETH, but further work is needed on evaluating existing data for the upper atmosphere to inter-alia determine the fate of pollution at high levels. The results reported seemed to show evidence of fumigation occurring not only over periods of days but also on the scale of months. It was suggested that the physical mechanisms underlying this could be well worth studying.

In discussing the direction future research must go, it was pointed out that a greater deal of knowledge is required of the diurnal variation of the boundary layer, of the turbulence levels of the atmosphere for different stability condi-

tions and of the vertical wind component in the lower boundary layer. With regard to the latter it would be timeous to do some studies based on the equation of continuity, using existing information from wind roses to analyse low level divergence-convergence of the wind fields in order to infer vertical wind directions.

It was indicated that the work on plume and dispersion climatology in the ETH should eventually lead up to, and in fact, be aimed at development of working models whereby the transportation and dispersion of atmospheric pollutants could be predicted. Such models are a prerequisite for the quantitative coupling of cause and effect which is needed for decisionmakers to formulate planning and control strategies. For this purpose there is justification for the development of simpler ('pillbox') type models and more sophisticated (multiple-source type) models, both of which were reported on at this seminar. In this regard it was stressed that the laws of physics are universal and therefore note should be taken of earlier work done locally and work done elsewhere. Mention was also made of several already developed models, e.g. the USA regulatory type models, which are available and it was suggested that current work to evaluate and validate these for local climatological conditions should be pursued further.

With regard to the development of dispersion models it was noted that at this stage some of the required input parameters such as temperature structure, have already been well characterized for the ETH. However, other parameters, such as turbulence, windfields in the upper boundary layer, vertical concentration profiles and deposition rates still need to be quantified in order to allow the development of models which will properly handle chemical transformation and physical removal processes. Once developed, such models can be applied, albeit with adaptations, to also other developing regions of the RSA.

Impact assessment

It was emphasized that the attitude in impact assessment studies should not be to assess how man must adapt to a particular environmental pollution situation but rather how man must intervene in the situation to reduce the negative impacts to suit him. Following on from here, due recognition was given to the current work initiated on the effects of air pollution on human health, vegetation and plants as well as on the quality of surface waters. However, the opinion was expressed that this effort should be extended to include effects on animals (birds could be very good indicators of effects because they are at the top of the food chain), insects (insects play an important role in fertilizing crops), grazing lands, soil (notably fertility of soils) and land-use planning. With regard to land-use planning one of the questions posed was whether air pollution is becoming a significant factor in decision-making as regards town planning. Also, the economics of the extent of damage that is being done to the environment in the ETH should receive attention. In this regard structural damage

due to corrosion was identified as a topic that warrants investigation.

It was also suggested that a public opinion survey should be done, in a responsible manner, to determine the extent to which air pollution affects the inhabitants of towns in the ETH.

In addition, a strong plea was made that a balanced attitude be adopted in assessing impacts and effects, particularly with regard to those related to the field of epidemiology. The need for the development of a methodology to detect small changes in the health status of humans was pointed out. However, it was suggested that a direction that could be followed would be to study cases of gross exposures as in working places where health symptoms would be more readily identifiable rather than to study exposure of people living in towns.

Data processing and management

It was apparent from the various presentations that a wealth of climatological and air pollution data had already been acquired. However, some concern was expressed that only a relatively small fraction of this data had been sufficiently processed as to be of practical use to the decision makers. Consequently, it was advocated that a consolidated effort be made to fully process, and evaluate all the collected data.

A suggestion which received strong support was that a data management system be devised whereby all data collected would be readily accessible and available to participants and end users. In this regard the appointment of a data co-ordinator as well as the creation of a central database were proposed.

General

It was pointed out that the programme could be seen as developing in three phases i.e.

- establishing the relationship between source and environmental concentration;
- establishing the relationship between environmental concentration and effects/impacts; and
- establishing the cost implications of introducing stricter control measures and the benefits to be gained from this.

Up to now most of the work has been concerned mainly with the first phase and to some extent with the second phase. It was regarded necessary that more attention should now be directed at the second and third phases. However, in doing this and in order to effectively address the ultimate goal of developing a predictive capability it was emphasized that a very close collaboration would be needed amongst the different participants.

Finally, there seemed to be general agreement that, despite some existing deficiencies, good progress has been achieved in a relatively short time and that the co-operative Mesoclimate Air Pollution Research

Programme in the ETH has laid the foundation for fostering close collaboration and allowing goal-oriented research to address problems of common interest in the ETH.

SUMMER SCHOOL IN AIR POLLUTION CONTROL AND OCCUPATION HYGIENE

The Department of Chemical Engineering, in co-operation with the National Association for Clean Air, the Occupational Hygiene Association of SA and the SA Institution of Chemical Engineers (N. Tvl. Branch) presents a summer school in air pollution control and occupational hygiene. As responses to our January 1984 short course requested, a limited number of subjects is now offered more intensively. Each subject is introduced by a lecture on the theory followed by a practical session during which participants will have the opportunity of handling analysis apparatus and carrying out design calculations. The size of groups in certain sessions will therefore be limited to 4 persons and multiple sessions will be offered in some subjects. It might however still be necessary to limit the total attendance, in which case early registrations will receive preference.

Enquiries should be directed to G Kornelius at tel (012) 420-2199 or 420 - 2475.

UNIVERSITY OF PRETORIA DEPARTMENT OF CHEMICAL ENGINEERING SUMMER SCHOOL IN AIR POLLUTION CONTROL AND OCCUPATION HYGIENE

PROGRAMME

21 January 1986:

Registration 08h00

Sessions 08h30-10h30; 11h00-13h00; 14h00-16h00

22 January 1986:

Sessions 08h00-10h00; 10h30-12h30; 13h30-15h30

During these two days the following subjects are offered in rotation:

Subject 1:

Simple calculations for dispersion from stacks under varying atmospheric conditions. Ground level concentrations. Simple microcomputer applications.

Subject 2:

Isokinetic sampling for dust from ducts and stacks: Theory and practice.

Subject 3:

Particle size distribution of dust using impactors: Theory and practice.

Subject 4:

Worker exposure to dust in the factory environment: Theory and practice of personal dosimetry.

Subject 5:

Worker exposure to organics: Theory and practice using organic solvents as an example.

Subject 6:

Measurement of worker exposure to coal tar pitch volatiles.

Subject 7:

Determination of SO₂/SO₃ in off-gass. Acid dew point determination.

Participants attending one of the first two days select three of these seven subjects. Participants attending both the first and second day select six of the seven subjects.

23 January 1985:

Subject 8:

08h00-10h00. Designing process ventilation to limit worker exposure.

Subject 9:

10h30-13h30. Designing equipment to limit stack emissions.

Subject 10:

14h30-16h30. Drawing up specifications and enquiry documents.
