NOTES

# NATIONAL SURVEY OF SMOKE AND SULPHUR DIOXIDE : QUALITY OF SMOKE MEASUREMENTS

*N.P. Walker, R.H. Ellerbeck and E. Kemeny*
*Atmospheric Sciences Division, CSIR*

Since the inception of the National Survey, considerable efforts have been made to maintain reasonable standards of accuracy: these have included the training of operators, site visits and computer tests on the collected data.

In May of this year a detailed questionnaire was sent to all of the participating municipalities. The questionnaire was used to collect information on the measuring procedure used at each of the National Survey sites. In addition, it was designed to indicate potential faults with either the site or the equipment used. This information is still to be analysed.

In July the programme was extended to concentrate on the measurement and determination of the Soiling Indices, by means of which the smoke concentrations are expressed. The aim was to highlight the accuracy and any errors in either the method of sampling, the operation of the densitometer, or the calculation of results.

Each co-operating municipality received three pre-measured clean Whatman No. 42 filter papers (pre-measured on the standard densitometer), for each of the measuring sites for which they were responsible. These filters were used in the standard sampling instrument over a period of one week. The municipality was responsible for determination of the reference value for the clean paper, the measurement of the exposed paper and the calculation of the Soiling Index ($S/m^3$) in accordance with the standard method (Kemeny and Halliday, 1974). The exposed filters and results were then returned to the Atmospheric Sciences Division which re-measured the exposed filters on the Division's standard densitometer. All of these readings were taken by one person.

The differences between this Division's calculations for the Soiling Index and those of the co-operating municipalities were calculated and illustrated graphically in Figure 1. The deviations are the result of instrument and/or operator error.

The returns from two municipalities indicated that substantial errors were being made. These were immediately followed up and a repeat measurement test is in progress and visits are being planned. These results and a few others have been excluded from the data set because obvious errors were being made. All of the municipalities involved were informed of their individual results.

After the exclusion of the obvious errors (amounting to less than 7% of the total returns) there were 373 valid results. Of these 35% had zero deviations, 72% were within ± 1 unit, and 90% within ± 2 units. Each Soiling Index unit is equivalent to 5 $\mu g/m^3$ (Kemeny, 1980), thus 90% of the results will be repeatable within ± 10 $\mu g/m^3$. This accuracy will increase for the highest concentrations, but decrease for the lowest.

These results indicate that the smoke measurement technique which was developed and is used in this country is a

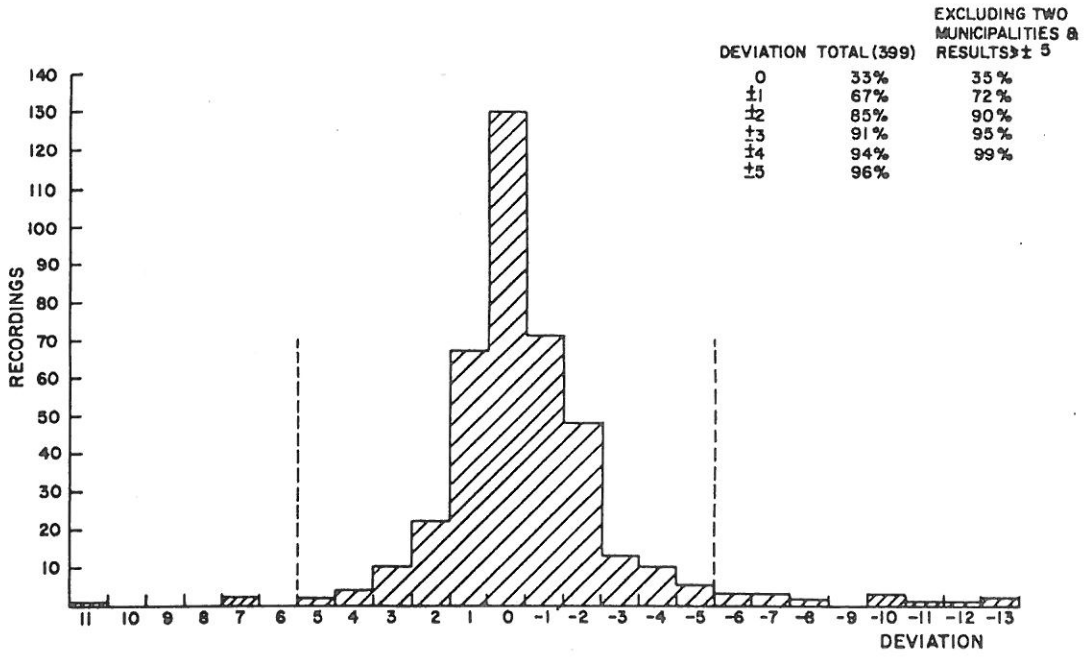
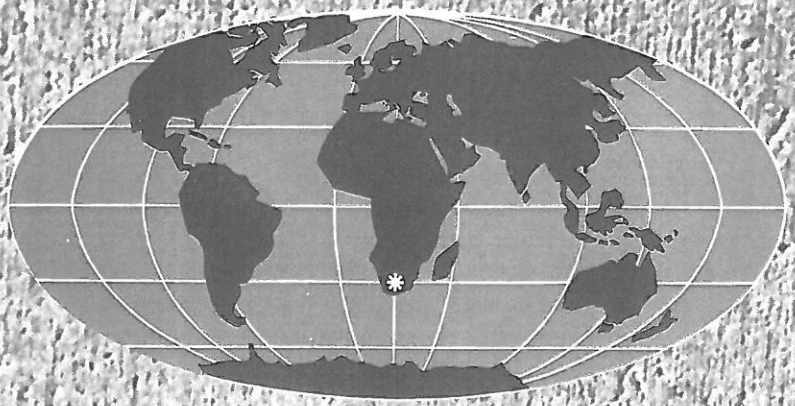



*Figure 1. Distribution in deviations as measured by Soiling Indices.*

# a world leader in high pressure centrifugal blowers for new or existing plant



# is here... on your doorstep

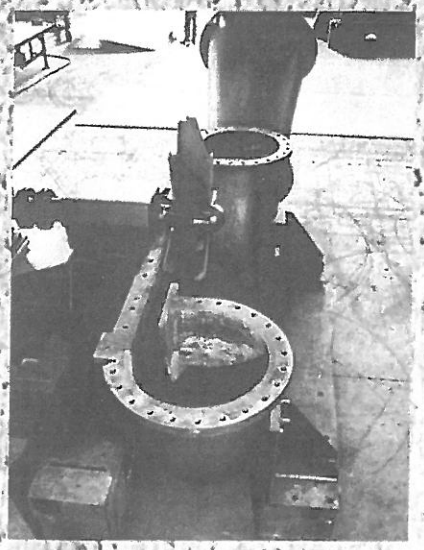
We've been making high pressure centrifugal blowers since 1970 . . . exporting our know-how to sister companies in Britain, Europe, America and Australia. In turn we've gained from their experience . . . and today we're the world's biggest single fan manufacturing group.

But it's here in South Africa that it all started . . . built on the years we've spent in making ventilation and high pressure blowing equipment for the mining industry.

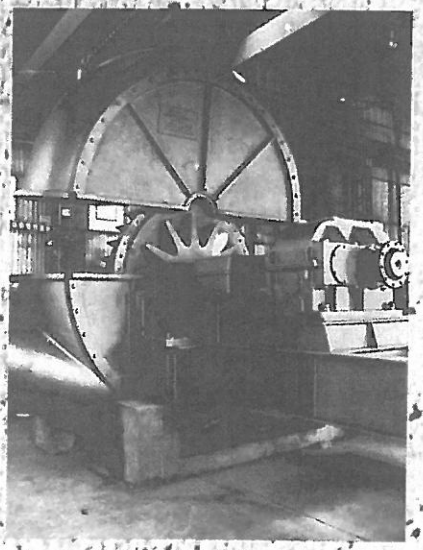
And now we're geared for expansion into chemical processing and effluent treatment . . . or wherever gases, corrosive or non-corrosive, must be handled safely and efficiently under high pressure.

Our pricing and delivery are keenly competitive . . . and full servicing facilities are also on your doorstep.

We'll be glad to hear from you if you've plans for a new plant. And if present equipment is obsolete or troublesome we'll design, make and install a replacement to fit the existing location . . . As we're doing at Rustenburg Plats for example.*



*The photograph on the right is of a machine of 1300 mm dia designed to run at 4250 r/min. This radial configuration of the impeller allows us to design with a safety factor of 4 on yield, even at this high tip speed. This resultant low stress level reduced the risk of stress corrosion making the design ideal for handling contaminated corrosive gases. The cast iron casing shown on the left has a minimum thickness of 50 mm to reduce noise break-out level and to ensure extended life under corrosive and abrasive conditions. The unit generates 46 kPa when handling 28 $m^3$/sec. Design and manufacture are 100% South African.



**Airtec Davidson**

Box 512 Edenvale 1610 Transvaal Tel (011) 53-8946 Telex 8-6743 SA

A member of the Abercom group

successful one on the basis that the number of errors which can occur is relatively small and these are usually caused by not following the correct procedure or making unauthorized alterations to the densitometer. The technique therefore plays a valuable role in the pollution monitoring programme and it is possible to have reasonable confidence in the data which is currently being collected. This data base may be usefully tapped for other research projects and for the assessments of the current smoke pollution situation in South Africa.

ACKNOWLEDGEMENT

The work and dedication that many municipal officers displayed in the performance of their duties made this assessment possible.

REFERENCES

KEMENY, E. and HALLIDAY, E.C., 1974. Methods recommended for the measurement of air pollution in South Africa. Determination of smoke and soot. CSIR Special Report SMOG3.

KEMENY, E., 1980. Long-term trends in smoke and sulphur dioxide pollution in the Republic of South Africa. The Clean Air J. 5(4), Johannesburg.

---

## ASSOCIATION NOTES

### INDOOR AIR POLLUTION – RADON IN HOUSES
*– IUAPPA Newsletter*

The provisional results of a UK survey into radon in houses were presented to the Conference of the National Society for Clean Air in October 1985 by the National Radiological Protection Board. The NRPB concluded that radon, a naturally-occurring radioactive gas, is the most significant source of radiation exposure in the country but that there are marked regional variations.

Radon gas is created by the trace quantities of uranium in the ground and in building materials. The gas moves through rock and soil or brick and concrete and enters the atmosphere. Levels in outdoor air are low, but radon accumulates indoors because of restricted ventilation. It undergoes radioactive decay into solid products, which are also radioactive; these attach themselves to dust particles in the air, which, when inhaled, irradiate the lung.

The National Radiological Protection Board has conducted a survey of radon in dwellings throughout the UK and several smaller studies in regions where levels were expected to be above the national average. Higher levels are particularly likely in and around granite areas where the uranium quantities are higher than average.

Provisional results from the survey show that radon concentrations in London are about half the average value, in eastern England about average, and in south west England about three times the average. The highest regional levels were found in Cornwall, where typical values were around ten times the national average, with some samples over 10 times higher still. Elevated levels were also found in Devon and in the Pennines region but, contrary to expectation, levels in Aberdeen were below the national average. This unexpected result was attributed to the type of granite and local building practices.

While there is no *direct* evidence that exposure to radon decay products in the home causes harm to human beings, there is evidence that prolonged exposure experienced by uranium and other miners to high levels of radon decay products underground has caused lung cancer. Therefore, the NRPB researchers have made the cautious assumption that there might be a proportionate risk to the public at the levels of indoor exposure found. The NRPB are now working together with the UK's Building Research Establishment to develop methods for reducing radon levels. Techniques under study include: increasing the ventilation rates; preventing the gas from entering the home; and extracting the gas under the floor. Also under consideration is possible remedial action for existing dwellings and preventative action for new buildings in some regions.

In the United States, too, there is growing concern about radon contamination. Both Congress and the Senate have made provisions for funding further radon studies, and congressman James Scheuer, a sub-committee chairman with the Science and Technology Committee, has said that he may introduce a Bill to force more action if the US Environmental Protection Agency does not tackle the problem more aggressively. The EPA is already undertaking a national survey to locate naturally-occurring radon and evaluate its potential for harm. With evidence mounting of potentially dangerous levels of contamination in several states, it may be only a matter of time before more definite proposals emerge.