demonstrated that a basic dust could best be conditioned using an acidic conditioner.

RECOMMENDATIONS FOR USING GAS CONDITIONING AGENTS

Before resorting to gas conditioning an electrostatic precipitator it must be established that the problem is due to fly ash resistivity.

High resistivity ashes could best be conditioned using sulphur tri-oxide or other acidic chemicals while problems due to very low resistivity may be more amenable to ammonia.

It is also most essential that gas conditioning of a precipitator is not attempted as a "do it yourself job" as disaster is likely to result. The manufacturers of the equipment have had years of experimentation resulting in successful application behind them. Inexpert applications of conditioning agents can result in, at very best, failure to be effective and further in corrosion problems, plugging of airheater and precipitators and the release of dangerous gases.

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THE CAPE POINT TRACE GAS MONITORING PROGRAMME

E G BRUNKE

World-wide concern about the possible environmental influences of certain atmospheric trace gases gave rise to the International Conference in Stockholm in 1976, where a call went out to nations to participate in a Global Environmental Monitoring System. In 1977 Dr Halliday took the initiative on behalf of the CSIR and established a small baseline station at Cape Point, which satisfies the essential requirements for the background monitoring of the trace gases. During most of the time, measurements are made in air derived from the South Atlantic.

The analytical instruments are housed in a little building kindly rented to the CSIR by the Department of Transport, whose light-house generator also supplies the electricity. After a very modest beginning with the occasional air sample being collected and mailed to Pretoria for analysis, the project has grown considerably over the past five years mainly with the assistance obtained from the Max Planck Institute in West Germany. The Cape Point team now comprises two researchers, one technician and a data processor, who have office, laboratory and computer facilities at the National Accelerator Centre/Faure. At present CO and O_3 are being measured continuously and F-11, CCl_4, CH_4 and N_2O on a semi-continuous basis. In addition, an automatic anemometer records wind velocities and directions on magnetic tape. Meteorological parameters such as temperature and pressure are obtained from the light-house staff, who collect these data for the Weather Bureau. The hourly averages of the 11 parameters measured, comprises 77 745 data points per year, which are handled by the CSIR's computer in Pretoria.

The environmental importance of the six trace gases being monitored can be divided into two categories:

* those which directly or indirectly attack the stratospheric ozone layer; the earth's UV filter
* those which absorb IR radiation, thereby contributing to the 'greenhouse effect'.

The CO measurements made in Cape Point since 1978, represent the longest and only continuous CO record in the Southern Hemisphere. The main interest in CO, is that its dominant link is the reaction with hydroxyl radicals, which is the primary absorber of many pollutants including 'greenhouse' and 'O_3-destroying' gases.

In the Northern Hemisphere fossil fuel use is believed to be responsible for 23% of the total CO source strength. The ambient CO level at Cape Point displays a repetitive annual cycle with a spring high (82 ppbV) and a summer low (53 ppbV). Various arguments suggest that this seasonal variation is a function of the annual ITCZ shift. As a consequence, it is impossible at this stage to say whether the CO level is rising or not.

Atmospheric CH_4, which has a mean troposhperic mixing ratio of 1,6 ppmV, has in recent years aroused considerable interest, because it is considered to be the second strongest IR absorber after CO_2. In addition, CH_4 is also an important remover of OH during which reaction CO is generated. Methane is produced in swamps and rice fields and by the digestive processes in cattle and termites. These processes are largely coupled to the world's increasing food production and as such it is not surprising that scientists elsewhere around the globe have observed a CH_4 increase ranging between 1 and 2% annually. As our data base at Cape Point is only 1,5 years old, no such inferences can yet be made.

The tropospheric O_3 cycle must be viewed in conjunction with those of CO, CH_4 and OH. Ozone, which is a small IR absorber, does not solely originate from the stratosphere as has previously been assumed, but is also produced in the unpolluted troposphere. Together with sunlight and water vapour it forms the major source of tropospheric OH. Ambient O_3 concentrations have been monitored at Cape Point since 1979, but unlike CO, no repetitive annual cycle has been observed. During the years 1979 and 1981, however, a spring high was recorded, which is believed to be the result of stratospheric-tropospheric air exchange. The 1982 O_3 mean (21 ± 1 ppbV) compares favourably with those annual means reported by other global baseline stations such as the one in Tasmania (23 ppbV) and the one at the South Pole (20 ppbV).

Freon-11 is a man-made gas which is mainly used in aerosol cans. When F-11 reaches the stratosphere it is photolyzed, whereby O_3-destroying Cl atoms are liberated. Additionally, F-11 also absorbs some IR radiation. Carbon tetrachloride, which probably has both natural as well as anthropogenic sources is, like F-11, a potential destroyer of stratosphere O_3.

The halocarbon means for the first five months of 1983 were: F-11 (196 pptV) and CCl_4 (150 pptV). The annual growth rate of F-11 (1979 - 1980) was 11,8 pptV, but has since come down to 8,6 pptV. This decline in the atmospheric accumulation rate of F-11 is to be expected

after several countries, notably the USA, had placed a ban on the essential uses of F-11 and F-12. Nonetheless, F-11 is still increasing in the atmosphere and a vigilant check on its growth has to be maintained. Carbon tetrachloride has shown a small, but steady rise (3,7 pptV/year^{-1}) since 1980, which agrees well with estimates made in other parts of the world.

Nitrous oxide is, like F-11, relatively inert in the troposhere, whilst in the stratosphere it reacts with excited oxygen atoms to yield nitric oxide, which plays a pivotal role in O_3-destroying reactions. Micorbial activity in anaerobic soils and ocean sediments produce N_2O. The strength of this source is magnified by the world-wide use of N-fertilizers. Measurements of N_2O were initiated at Cape Point in March this year. To date little monthly changes have been detected (average : 295 ppbV).

The basic project of monitoring gases, which absorb IR radiation or which influence stratospheric chemistry, will continue at Cape Point. Additionally, it is planned to expand the measuring programme to include such parameters as solar flux, HCNO, NO_x and H_2, in order to obtain a better understanding of the chemical cycle involving CH_4, OH and CO.

In air-chemical research circles, a general need exists to verify and quantify theoretical models of trace gas cycles by good-quality in situ measurements. In this way the ability of the atmosphere to absorb and neutralize man-made pollutants can best be checked.

With the technical ground work already being laid and its favourable geographic position in the South Atlantic Ocean, Cape Point is ideally suited for such a study.

E G Brunke Atmospheric Sciences Division National Physical Research Laboratory CSIR

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LONG-TERM TRENDS IN SMOKE AND SULPHUR DIOXIDE POLLUTION IN SOUTH AFRICA

DR E KEMENY & C M VLEGGAAR
ATMOSPHERIC SCIENCES DIVISION
NATIONAL PHYSICAL RESEARCH LABORATORY

At present 33 cities and towns participate in the national survey on smoke and sulphur dioxide and in a recently issued report [1] the results obtained between October 1980 and September 1982 were statistically analysed together with those collected in previous years. This report reveals the alarming fact that the concentrations of smoke and sulphur dioxide no longer have the tendency to decrease as was the case up to 1978. Instead, between 1978 and 1982 the concentrations of smoke fluctuated without showing any tendency at 95% of the 112 monitoring sites and the SO_2 concentrations did likewise at 81% of the 64 measuring sites. As far as the tendency to increase is concerned, 1% of the smoke and 13% of the SO_2 stations have this tendency, which for SO_2 represents an increase of 4% in comparison with the past.

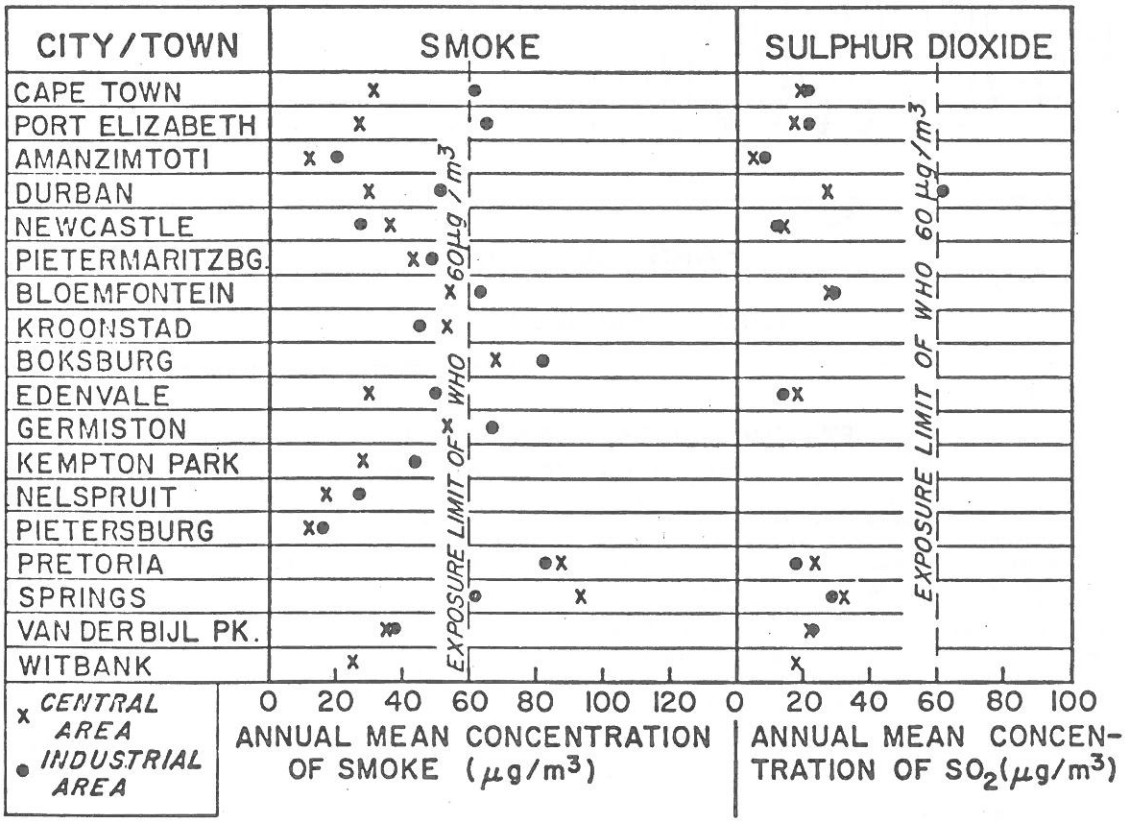

FIGURE 1 SOUTH AFRICAN SMOKE AND SULPHUR DIOXIDE LEVELS IN RELATION TO EXPOSURE LIMITS OF WORLD HEALTH ORGANIZATION