AIR POLLUTION CONTROL – TODAY AND TOWARDS THE NEXT CENTURY

by

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SUMMARY:

The effect of industrial air pollution control through the provisions of the Air Pollution Prevention Act is discussed. The efficiency of control and its effect on the economy of the country is considered and a forecast is made of the long term effects on pollution concentration and overall industrial costs.

OPSOMMING:

Die effek van industriële lugbesoedelingbeheer deur die bepalings van die Wet op die Voorkoming van lugbesoedeling word bespreek. Die doeltreffendheid van die beheer en die effek op die landsekonomie word beskou en 'n voorspelling van die langtermyn effekte op besoedelingkonsentrasie en totale industriële koste word gemaak.

At a time when South Africa is facing extremely grave financial and economic problems, inter alia a rampant inflation rate, an unfavourable balance of payments, rocketing interest rates, plummeting rates of exchange and a drop in the price of gold, the authorities are prescribing higher productivity, increased exports and a curb on imports as remedial steps to counteract the gloomy recessionary economic climate.

It would consequently be worthwhile to have a critical look at the impact of air pollution control on our economy, bearing in mind the fact that air cleaning equipment tends to be very expensive, that a fair percentage of know-how and equipment is still imported and that this equipment is totally non-productive with a high energy consumption. Optimising the utilization of existing air cleaning equipment and careful selection of new equipment with high cost effective design in mind is of the essence. The question is, how well have we succeeded in achieving these objectives in our control strategy?

A critical analysis of the progress in controlling industrial pollution in relation to the financial impact of the control measures has to be conducted against the background of the following considerations:

(i) Our legislation, although enacted in 1965, has only become effectively enforced since the early seventies, a mere decade ago, which in terms of similar legislation in other countries, represents a very short period.

(ii) The implementation strategy in force has had as prime objective the arrestment of pollution at the 1970 levels by requiring all new factories to be fitted with air cleaning equipment of the latest design and with a high efficiency. Subsequently the pollution levels have been steadily reduced by enforcing retrofitting or replacement programmes at eachof the plants commissioned prior to 1970. For each programme a realistic time limit for completion is set. The rate of reduction in visual pollution has consequently not been as spectacular as one would have liked, but on the other hand, by giving industry time to do proper planning, the money invested in air cleaning equipment has been well spent.

(iii) Air pollution control technology is still a relatively new science. Indeed in certain areas it could still be considered an art rather than a science. Inadequate know-how and expertise have resulted in several very expensive mistakes. In our experience it so often happens that new and sophisticated equipment which could not reach design efficiencies has to be modified at high cost and with serious delays in commissioning.

(iv) As a developing country, we make optimal use of sound land-use planning in establishing new industrial growth points as was the case with Saldanha, Richards Bay, Bronkhorstspruit, Secunda, etc. In positioning industrial zones in relation to the residential townships, factors like pollution potential and dispersion characteristics of such areas are carefully considered in order to minimize the effect of residual pollution on the residential areas. In the same way the risk of adversely affecting people during accidental release of high concentrations of pollutants is reduced. Consequently precautionary measures can selectively be required, avoiding very expensive "belt and braces" equipment.

With the above considerations in mind let us firstly have a look at what has already been spent on air cleaning equipment over the past decade and how our expenditure compares with other countries.

Based on reasonably reliable information available at my office, the capital expenditure on air pollution control per each industrial sector is given. The figures relate to current prices and include cost of equipment on new plants built since 1970 as well as old plants retrofitted since the same date.

		R million
(a)	Metallurgical industry (comprising steel plants, foundries, ferro-alloy plants and base minerals)	275
(b)	Power stations	260
(c)	Coal-based chemical plants (Sasols I, II & III)	370
(d)	Lime and cement works	153
(e)	Chemical plants	45
(f)	Pulp and paper	20
(g)	Primary aluminium	35
(h)	Sugar	20

In addition, the following major projects are in the pipeline and the figures give the cost that will be incurred in pollution control:

		R million
(a)	Two mammoth pulp and paper plants	32
(b)	Retrofitting of four old power stations	20
(c)	Several new power stations	75 *each*

These figures indicate that the South African industry has spent between R100 m and R200 m per annum on air cleaning equipment over the past decade with a total expenditure of approximately R1,6 billion.

An analysis of these figures shows that an average of approximately *4 per cent* of total capital expenditure on new projects is spent on air pollution control. The figure varies with the type of process, from as high as 20 per cent at ferro-alloy plants to less than 3 per cent at certain chemical plants. As a comparison the figures for other countries are as follows:

Britain	approximately 6 per cent
United States of America	approximately 10 percent
Japan	approximately 12 percent

Another factor to be considered is the total cost of enforcing legislation. In South Africa this expense is extremely low and runs at a figure of less than *0,1 per cent* of total expenditure on air cleaning equipment per annum. In countries using the air quality management approach, this figure can be as high as 5 per cent or more.

A final cost factor which has a bearing on the matter is the expense of litigation in disputes between industry and the controlling authorities. In the USA these expenses can run into hundreds of thousands of rands, while in South Africa we have had only one major court case and the total expense is negligible.

Seen in this perspective it would appear as if South Africa is spending a very small percentage of total industrial expenditure on air pollution control. Nevertheless this does not represent the full picture. The crux of the matter is rather, how well the money has been spent on air cleaning equipment and how effectively pollution has been abated, in comparison with other countries.

A careful survey of the entire industrial sector has revealed that about 80 percent of all industrial pollution sources in the country have already been fitted with approved air cleaning equipment of modern design, while 15 per cent are still equipped with substandard air cleaning equipment and 5 per cent without any air cleaning equipment at all.

Seen in the light of the small percentage spent on air pollution control compared with that of other countries, I believe this is a remarkable achievement. The above figures confirm that we have achieved a very high level in so far as cost effectiveness of air cleaning equipment is concerned.

A very important question now arises. Has the pollution indeed been reduced to acceptable levels at the 80 per cent of sources already fitted with approved air cleaning equipment? To this question I must admit the answer is a definite NO.

This anomolous situation, the reasons for which are not difficult to identify, has been of concern to us for some time.

I have learned, rather to my embarrassment, that it does not necessarily follow that when a plant has been fitted with high efficiency air cleaning equipment, emission levels will in fact be reduced to acceptable limits on a permanent basis. On the contrary, often no improvement can be detected in practice.

You may well have come across the same situation. Company X, for example, announces with great ado that so many millions of rands will be spent on eliminating the notorious stack emission at its factory Y, by such and such a date. You wait in anticipation for the promised reduction in emission, but to your consternation, long past that date, the pollution is still belching unabated. What has gone wrong? One wonders if the money has in fact been spent and, if so, why can one

not see any improvement? These valid questions often arise in the public's mind.

The reasons for these unsatisfactory situations can be attributed to two main factors – unreliability of machines and human fallibility.

It so often happens that, on commissioning, sophisticated air cleaning equipment of a highly efficient design fails to reach design efficiency as a result of sensitivity to variation in operating conditions or a hundred other reasons. Expensive and time-consuming modifications are required. These could take up to three years to complete while in the meantime the availability of the plant is close to zero.

But I believe the fallibility of the human element is by far the biggest cause of our problems. Operating staff not properly motivated, inadequately trained and without a sense of responsibility towards the public's wellbeing, grossly neglect to maintain air cleaning equipment and do not care about the proper operation of this equipment. This attitude is currently a common phenomenon in South Africa and one which has as a consequence the poor emission levels that we are experiencing. Quite obviously such a situation cannot be tolerated for much longer.

As a controlling authority, we have been concentrating on the installation of the proper air cleaning equipment and in this respect good progress has been achieved as the above figures reflect. In future the emphasis must be shifted towards the optimal utilization of the available equipment. Education, training, motivation and, where necessary, the big stick, will become the key words.

We have already introduced a programme to achieve just that. Monitors which will continuously record emission levels are to be installed at all offending plants. Emission limits will be set for each source and any excursion above that limit will have to be fully explained and reported to the authorities. Eventually a stage will be reached where no excursion will be permitted except under emergency conditions. These measures could definitely result in a dramatic improvement in industrial pollution in South Africa. The implementation of the programme will however take a period of time and the results will really only become evident in, perhaps, two years.

Die vraag ontstaan onwillekeurig watter invloed lugbesoedelingbeheer sal uitoefen op toekomstige nywerheidsontwikkeling en hoe die prentjie teen die einde van die eeu daar sal uitsien.

Dit is 'n voldonge feit dat gepaardgaande met ons verwagte snelle nywerheidsontwikkeling, beheervereistes strenger en strenger gestel sal moet word om die toename in besoedelingsuitlate binne perke te hou en om aan 'n meer besoedelingsbewuste publiek se hoër lewensstandaarde te voldoen.

Meer betroubare lugsuiweringstoerusting van 'n nog hoër doeltreffendheid sal vereis word en die inbou van voorsorg-

maatreëls teen die vrylating van groot hoeveelhede besoe stowwe wanneer noodtoestande ontstaan of wanneer p bleme met lugsuiweringstoerusting ondervind word, sal pligtend wees. Dit alles sal tot gevolg hê 'n skerp styging die persentasie van totale uitlegskapitaal van projekte wat lugbesoedelingbeheer bestee word tot 'n syfer so hoog as persent of 'n verdubbeling in die huidige syfer.

Deurlopende monitering en registrering van uitlaatvlakke besoedeling sal op alle beduidende bronne van krag wees daar sal streng toegesien word dat vlakke binne neergeleg perke gehandhaaf word. Dit sal ook gebeur dat problematie bronne so aan die moniteerder verbind sal word dat die kr toevoer na die aanleg outomaties onderbreek sal word wa neer ernstige oorskrydings van perke voorkom. Kragaa skakeling sal dan alleen deur 'n beheerbeampte kan geskie

Die nywerheidsproses waarmee die ernstigste besoedelin probleme in die toekoms ondervind sal word en waar da groot uitdagings voorlê vir die ontwerp van geskikte lugsu weringstoerusting is ongetwyfeld die steenkool gebaseer kragopwekkings- en petro-chemiese nywerheid, dit wil ons kragstasies en Sasols. Hierdie verwatging is gefundeer c twee faktore nl –

(i) die verbruik van steenkool gaan geweldig toeneem soo hierdie strategiese nywerheid uitbrei. As in gedagte g hou word dat daar uit een enkele kragstasie (of Saso tot 3,6 miljoen ton vlieg-as, 300 000 ton SO_2 e 250 000 ton stikstofoksiedes per jaar vrygestel word tesame met groot hoeveelhede ander spoorelemente kan die impak van sê nog 10 kragstasies en nog Sasol tipe aanlegte wat nog gebou moet word in perspektie gesien word;

(ii) ons vernaamste steenkoolreserwes is gekonsentreer i 'n redelike klein gebied van die Oos-Transvaal e Noord-Vrystaat en die toekomstige reuse kragstasie en ander steenkoolverbruikers sal om verskeie rede daar gekonsentreer word. Dit sal noodwendig tot ge volg hê 'n styging in besoedelingsvlakke tot onaanvaar baar hoë perke indien daar nie uiters streng vereistes gestel word vir die bekamping van alle besoedelstowwe nie.

Die besoedelstowwe wat ernstige aandag sal geniet is vlieg-as en SO_2. Die tegnologie vir die beheer van vlieg-as is reeds goed ontwikkel en òf elektrofilters òf sakhuise sal die uitlaatvlakke binne perke kan beheer. Die vernaamste redes vir die swak kondisies wat tans by ons kragstasies heers, is te wyte aan onder-ontwerp en swak onderhoud en bedryf van die lugsuiweringstoerusting soos reeds genoem.

Geen geskikte toerusting vir die beheer van SO_2 uitlate vir Suid-Afrikaanse kondisies is nog beskikbaar nie. As in ag geneem word dat nagenoeg een miljoen ton SO_2 reeds in die Oos-Transvaal per jaar uitgelaat word, kan aanvaar word dat hierdie besoedelstof teen die einde van die eeu, ernstige afmetings kan aanneem as beheer nie ingestel word nie. Nuwe

ontswaelingstegnologie wat tans oorsee ontwikkel word, lyk baie belowend maar die instelling van ontswaelingsvereistes sal die koste aan besoedelingsbeheer by 'n enkele kragstasie opstoot van die huidige R80 m tot oor R180 m.

Naas dié van 'n industriële aard, is 'n ander bron van besoedeling wat voor die einde van die eeu ernstige aandag sal verg – motorvoertuiguitlate. Alhoewel die vlakke van besoedeling van hierdie aard, soos gemeet in ons stede, huidiglik nog binne veilige perke is, sal dit noodwendig toeneem en sal beheermaatreëls betyds ingestel moet word.

'n Besluit hieroor sal deeglik besin moet word aangesien aspekte van strategiese, monitêre en landsbelang geraak sal word. Hierdie lugsuiweringstoerusting is duur en vereis die gebruik van loodvrye brandstof wat kan beteken dat tot 5% meer ru-olie ingevoer sal moet word om in dieselfde behoefte te voorsien! Geweldige finansiële implikasies gaan daarmee gepaard. Beheertegnologie kan miskien so ontwikkel dat hierdie faktore tot 'n groot mate geneutraliseer sal word.

'n Ander baie ernstige nie-industriële besoedelingsbron wat in die toekoms bekamp sal moet word is besoedeling vanaf steenkoolverbruikende toerusting in ons Swart woongebiede.

Die beskikbaarheid van die minimum-rook stoof sal wel bydra tot die bekamping van sigbare rook, dog SO_2 sal nog steeds onbeheers uitgelaat word, en op lae vlak. Die enigste oplossing skyn te wees volle elektrifisering van al hierdie woongebiede, spesiale tariewe vir ruimteverwarming en 'n program vir die onttrekking van alle ou konvensionele stowe. Die koste verbonde aan die implementering van so 'n program sal baie hoog wees, maar gesien in die lig van die afmeting wat rookbesoedeling reeds aanneem en die geweldige uitbreiding van die woongebiede wat in die toekoms verwag word, sal dié koste aangegaan móét word om ernstige probleme te verhoed.

In opsomming: Daar is tot hede relatief min deur industrie aan lugbesoedelingbeher spandeer, dog die fondse wat wel spandeer is, was baie goed benut. Daar sal nou toegesien word dat die beskibare toerusting tot die optimaal benut word en laksheid met onderhoud en swak bedryf sal in die toekoms uitgewis word deur streng optrede.

Industrie sowel as die algemene publiek moet aanvaar dat besoedelingbeheer in die volgende dekade groter opofferings, finansieel en andersins, gaan verg om te verseker dat ons omgewing ongeskonde bewaar word.

PRESS RELEASE

March 1983

HIGH CAPACITY IN STACK SAMPLING

Flow Sensor's high capacity, high mass loading Stack Sampler has up to five individual cyclonic samplers, each having a collection capacity of up to 10 grams of particulate matter. The Five-Stage (6 size fractions) cyclones sampler is designed to have five equally spaced particle size cuts on a logarithmic scale within the range 0.1 – 10 um.

This in situ Sampling System operates at a nominal sample flow rate of 28.3 L/min (1 ACFM) fitting through a 10cm diameter port. The six inter-changeable straight nozzles allow easy variations of the isokinetic sampling rate. The powerful cyclonic action eliminates particle bouncing, re-entrainment, and wall losses.

The standard material of construction is 316 stainless steel. Other materials such as titanium or hastelloy may be used where either low weight or high temperature operation is required.

Based on The Environmental Protection Agency (USA) design standards, this new Stack Sampler used in conjunction with Flow Sensor's standard In-Stack Impactor permits the most accurate assessment of air pollution control equipment fractional efficiencies.

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