GUIDELINES FOR AIR POLLUTION CONTROL

by

S M LLOYD
Chief Air Pollution Control Officer, Department of Health and Welfare

SYNOPSIS

Enabling legislation forms the basis of the Atmospheric Pollution Prevention Act, 1965, which means that no detailed requirements with regard to the limits to which pollution has to be controlled are to be found in the Act or regulations. Decisions on the requirements which have to be based on the concept of Best Practicable Means, are taken by the Inspectorate.

To enable the controlling officials to make consistent and objective decisions in this regard, a set of guidelines on minimum requirements and permissible emission limits has been developed for each of the 67 Scheduled Processes. These guidelines are used very successfully to implement a uniform policy of control on a national basis.

Met die Wet op Voorkoming van Lugbesoedeling nou vir ongeveer $1\frac{1}{2}$ dekades in werking en veral gesien in die lig dat oor hierdie tydperk geen wesenlike wysigings daaraan aangebring is nie, het dit sekerlik nodig geword om indringend daarna te kyk en te bepaal of dit nog beantwoord aan ons huidige behoeftes en omstandighede.

Ons leef trouens in 'n era van snelle verandering, veral op tegnologiese gebied. Gevolglik het omstandighede oor hierdie tydperk ingrypend verander; ook wat betref omgewingsbesoedeling en meer spesifiek lugbesoedeling en alles wat daarmee saamhang.

Ons land het oor hierdie tydperk byvoorbeeld op nywerheidsgebied geweldige vooruitgang gemaak en staan in sekere sektore kop aan kop met die hoogsontwikkelde lande soos die VSA, Japan en Duitsland. Gepaardgaande met hierdie groei het die lugbesoedelingspotensiaal skerp toegeneem en die aantal bronne dienooreenkomstig vermenigvuldig. Om te verhoed dat lugbesoedeling ernstige afmetings aanneem, word doeltreffende wetgewing en streng beheervereistes meer en meer noodsaaklik.

Verder het die lewenstandaard van ons bevolking geweldig gestyg en ontwikkel daar 'n sterk publieke aanspraak tot 'n skoner omgewing. Die groter publieke bewustheid plaas weer groter druk op die beheerowerheid om strenger teen besoedelaars op te tree en hoër vereistes te stel.

Die lewensuitkyk van nyweraars het ook verander. Met die totstandkoming van groot nywerheidsreuse soos wat plaasvind, kom eendersyds meer kapitaal vir besoedelingsbeheertoerusting beskikbaar maar andersyds het winsbejag 'n belangrike oogmerk geword en word van direksies verwag om meer krities te staan teenoor alle niewinsgewende faktore soos byvoorbeeld besoedelingbeheer.

Daar kan dus met reg gevra word of die wetgewing nog voldoen in ons veranderde behoeftes. Moet dit drasties gewysig word of is dit heeltemal uitgedien sodat dit vervang moet word met wetgewing wat gebaseer is op meer moderne benaderings soos in die toonaangewende lande van krag is?

By die oorweging van hierdie kern vrae moet die volgende aspekte in gedagte gehou word:

a) Alhoewel sekere sektore van ons nywerheid hoogs gesofistikeerd is, soos byvoorbeeld ons SASOL's en AECI's maak ander sektore nog gebruik van uiters primitiewe tegnieke, soos byvoorbeeld ons bousteenbedryf wat nog die oeroue klemoondstelsel gebruik.

b) Ons kan wel op tegnologiese gebied as 'n Eerste Wêreld land beskou word maar ons vorm nog deel van 'n Derde Wêreld milieu. Ons toerusting is miskien gesofistikeerd maar die operateur wat dit moet bedien het norme en standaarde wat hemelsbreed verskil van sy Europese eweknie.

c) Vir die suksesvolle implementering van moderne wetgewing word 'n groter personeel van hoogs deskundige beamptes benodig vir die suiwer beheer of kontrole funksie. So byvoorbeeld sal ons, indien ons dit sou invoer, ons inspektoraat moet uitbrei van die huidige sterkte van slegs 8 tot minstens 100 om beheer uit te oefen. Waar ons reeds 'n ernstige tekort aan opgeleide mannekrag ondervind, sou dit moeilik, indien nie onmoontlik, wees om die bykomende beamptes te werf. Dan word die addisionele koste van beheertoepassing nie eers genoem nie.

d) Die Suid-Afrikaanse posisie word gekompliseer deurdat ons op 'n hoogte van ± 1600 meter bo seevlak geïndustrialiseer het, dat ons 'n uiters swak dispersiepotensiaal gedurende winters beleef en dat ons 'n baie lae reënval en 'n beperkte watervoorraad het. Ons kan dus nie enorme hoeveelhede water vir skropdoeleindes gebruik soos dit in Europa en die VSA die geval is nie.

e) Suid-Afrika is 'n ontwikkelende land en om in ons groeiende bevolking se behoeftes te voorsien is die skepping van werksgeleenthede 'n top prioriteit. Dit beteken vinnige industrialisasie en gevolglik moet enige beperkende faktore wat nywerheidstigting kan strem tot 'n minimum beperk word. Moderner wetgewing veroorsaak dikwels lang vertragings met die goedkeuring van

nywerheidsvestiging, soveel as 4 jaar in sommige gevalle. Dit kan ons nie bekostig nie.

Met hierdie as agtergrond, laat ons die voor- en nadele en tekortkominge van ons huidige wetgewing, gebaseer op BBM, kortliks skets en die vraag oor die aanpasbaarheid by veranderlike omstandighede, nou bespreek.

Daar bestaan geen twyfel dat die BBM vinnige besluitneming en beleidsverandering in die hand werk nie. Meeste nyweraars het seker reeds ervaar hoedat uiters belangrike besluite na 'n enkele vergadering met die beheerbeampte, geneem kan word. Daarna kan 'n sertifikaat, wat die besluite amptelik bevestig, binne die bestek van twee maande uitgereik word.

Die wetgewing is ook goed aanpasbaar tot veranderde omstandighede deurdat besluite tot beleidsverandering deur die beamptes self geneem word en dus baie gou in werking gestel kan word.

Die wetgewing is verder nie star nie en het 'n ingeboude meganisme tot redelikheid en samewerking deurdat 'n enkele beampte betrokke is by besluitneming wat volgens die Wet gebaseer moet word op redelikheid en na evaluasie van alle faktore wat betrekking mag hê.

Die voordele hierbo genoem is van kardinale belang in 'n ontwikkelende land en moet baie goed opgeweeg word teen die nadele van BBM wat nou geskets sal word.

Die ernstige kritiek teen die huidige wetgewing lê daarin dat die vereistes vaag is en dat daar nêrens in die Wet of andersins enige handleiding bestaan wat die vereistes wat vir elke proses gestel word, duidelik omskryf nie. Nyweraars voel hulle beskik oor onvoldoende inligting oor wat die vereistes is om in doenlikheidstudies van beoogde projekte te gebruik. Verder word die hele kwessie van subjektiwiteit en uniformiteit by die vasstelling van vereistes, geopper. Dit word veral bevraagteken of konsekwente besluitneming oor vereistes moontlik is, waar in die praktyk beheerbeamptes in 'n groot mate outonoom in hul onderskeie gebiede optree.

This weakness in BPM was well recognised in the period immediately after the Act was passed and in order to overcome this problem, a set of minimum requirements for each of the scheduled processes has been composed, extended and developed over the period under discussion. This set of requirements serves as guidelines for both the controlling officials as well as the industrialist.

The procedure for formulating guidelines for a particular process can be summed up as follows:

After wide consultation with many authoritative sources on the process, both local and abroad, and taking local conditions, available expertise and other relevant factors into consideration, the inspectorate draws up draft guidelines for minimum requirements which would be practicable, reasonable and feasible for the process. The guidelines are then discussed with organised industry such as the Galvanising Association, the Ferro-Alloy Producers Association, the Brickmakers Association, Sugar Millers Association or Seifsa, depending of course on the group most concerned with the process under consideration. Other interested parties such as major groups or organisations like Escom, AECI, Sentrachem, are also consulted about possible problems with the practical implementation of the proposed guidelines.

If, after careful consideration of all the relevant aspects and information, the inspectorate is satisfied that the draft complies with the principles of BPM, it is adopted as official guidelines. These guidelines are under continuous review and are updated as and when required, depending of course on factors like changes in local conditions, improved control technology, etc. New guidelines apply to new plants only and are not retrospectively enforced.

These guidelines are not officially published or released for the following good reasons: (a) As the word implies, these requirements are not final but still negotiable should circumstances prevail where slight adjustments can be allowed at the discretion of the controlling official. Should the guidelines be published they would become standard requirements without any discretionary option. (b) Since the principle of BPM is based on discussions, co-operation and negotiation, we, as controlling authority, would like to become involved in all new projects at the earliest possible stage. Industrialists are quick in this way to approach us for discussions on principles for any proposed project. We welcome these opportunities and endeavour to supply the interested party with as much information on our requirements as is possible.

In reply to the obvious question of how we arrive at the individual requirements as contained in our guidelines, the following: The main objective of our legislation is the protection of health and the environment. To achieve this objective we have formulated guidelines with respect to (a) permissible emission levels or, in other words, efficiency of collecting equipment and (b) the proper operation and maintenance of such equipment.

These guidelines can be classified as those for general use and those pertaining to specific processes:

A. *General guidelines*: A very useful general guideline is that on presumptive emission limits and can be formulated as follows: The abatement equipment to be used to control a particular pollutant must be designed with a collecting efficiency high enough to ensure that under normal operating conditions the ground level concentration of that pollutant will not exceed $(\frac{TLV}{50})$ mg/m^3 at any point around the plant.

   In practice this means that by using the three parameters: (1) emission height; (2) atmospheric dispersion potential; and (3) TLV of pollutant, the collec-

tion efficiency of a pollutant, generated at a certain rate can be determined using from simple to very complex mathematical formulas or models. One such very simple formula using typical South African atmospheric condition parameters reads:

$$E = [1 - (\frac{TLV}{50}) \frac{H^2}{KT}] \times 100$$ where

E = percent efficiency required of collecting equipment

H = effective height of release (m)

K = a constant equal to 6,42

T = rate at which pollutant is generated (kg/h)

To illustrate the use of this formula – In a process 25 kg/h of formaldehyde will be generated. What must be the efficiency of a scrubber to control the emission to acceptable levels if it is to be released at a height of 20 metres?

The TLV of formaldehyde is

$3\ mg/m^3 : (\frac{TLV}{50}) = 0,06\ mg/m^3$

K = 6,41

T = 25 kg/h

$$E = [1 - \frac{(0,06) \times 400}{6,41 \times 25}] \times 100$$

E = 85%

Percent efficiency = 85% of scrubber

This formula may be used with the following exceptions and modifications:

a) If a pollutant is carcinogenic or accumulative $TLV/_{100}$ must be used.

b) If the pollutant has an odour threshold limit lower than $TLV/_{50}$, the odour threshold limit must be used in the formula rather than TLV.

c) If a presumptive emission limit for a pollutant is set in a specific process guideline, that limit takes precedence, e.g. 35 mg/m^3 fluorine in fluorine processes, 100 mg/m^3 ammonia in NH_3 processes, etc.

Another useful general guideline is a particulate matter emission limit of 120 mg/m^3. This limit applies to all inert dust and particulate matter emissions except where otherwise stated in process guidelines.

B. *Guidelines for scheduled processes:* For each of the 67 processes a set of guidelines has been drawn up and is regularly reviewed and amended as required. The guidelines for a few of these processes will now be quoted in order to give an idea of what they are all about:

1) **Sulphuric acid processes : No. 1**

Sulphuric acid manufacturing plants using bright sulphur and erected after 1978:

(i) *Guidelines on emission limits*

a) Total conversion efficiency $S \rightarrow H_2SO_4$: 96% min.

b) Conversion efficiency $SO_2 \rightarrow H_2SO_4$: 99,5% min.

c) Maximum concentration of SO_3 in off-gas: 30 mg/m^3

d) A clear stack is required.

e) Exit velocity in stack > 15 m/sec

(ii) *Guidelines on operation and maintenance*

a) Accurate control of temperature in converter.

b) Control of acid concentration and temperature in absorption towers.

c) Preheat of acid and catalyst before start-up.

d) Leaks must be kept to a minimum.

e) Mist eliminators must be regularly maintained.

f) Records must be kept of total SO_2 releases.

g) Continuous monitoring of SO_2 in area recommended.

2) **Phosphate Fertilizer Processes : No. 2**

(i) *Guidelines on emission limits*

a) Particulate emissions <150 mg/m^3

b) Fluorine emissions < 30 mg/m^3

(ii) *Guidelines on operation and maintenance*

a) The erection of new prilling towers should be discouraged.

b) pH control on fluorine scrubbers.

c) Regular cleaning of scrubbing liquor lines to prevent blockaging.

d) Standby pump facilities on fluorine scrubbers.

e) Monitoring of fluorine levels recommended.

3) **Cement processes : No. 22**

(i) *Guidelines on emission limits*

Dust concentration from plants erected after 1980: < 150 mg/m^3

(ii) *Guidelines on operation and maintenance*

a) ESP must be fitted with a power supply on each field.

b) Minimum of at least 3 fields on ESP.

c) Dust monitors on all plants causing problems: Opacity : < 20%.

d) Conditioning of gases essential.

e) The use of baghouse to be recommended.

f) CO monitors on kilns where explosions in ESP may occur.

g) Dust on premises must be kept to a minimum by using industrial vacuum sweepers.

h) Bulk loading must be done by means of telescopic spouts with dust extraction facilities.

i) Silos and conveyor belt transfer points must be enclosed and fitted with dust extraction facilities.

4) **Iron and Steel Processes : No. 30**

(i) *Guidelines on emission limits*

Sinter plants erected after 1978:

Particulate emission < 200 mg/m^3
(if $CaCl_2$ is added < 100 mg/m^3)

a) Arc furnaces: fumes emission < 120 mg/m^3.

b) Arc furnaces: roof extraction for furnaces with holding capacity < 50 tons.

c) Ferro alloy furnaces: fumes < 120 mg/m^3. (Tapping and slagging fumes to be collected on new furnaces.)

d) BOF and AOD must be fitted with primary and secondary extraction. Dust and fumes < 120 mg/m^3.

e) *Cupolas*

i) With inside diameter across melting zone of less than or equal to 910 mm (36''):

a) closed circuit water-cooled cap inside a dropout chamber; or

b) a 6 mm thick stainless steel cap may be used provided distance between top of charge door and cap is not less than 6 m.

ii) Cupolas with inside diameter greater than 910 and up to 1 220 mm: Collection equipment should be capable of removing 85% of particles with a size of 10 μ and a specific gravity greater than 2.

iii) Cupolas with inside diameter greater than 1 220 mm fume and grit emission < 120 mg/m^3.

f) Hot blast cupolas: Dust emission concentration to be controlled to < 120 mg/m^3.

g) Fettling, sand handling and sand blasting operations: Emissions to be controlled to < 120 mg/m^3.

h) Sponge iron plants: If ESPs are used, minimum of three fields allowed: Emission limit of < 120 mg/m^3.

i) All other sources of fume from steelmaking processes < 120 mg/m^3.

(ii) *Guidelines on operation and maintenance*

a) Dust control on all transfer points.

b) Fugitive dust to be kept to a minimum.

c) Smoke from sponge iron plants to be minimized.

d) Opacity meters to be installed on all plants causing problems.

e) Provision must be made for easy maintenance of stainless steel caps on cupolas.

5) **Galvanising processes : No. 55**

(i) *Guidelines on emission limits*

a) Particulate emission < 120 mg/m^3.
b) HCl acid fumes < 30 mg/m^3.

(ii) *Guidelines on operation and maintenance*

a) *Acid baths*

i) Preference should be given to the use of sulphuric acid with inhibitor.

ii) Should HCl be used, sufficient inhibitor must be used – control records to be kept. HCl strength must not exceed 14%.

iii) Baths should be cleaned regularly.

iv) No sludge on bottom causing gas generation.

v) Side extraction through high stack recommended.

b) *Zinc baths*

i) "Wet" method, that is bath with flux blanket, only to be allowed if extraction on bath is provided. Only pellet flux of the low fuming type allowed.

ii) "Dry" method, that is where pieces are precoated with flux followed by drying before dipping. Should preferably be equipped with extraction.

iii) No hand dusting to be allowed. Black spots to be treated with powder spray gun only.

c) *Stack* must be above turbulent area of roof and in all cases not less than 7 m above highest point of roof. Emission from stack to be less than 20% opacity.

d) *Bag filter*. Should bag filters be used it is preferable that $Ca(OH)_2$ be added to the gas stream on a constant basis to act as a precoating agent.

In conclusion, I believe that by using the guidelines as set out above, the major weakness and point of criticism against BPM, namely that of inconsistency and subjectivity in formulating requirements, has largely been overcome.

I should also like to reiterate my request to industrialists to approach us for more details on guidelines for any of the scheduled processes. We would indeed welcome enquiries of this nature and would provide as much information as possible as well as on the site selection for new projects.