THE INDUSTRIALIST'S RESPONSIBILITY IN AIR POLLUTION

J.D. LOUW

Mr. Boegman spoke to you from the viewpoint of the control authority. I should like to speak to you from the viewpoint of the industrialist himself. There is sometimes a degree of conflict between the controller and the controlled and this is certainly natural. If the control authorities lose sight of the realities of the existing technology and the economics of a project, the industrialist will have reason to complain. If, in addition, as has happened in America, politics and the influence of pressure groups start playing a role, a rather difficult situation can arise for the industrialist. I am not saying that it is wrong that a large number of old chemical plants in the USA have had to close down on account of current requirements for clean air, but it is unfortunately so that unnecessary bans and delays on the construction of certain plants as well as other unfortunate happenings have resulted through the emotional actions of pressure groups.

For instance, even although scientists and engineers are still debating the lead in gasoline question, an extra almost $300 had to be paid by buyers of motor cars during the last four years. Many technological problems are still unresolved. For instance, the electric utilities must use stack gas scrubbers for sulphur dioxide emissions although there are consistent reports that reliability tests for this type of equipment keeps on failing. Energy shortages in the USA are heavily affected by environmental requirements. One executive has stated that bans on burning of high sulphur coal, delays in the construction of nuclear power plants and greatly increased consumption of gasoline as a result of emission controls on automobiles have caused average annual per capita consumption of oil to increase 50% between 1970 and 1973.

The cost of erection of new plants is heavily affected by the requirements for air pollution control. It was established that in 1974 212 firms spent $2,7 billion on pollution control - $44 million of it by petroleum companies. Stauffer Chemical is now erecting a chemical complex in Tennessee and there 25% of the total cost will go for pollution controls.

It is only natural under such circumstances that voices will be crying out for greater realism with regard to the demands of the public. An example of such a plea is the new perspective pleaded for by Dr. John J. McKetta, chemical engineering professor at the University of Texas and chairman of the National Air Quality Management Committee of the National Academy of Science. He reveals the following eight "surprises":-

1. Most oxygen in the atmosphere doesn't come from photosynthesis. It possibly comes from the upper atmosphere and is virtually unlimited.
2. Carbon monoxide comes 93% from trees and greenery; 7% from man.
3. Most oxides of nitrogen come from nature - some 97%.
4. The organic carbon content of sewage is using up oxygen in Lake Erie, not phosphates in detergents.
5. It is estimated that 100 million human beings who would have died from insect-borne diseases are alive today because of DDT.
6. Man has had nothing to do with the disappearance of a million of animal species that preceded him.
7. All of man's air pollution during his thousands of years on earth does not equal that of just three volcanoes.
8. Last surprise! We're going to live!
   We're not on the brink of ecological disaster!

But nobody wants to stop air pollution control. Everybody - also the industrialist - wants clean air and water.

In the first place as we are going to talk about air pollution let us consider the fact that air is everybody's air, but it is also a raw material for industry, and everybody should get its legitimate share of it. Any user of the atmosphere must also look after the interests of the other users with whom he has to share the same air.
Therefore, let us look at what an industrialist will do if he plans a new factory on a virgin site. There is of course some differences when the site is already industrialised.

In the first place the industrialist has to study the local climate, he must obtain reliable wind roses for the environment, he must know about climatological conditions like inversions, rainfall, atmospheric humidity, maximum and minimum temperatures, etc. Then he must know, and make an inventory of, all the sources of air pollution which will stem from his operations, and for each source he must list the nature of it, the magnitude and the expected impact on the environment. Not only must he consider the impact on the environment, but also the impact on his own operations. A typical example is the case in the Oil from Coal Industry where you have to have a large oxygen plant and where air is your raw material. There you have to guard against the contamination of this raw material by unwanted gaseous compounds like hydrocarbons, especially the highly unsaturated hydrocarbons (and also the oxides of nitrogen) which can cause explosions in your oxygen plant.

The first assignment in this sort of analysis is to do whatever you can to eliminate the pollution completely. In other words, to try and remove the pollution at its source, and therefore you have to employ the best possible technology. One can do almost anything these days with technology, but at a cost, and therefore, without going overboard on too sophisticated processes one has to select that technology which will enable you to render the atmosphere essentially harmless in the environment of your plant.

If complete removal of pollution at its source is impossible then one can still employ technology to prevent the air from being polluted too much. For instance, one can use scrubbers. Water scrubbers, for instance, are extensively used especially to allay dusts. One could use demisters, which remove droplets from the air emitted by various processes; or bag filters especially for dusts. You can use cyclones, again for solid particles and if these things don't bring the desired results, you can use electrostatic precipitators. Cyclones fail to collect the very fine dust and therefore in some cases you have to resort to the use of electrostatic precipitators which can remove dusts of the order of fractions of a micrometer diameter. Other technology which is available may be the use of flares to combust unwanted gases. Or one could use conversion or extraction processes by means of which unwanted gaseous compounds in your effluent can either be converted to obnoxious compounds or can be extracted completely and then right at the end of the list when all these things cannot be done any longer and you still sit with an air pollution problem you could resort to high stacks. If you make a proper study of the local climate of the area in which your plant will be situated, it is possible to calculate how high this stack should be to bring the effluents from such a stack to above the generally accepted height of the inversion layer in that area.

After having done all this the industrialist must now sit down and calculate, or if it is impossible to calculate, he must experiment to determine what the expected ground level concentration of the gases, which he will be emitting, will be in the residential areas. You see he has to plan the relative position of the town and the factory, and this is not a very easy matter. To cite an example: The Sasol II plant which is going to cost over R1 000 million to build and the Sasol II township must both be situated on such ground that no economical recoverable quantities of coal are underneath them. Therefore one finds that one is sometimes in the position where the site choses itself; there is very little choice in the matter; but then again the overriding factor is still that you have to look at what the effect of the plant will be on your residential area.

Then after having planned all this the industrialist must consider that there are various pitfalls which will arise during operations. He must realise that start-up conditions may be very different from normal conditions in any plant. A typical example is the case of a sulphuric acid plant where during start-up conditions copious quantities of SO_3 must be emitted to the atmosphere for a limited length of time. He must for instance try and plan to start his sulphuric acid plant only at times when the wind direction and the wind velocity and also the humidity in the atmosphere are capable of dealing with this situation adequately instead of forming heavy mists of SO_3 or H_2SO_4 droplets. There is also another pitfall and that is that one may find that in one part of the plant you are emitting an acid vapour like for instance SO_2 or HCl or NO_2, whereas at another part of your plant you are emitting alkaline vapours like for instance ammonium. When these vapours meet in the atmosphere under the right conditions of humidity you are sure to form a very thick fog of ammonium salt which can in some cases be more than just a nuisance; it can cause great hazards on account of the thickness of the clouds and on account of the effect that it has on people who breathe in this material. I shall show you some slides at the end of my talk of actual occasions when such chemical fogs occurred in the atmosphere.

Another pitfall is that you might have calculated everything on the premise that there will always be some wind to carry away some of the pollutants which you are bound to emit into the atmosphere. You may get a calm and if the calm persists for six hours; for twelve hours; for an entire night and a day then you are really in trouble because all the material that has been emitted from your chimney stacks is just hanging above the plant in a huge bubble of air and it cannot escape on account of the fact that there is a calm and possibly in addition an inversion.

Another difficulty is that during the night, especially in the early hours of the morning, the temperatures usually drop so low that the dewpoint of the atmosphere is reached and should there be any dust or anything on which a mist can form then very heavy smog clouds can be formed under these conditions under only the slightest provocation.

If you consider that you would like therefore to keep particles out of the atmosphere, especially the small ones which are the most difficult to remove, then you will probably have resorted to water scrubbers, but please remember that scrubbing, especially water scrubbing, has this disadvantage that you are probably creating a water pollution problem in your attempt to solve the air pollution problem.

I have already indicated earlier that the cost of pollution abatement equipment is high when I said that in the case of Stauffer Chemical about 25% of the cost of its chemical complex in Tennessee will go for pollution controls. This is a very real problem which we have to deal with in our day. Some people say that it is not the right thing to calculate the cost of pollution control equipment separately from that of your plant because it must be considered to be part and parcel of your plant; you are not allowed to even plan a plant which will cause unwanted emissions in the atmosphere, but all of this makes life complicated and more expensive these days than it used to be. Not that I am pleading therefore that this is not necessary. This is really necessary, but the fact is that while an industrialist can only exist if he has a profit, it just means that the consumer eventually in the end pays for all his attempts at pollution control.

I think I should say something else about air pollution and occupational health. When one talks about occupational health you are not really referring to the occasional cold or headache which comes and goes without leaving any permanent effects on the sufferer. You rather think about some chronic disease, something which causes a permanent disability of some sort or another. In South Africa there has recently been passed the Occupational Health in Mines and Works Act, which replaced the old Pneumoconiosis Act and which is aimed at the protection of the worker against any disease which can be classified as an occupational disease. There are not many such diseases or conditions known. The following small list was all that I could think of:

pneumoconiosis (with or without tuberculosis)
permanent partial deafness
allergic skin diseases
poisoning by heavy metals like lead, cadmium, vanadium, etc.
asbestosis

Because the responsibility of the industrialist is generally recognised in having to protect his workers adequately against such diseases, the Act requires that the risk for contracting any such occupational disease in a mine or a factory has to be assessed and that the owner of the mine or factory must pay a levy on each man-shift worked under such conditions. The levy goes into a compensation fund out of which people who later have been found to suffer from an occupational disease, can receive compensation payment. To do this properly requires much more and better knowledge than that which we possess today and much effort is consequently being devoted towards obtaining that knowledge. It remains difficult though, because, as an example, when we tried to assess the possible chronic effects of prolonged exposure to carbon monoxide, by testing the blood of the workers for carboxy haemoglobin content, we found that all which we could be sure of was which men were smokers and which not!

Nevertheless we are making progress and I can see that in future much more will be done for the protection of the health of people than in the past. We should try to forestall a situation like the one which suddenly arose when it was discovered that vinyl chloride monomer was the cause of liver cancer in workers exposed to what was previously considered to be harmless concentrations.

If there is the proper concern on the part of the industrialist and the right sort of approach on the part of the authorities, we can go a long way in the protection of the health of our workers and the general public against diseases and maladies caused by air pollution.