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THE IMPACT OF INDUSTRIAL AIR POLLUTION ON THE HEALTH OF RESIDENTS OF MEREBANK, DURBAN, SOUTH AFRICA

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Abstract

The Merebank area of Durban, South Africa, is a good example of what can happen when industrial development goes unchecked with nearby residents, usually poor, bearing the tragic social costs of rampant health problems. Merebank, a South African Indian township of about 50,000 people, may be more aptly described as an island surrounded by a sea of polluting industries. Merebank is located 16 km south of Durban, Kwa-Zulu Natal, in what is described as the Southern Industrial Basin. The residents in Merebank show a remarkably high incidence of respiratory and dermatological ailments as a result of exposure to industrial pollutants. The pollution problem experienced in Merebank and the southern Durban region may be unique in the most industrial nation on the continent. Its severity seems to be due to a combination of social, political and economic factors, topographical and meteorological conditions and environmental legislation that does not serve to protect all its citizens. Since some of the citizens involved are from the poorest sectors of the Durban urban area, the problem would also be considered one of environmental equity.

The core of this study deals with a survey conducted in Merebank to determine the perception of residents on the types of pollution they experienced, and the industries that they believe cause the pollution problem. Respondents were also questioned on their proximity to nearby industries and the types of illnesses/ ailments experienced and how often medical treatment was received. The results of the survey indicate that the majority of respondents not only lived in close proximity to industries, but also that most of them receive medical treatment for respiratory and skin ailments and that these treatments were quite frequent. These results lead the investigators to recommend several redemptive solutions

1. Introduction

There are numerous studies globally linking excessive ambient air pollution emissions with deteriorating health, elevated morbidity and mortality rates. In most cases, extreme outdoor air pollution leads to increased respiratory illnesses as well as irritation to skin and eyes (Waldbott, 1978). Merebank lies in the southern Industrial Basin, which has a topography and climate that lend itself to severe air pollution episodes. Similar episodes have been reported in other basins and valleys, such as the lethal Meuse Valley, Belgium episode in 1930, Donora, PA. (USA) in 1946 and Poza Rica, Mexico, 1950 (Wark and Warner, 1981). In these basins, industrial air pollution becomes trapped under a persistent inversion with stagnant wind conditions (Strauss and Mainwaring, 1984). Durban, located in the subtropical high belt of southern Africa, lies along the Indian Ocean. Its climate is humid and subtropical, with relatively high rainfall primarily occurring in the summer. Prevailing winds are northeast and

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southwest, roughly parallel to the coastline (Chenje and Johnson, 1994). However, it is the calm drier winter weather conditions that contribute to air pollution problems by preventing dispersion. Inversions are common, trapping tons of sulphur dioxide in the lowest atmosphere (MRA, 1992).

Air pollution in developing countries affects millions of people, with children, the aged and those with respiratory ailments being the most susceptible. In parts of Africa, acute respiratory diseases account for a quarter to a third of deaths amongst young children. There are indications that in some South African urban areas, death caused by respiratory infection is becoming more common than those resulting from diarrhea (Mathee and Von Schirnding, 1994).

2. The Study Area

Merebank is a residential area located on the doorstep of industry in every direction. It is faced by two oil refineries (Genref and SAPREF), a mass paper mill (Mondi), a chromium processing plant, Chrome Chemical, an airport and a multitude of chemical processing industries border family homes (IDRC, 1994). Industries in the Durban Metropolitan Area (DMA) produce more than a million tons of waste per year, including air, water and solid emissions. The largest waste producer, besides mining, is the chemical industry, which produces half the total industrial wastes, but contributed only 16% to the DMA economy in 1988 (State of the Environment, 1999).

Merebank is divided into three distinct areas: Ridge, which borders the Indian Ocean, Central, which is the valley, and the Navy Industrial Park, which borders Mobeni and Lamontville (figure 1). The Jacobs and Mobeni Industrial belt and the Isipingo and Prospecton Complex fringe the borders of Merebank. The two main industrial areas in the Merebank area are (a) the Ridge Industrial Park, comprising two petrochemical refineries and the Mondi Paper Company, (b) the Navy Industrial Park, comprising C.G. Smith Chemicals, Chrome Chemicals South Africa, and Sacca.

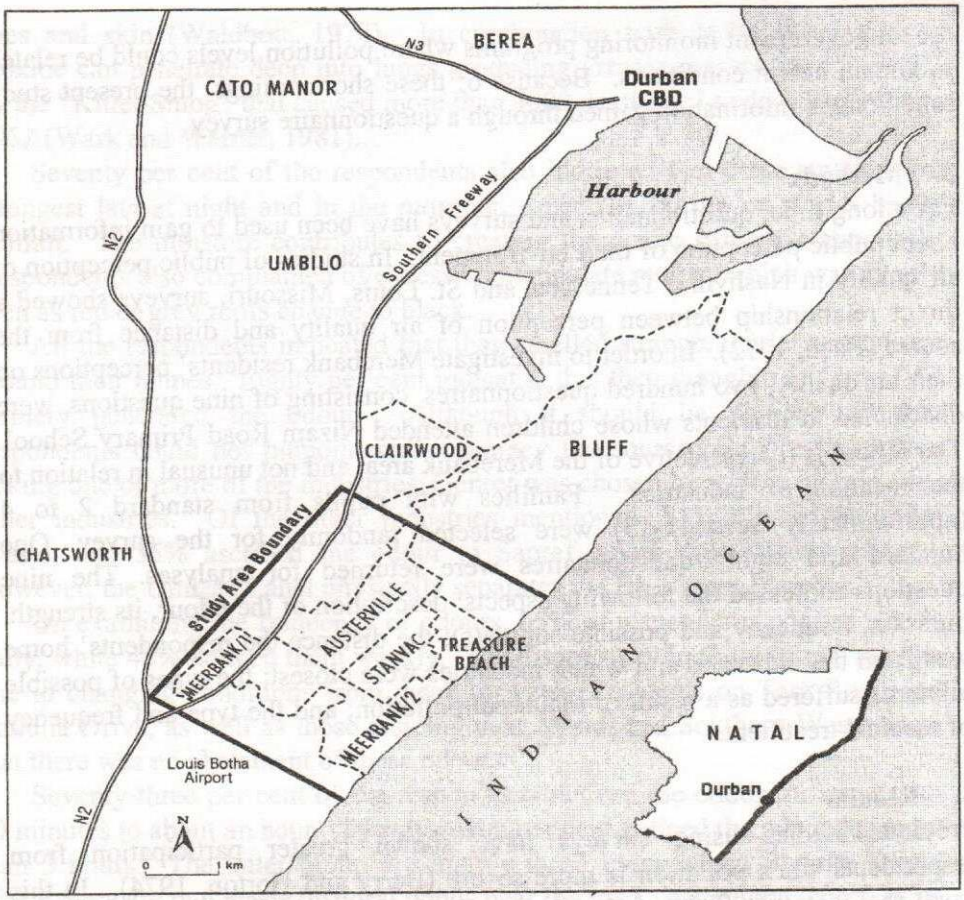

Figure 1: ***Location of the study area***

Petroleum refineries, chemical plants and pulp and paper in this southern industrial basin have overburdened the environment. Coal and oil create air quality problems for Merebank. Coal, which is mostly bituminous, is the primary fuel used by industries and it has a high ash and sulphur content, that leads to high concentrations of particulate, sulphuric acid mists and rain (WHO, 1997). The impact of these particulate and gaseous materials on human health has been of concern to scientists and policy-makers alike; often leading to strict controls and standards in the developed countries (NAS, 1974; NRC, 1980). No such controls or standards are in place in Merebank, or in the rest of South Africa. Electricity is cheap in South Africa, providing economic advantage to industry at the expense of atmospheric pollution, environmental degradation and lowered personal health (Durban Metropolitan Council, 1999). Similarly, there

are no government monitoring programs where pollution levels could be related to human health conditions. Because of these shortcomings, the present study relied on the information gained through a questionnaire survey.

3. Methods

For a long time, questionnaires and surveys have been used to gain information about public perception of their environment. In studies of public perception of air quality in Nashville, Tennessee, and St. Louis, Missouri, surveys showed a direct relationship between perception of air quality and distance from the source (Bach, 1972). In order to investigate Merebank residents' perceptions on their air quality, two hundred questionnaires, consisting of nine questions, were distributed to residents whose children attended Nizam Road Primary School. The school is representative of the Merebank area, and not unusual in relation to the location of industries. Families with pupils from standard 2 to 4 (approximately ages 11-13) were selected randomly for the survey. One hundred and eighty questionnaires were returned for analyses. The nine questions addressed the following aspects: description of the odour, its strength, duration, frequency and possible source(s); the distance the respondents' home was from the industries and which industries were closest; the types of possible ailments suffered as a result of industrial pollution; and the type and frequency of medical treatment.

4. Results

Previous studies using surveys have shown greater participation from respondents when pollution is more severe (Berry and Horton, 1974). In this case, the fact that 90% of the questionnaires were completed and returned indicates that residents are truly concerned and that there is a genuine problem affecting the community.

4.1 Odour

Sixty per cent of the respondents identified the odour as a sharp smell or a rotten-egg smell. Sulphur dioxide and hydrogen sulphide, both products of oil refineries, smelters, paper mills and chemical processes, emit such a smell. Forty percent of the respondents described the odour as having a rotten-egg smell and a "stinging" odour that caused a burning sensation to their nostrils. Ninety per cent of respondents believed that closing doors and windows would not be enough to keep out the smell. These respondents also claimed to experience constriction in their chest and incessant tearing of their eyes. Sulphur dioxide and sulphuric acid mist, which forms when sulphur dioxide is mixed with moisture, is known to cause respiratory ailments and irritation to

eyes and skin (Waldbott, 1978). In combination with particulates, sulphur dioxide can penetrate deep into lungs producing greater damage, as evidenced by the "Killer Smog" that caused more than 4000 deaths in London, England, in 1952 (Wark and Warner, 1981).

Seventy per cent of the respondents also indicated that these smells were strongest late at night and in the morning, especially during or after a heavy rainfall. The moisture contributes to creating the acidic sulphur compounds. Respondents also complained of excessive particulate matter, which was clearly seen as red or grey roofs change to black.

All the respondents indicated that they smelled strange, unpleasant odours around their homes. Eighty per cent indicated that they thought the Genref oil refinery generated the odour. Although it should be pointed out that respondents could not pinpoint with accuracy the source of the odour, often ticking one or more of the industries, Genref was chosen by a clear margin over other industries. Of the other industries mentioned, 51% blamed Southern Waste, and 35% ascribed the odour to Sapref, another petroleum refinery. However, the Umlaas Canal physically separates the latter from Merebank.

On examining the frequency of odours, 65% of respondents noticed smells daily, while 45% noticed them weekly. The discrepancy in these results may be due to changing conditions from week to week. Residents on Tara Road and Badulla Drive, as well as those residing near Mondi and Southern Waste, state that there was no abatement of these odours.

Seventy-three per cent of the respondents noticed the odour for more than 10 minutes to about an hour. Twenty-seven per cent noticed the odour for more than 3 hours. The latter group are mainly those living along Badulla Drive, where there are two waste disposal ponds near the road. Although Genref, in its current expansion has relocated the ponds somewhat farther away from the road, the odour still persists throughout the day.

4.2 Distance From Industries

Fifty-five per cent of the respondents live within a 1-km radius of an industry. Furthermore, 33% of the respondents reside less than 300 m from any industry. Some respondents such as those residents on Badulla Road and Tara Road, near Genref, live as close as 10 m from industrial complexes. Residents on Sambulpur Road are adjacent to Southern Waste works. The furthest away from industries were those living on the Ridge. However, the concentration of residents decreased with distance from industries

Twenty-five per cent of respondents stated that they lived near two industries; fifty-five per cent lived near three industries; and twenty per cent lived near four industries. Seventy-six per cent of respondents are found in close proximity to the large industries: Genref, Mondi, Sapref and Southern

Waste. More than half of the respondents live near the Southern Waste complex near the center of Merebank. Other respondents live closer to smaller industries such as the Bayer Group of Companies, Illovo Sugar, Chrome Chemical and Sacca. Even more alarming, 10% of the respondents are virtually residing in an industrial complex (figure 2).

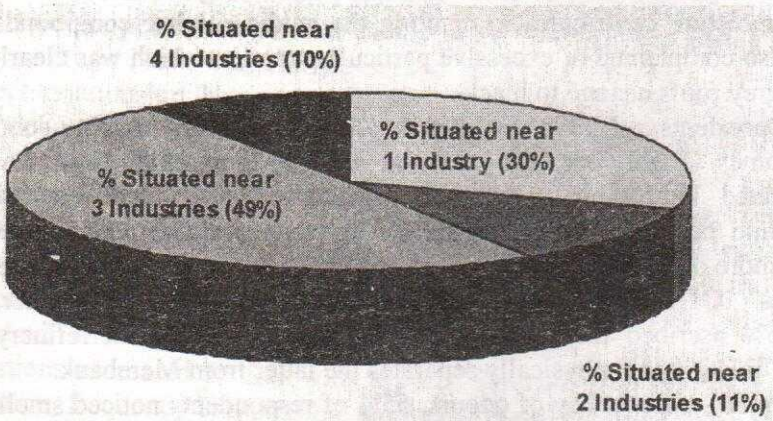

Figure 2: ***Closeness of respondents to industries***

Health

4.3 Health Problems and Treatment

The surveys revealed that 33% of respondents reported suffering from chronic sinusitis, bronchitis, asthma and skin allergies. According to Earickson and Ballick (1988), these ailments are common symptoms of air pollution, especially sulphur dioxide. Health impacts are notoriously underreported or respondents may not know what they suffer from. So these figures may be more significant. Closer examination of the results revealed that respondents often suffered from a combination of illnesses. A minimum of thirty percent suffered from one or more of the following illnesses: chronic sinusitis, bronchitis, asthma and skin allergies. Thirty-one percent of respondents indicated that they had suffered from bronchitis and asthma. Five per cent of respondents suffer from lung cancer. As much as ten percent of respondents were affected by conjunctivitis (figure 3). Although the percentages appear somewhat low, eighty percent of respondents reported receiving medical treatment, presumably from pollution related ailments. Fifty per cent indicated that they go to private medical practitioners, while the rest attend provincial hospitals. For Merebank, private means more cost for treatment.

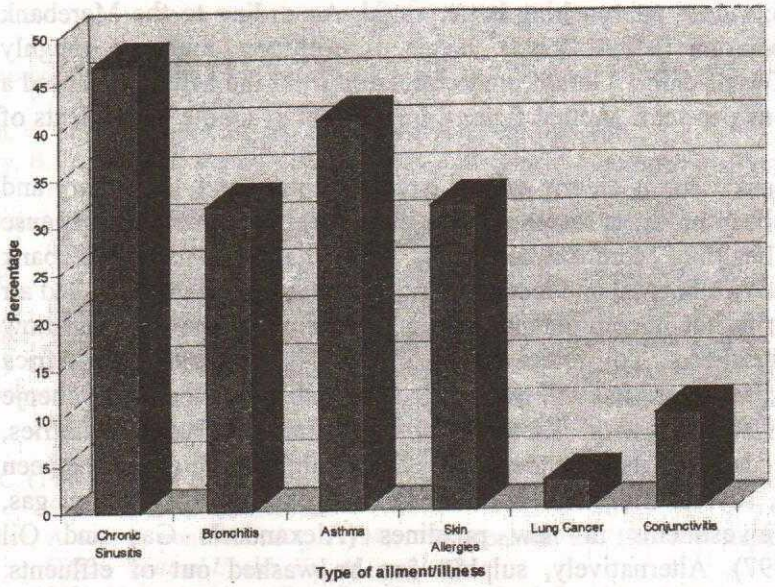

Figure 3: ***Type of ailment/ illness***

These ailments are generally chronic. Sixty-one per cent of the respondents received treatment once a month. Therefore, whether treatment comes from private or provincial hospitals, these respondents are not cured, but require treatment again and again. While patients may be given healing care, they must return to the source of their ailments; their polluted neighbourhoods.

5. Analysis

The evidence obtained from this survey and supported by other sources of information, provide a strong argument for establishing a cause-effect relationship between the high incidence of respiratory and skin ailments and the prevailing industrial air pollution smothering Merebank. In a survey of air pollution over Durban, conducted by the CSIR in the late 1950s, sulphur dioxide was found to be heaviest over the Merebank area (CSIR, 1991). In a more recent estimate of sulphur dioxide emissions in South Africa, Waddacor (1992) measured a million tons emitted by power stations, oil refineries and ore-smelting plants. In Merebank, the main polluter of sulphur dioxide seems to be the two oil refineries, as well as the Mondi paper mills that like many South African industries use coal and oil boilers and furnaces in the processing of primary products and to drive steam turbines. These boilers and furnaces release sulphur oxides through smokestacks into the atmosphere to form acidic solutions, which then precipitate as acid rain. The acidic solutions range in pH

from 3.9 to 4.6; values approaching battery acid. According to the Merebank Residents Association (MRA, 1992), levels of pollution could be roughly estimated at 200 tons daily. Genref, under pressure from the MRA, disclosed a figure of 500 tons per year. Actual figures are still not available to residents of erebank.

The Merebank issue is clearly one of environmental equity. Industry and those that buy cheap products resulting from these plants benefit at the expense of the impaired health of Merebank residents. Those that live outside Merebank do not pay the environmental and medical costs associated with uncontrolled air pollution. This is not uncommon in developing countries that are just now becoming industrialized. To protect the health of all its citizens, South Africa will need to find solutions that will encourage sustainable development (Chenje and Johnson, 1994). As with cleanup efforts in Britain and other countries, South Africa needs to rid its dependence on cheap, sulphur-rich coal. Between 1997 and 1998, several industries north of Durban converted to natural gas, after making investments in new pipelines (Alexander's Gas and Oil Connection, 1997). Alternatively, sulphur can be washed out of effluents, reducing pollution significantly (ref). Increasing the distance between polluters and residents, greenbelts and other land use controls, meteorological controls (burning only when wind dispersion is adequate) are other solutions to the problem (Bach, 1972; Stern, 1976). The World Health Organization recommends that industries need to be placed in designated areas, away from populated areas and downwind from cities (W.H.O., 1988).

6. Conclusion

The responses of residents in the Merebank survey clearly show that industrial pollution is the prime cause of respiratory and skin ailments. Most residents, often living on the doorstep of industries, report sickening smells, which they claim comes from nearby plants. Respondents report high incidences of several respiratory and skin ailments requiring frequent treatment from private or provincial medical facilities. The residents believe that the cause of these ailments is the offensive pollutants in the air (MRA, 1993). These health problems will probably not clear up until residents are removed from the offending pollutants, whether by increasing their physical distance from industries, controlling sulphur dioxide or converting to cleaner fuels and plant processes. The need for formulating and executing an environmentally friendly legislation to underscore environmental equity cannot be overemphasised.

References

"Alexander's Gas and Oil Connections News and Trends, Africa." (1997). *Gas and Oil Connections, Vol. 3*, Issue 21, (July 29).

Bach, W. (1972): *Atmospheric Pollution*, New York: McGraw-Hill.

Berry, B.J.L. and F.E. Horton. (1974): *Urban Environmental Management*, Englewood Cliffs, N.J.: Prentice-Hall.

Chenje, M. and P. Johnson. (1994). *State of the Environment in South Africa*, Gauteng, S.A.: Creda.

CSIR. (1991). *Programme for the Environment.* Pretoria: Council for Scientific Industrial Research.

Durban Metropolitan Council. (1999). *State of the Environment.* DMC Internet site: http://www.ceroi.net/reports/durban

Earickson, R.J. and I.H. Ballick. (1988). "The Areal Association of Air Pollution and Residential Characteristics: Louisville and Detroit." *Applied Geography, Vol. 8*, pp.5-23.

IDRC. (1994). *Environment, Reconstruction and Development in the New South Africa, Mission Report.* Ottawa: IDRC Press.

Mathee, A. and Y. von Schirnding (1994). "Environment and Health in Rapidly Urbanising Cities." *Critical Health, Vol. 46*, pp.21-27.

MRA. (1992). *Memorandum to Genref.* Durban: Merebank Residents Association.

MRA. (1993). *Pollution in Merebank.* Durban: MRA.

National Academy of Science. (1974). *Lead.* NAS and Washington D.C.

National Research Council. (1980). *Controlling Airborne Particles.* Washington D.C.: NRC.

Stern, A.C. (Ed.). (1976): *Air Pollution, Vol IV*, 3rd ed., New York: Academic Press.

Strauss, W. and S.J. Mainwaring (1984): *Air Pollution*, Edward Arnold, and London.

Waddacor, M., (1992): *Technology of South African Chemicals*, Sasol Ltd., Johannesburg, S.A.

Waldbott, G.L., (1978): *Health Effects of Environmental Pollutants*, 2nd ed., Mosby, St. Louis, USA.

Wark, K. and C.F. Warner, (1981): *Air Pollution: Its Origin and Control*, 2nd ed., Harper and Row, New York.

World Health Organization, (1997): *Health and Environment in Sustainable Development: Five Years After the Earth Summit*, W.H.O., Geneva.

WHO, (1988): *Air Pollution in African Villages and Cities*, W.H.O., Geneva.