

Control of Industrial Pollution in Kolkata Metropolitan Area

Mahalaya Chatterjee

Head, Department of Urban Studies,
University of Calcutta

Abstract

This study is concerned with the idea of environmental management and people's perception about the extent to which various industries practice this new facet of management. The objective is two-fold: (1) to know the attitude of the industries in the context of pollution control; and (2) if industries do adopt some sort of pollution control measure (s), then what is the perception of the people in this regard? Do they feel that they really benefit from these measures? For the purpose of the study, ten factories were selected in the Kolkata Metropolitan Area, which is one of the oldest industrially developed regions of the country. The author concludes that the existing methods for pollution control may not lead to full-proof solutions, and so it is necessary to think of other alternatives. From the point of view of the industries, they should change their technology and move to cleaner production process such as reverting to oil-based boilers from old coal-based boilers. The Indian Chamber of Commerce has taken an initiative in West Bengal to establish a "cleaner production" centre. They guide the manufacturers about the options available in this respect. On the other hand, the role of the community should not be discounted. They can become the major force in pollution control if equipped with proper education and involvement.

Key-Words : Pollution control; White Gas; Household survey; Pollution Control Equipment; Legal compliance; Self-awareness; environmental education.

1. Introduction

India has an elaborate structure for pollution control, at both the central and the state levels. The pollution control boards are functioning from 1974. The environmental laws were also modified over the years, so that the authorities can monitor and control pollution effectively. Of late, public awareness has also increased, as reflected by the increase in the number of Public Interest Litigations (PIL) at the Supreme Court and the State High Courts. Green Benches have been constituted in the apex courts. In this respect, some of the judgments have become really landmarks in the history of environmental protection. Yet, there is hardly any empirical study to show that what has actually happened in the control of pollution, especially from industrial source.

In this context, this study is a modest attempt to get an idea about environmental management. Our objective is two-fold. On the one hand, we wanted to know the attitude of the industries in the context of pollution control. On the other hand, if the industries adopted some sort of pollution control measures, what is the perception of the people about it? Do they feel that they

are really benefited from these measures? In this context, we have selected ten factories in the Kolkata Metropolitan Area, which is one of the oldest industrially developed regions of the country.

The selection of the industries was based on the following criteria:

- a) the high pollution potential of the industry;
- b) the adoption of any sort of pollution control measures by the industries;
- c) the spatial spread of the industries over the KMA;
- d) a proper mix of the industries in terms of product and size and age;

If the industries were the major source of pollution, then any sort of pollution control measure adopted by them would benefit the neighbouring population mostly. Therefore, we planned a survey of the households residing within a radius of two kilometres of each factory. Though our initial idea was to collect data from 100 households around each factory, so that the total sample size would be 1000, we were not very successful. Some of the industries were situated away from the residential areas and it was difficult to find out 100 households within the specified range. In addition, we had problems in conducting the survey around at least two of the selected industries. One area was mostly inhabited by the minority community and they have their reservations about the giving information about their households. For another industry, it is away from the proper residential area. There are only few slums and shops within the specified range. The problem of sparse number of households in the area was aggravated by the high level of anti-social activities in the area. This made household survey an impossible task for our researchers. So, the total number of households included in the survey was around 600

We stated that the following two chapters will describe the results of the primary survey. In this particular article we will discuss some of the information gathered in the survey.

2. Results of the Survey

The Companies

We will start with the activities of the ten selected factories. Table 1 will give an idea about the products of the factories. The variety of the products produces and the processes involved there in, will justify the basis of our selection. The production processes being different, the nature of pollution is also expected to be different. It is also pertinent to mention that these factories belong to different age-groups. Some of the industries like the paint factories of Jenson & Nicholson, Berger, textile factory of Jayshree are more than fifty years old. The others were established in the fifties. Mother Dairy was established in the late seventies, whereas Arora Mathey Limited is absolutely new, both in terms of product and year of establishment.

Table 1
Industries and Their Activities

NAME OF THE INDUSTRY	ACTIVITY
JENSON & NICHOLSON	Manufacturers of liquid paints and varnishes.
ARORA MATTHEY LIMITED	Chemical catalyst, salt and fabricated metal products.
KATIYA STEEL ROLLING MILLS	Galvanisation of bars and rods. Manufacturers of steel items and fabrication also.
UNITED BREWERIES	Manufacturer of beer.
ALSTHOM	Electrical engineering, Industry motor and switch gear and control panels.
ORGANON INDIA LTD.	Production of bulk drugs and intermediates.
BHARAT ENGG. WORKS	Production of cast iron castings.
MOTHER DAIRY	Milk processing, product manufacturing, pasteurization, homogenisation and clarification of milk.
JAYSHREE TEXTILES	Linen product from flax, yarn, dress materials and furnishing fabrics with fire redundant techniques, wool processing.
BERGER PAINTS	Manufacturers of paints.

Source: Field Survey

The annual turnover of the companies is given in Table 2. We already said that we wanted a mix of industries in terms of size. The smallest factory in terms of turnover is Jenson & Nicholson Limited, whereas the largest is the drug factory of Organon. (previously known as Infar India Limited).

Table 2
ANNUAL TURNOVER OF THE INDUSTRIES

NAME OF THE INDUSTRY	TURNOVER (Rs. in crores)
JENSON AND NICHOLSON	1.5
ARORA MATTHEY	26
KATIYA STEEL ROLLING MILLS	15
UNITED BREWERIES	40
ALSTOM	50
ORGANON	2000
BHARAT ENGG WORKS	3
MOTHER DAIRY	200
JAYSHREE TEXTILE	3
BERGER PAINTS	6

Source: Field Survey

Table 3 gives an idea about the major type of discharges in air and water from the ten factories. All the factories have both type of discharges except Organon, which has not reported about any type of air discharge. If we look through the air discharges, two points can be noticed. At least six of the factories disclosed the actual discharges, i.e. they specified the names of the gases or sometimes the source of such emissions. However, the other three did not disclose the actual emissions. Some of them by-passed the questions to the field workers on the plea that they were not students of science and would not understand it. If we infer it as lack of transparency on the part of the companies, we are not perhaps mistaken. About the discharges in water, three companies did not disclose the nature of the effluents. They said that the presence of effluent treatment plant reduces the pollution load, so the discharge can be called least harmful. So they did not feel the need to disclose. Berger paints was silent about the discharge in water. However, the other five companies were frank enough to disclose the actual nature of the discharge, whether treated or untreated. This mini survey shows that the discharges in air comprise of not only harmful gases like SO_2 , NO_x and CO_2 , but also SPM, metal and acid fumes. The last two discharges are the fund pollutants, and if these discharges are let into air without control, they will affect the environment, over a longer period. As for the discharges in the water, the presence of toxic chemicals like acids will be harmful for the aquatic life in the receiving water body. Oils, grease and dyes float over the water making the water unfit for further use.

Table 3
MAJOR TYPE OF DISCHARGES IN AIR AND WATER

INDUSTRY	DISCHARGES	
	AIR	WATER
JENSON & NICHOLSON	process emissions through wet scrubbers, SPM, SO_2 , NO_2 , CO_2	treated effluent water
ARORA MATTHEY	stack fumes, neutralized gases from the scrubber, NO_2 , SO_2	treated effluent water
KATIYA STEEL ROLLING MILLS	zinc and acid fumes	acidified water
UNITED BREWERIES	boiler stack	ETP discharge
ALSTHOM	fumes from high speed diesel	silver, tin, copper, zinc and Cyanide
ORGANON	NIL	organic solvents like acetone
BHARAT ENGG WORKS	air discharges	detergent, lactic acid, alkali, hot water, milk solid, Organisms, suspended, solids, oil and grease BOD
MOTHER DAIRY	diesel and furnace oils	flax chemical unit discharge generated from wool scouring and dye hose
JAYSHREE TEXTILE	boiler stack	
BERGER PAINTS	emission of gases due to furnace and boiler (thermic fluid heater, smoke due to generator and solvent vapour.	

Source: Field Survey

In Table 4, we showed the quantity of discharge in the air by the factories. We tried to collect the number of chimneys and scrubbers in the factory, the volume of emission in the air and again the nature. A small factory like Arora Mathey situated in a dense residential locality has as many as 13 chimneys and the volume is also noticeable. The volume of emission seems to be highest by Jayshree Textile. But, considering the height of the chimneys (about 30 metre) and the location of the factory being on the other side of the railway line, the immediate problem is less than the previous one. Again, about the nature of the discharges, the responses were not very clear. 'White gas' can be most harmful if it comprises of smoke from toxic metals. This is very much possible in case of steel rolling mill and for a company manufacturing electrical equipments.

Table 4

INDUSTRY	NO. OF CHIMNEYS /SCRUBBERS	VOLUME OF EMISSION (mm ³ per hour)	NATURE
JENSON & NICHOLSON	4	2850	as before
ARORA MATTHEY	13		gaseous
KATIYA STEEL ROLLING MILLS		4554.99	white gas
UNITED BREWERIES	3		white gas
ALSTOM	3	4139	white gas
ORGANON			
BHARAT ENGG WORKS	4	100	SO _x , SPM, CO _x
MOTHER DAIRY	1	5091.38	CO ₂ , CO, SO ₂ , NO ₂
JAYSHREE .	1	50,000	boiler stag
BERGER PAINTS	3	9572.83	as before

Source: Field Survey

In Table 5, we have the information on the discharge of water and the location of outlets. Organon did not mention the number of outlets, three of the factories have two outlets, whereas six other have single outlets for discharge of waste water. Six of the factories drain their water in the municipal drains, in Kolkata, Howrah, Panihati, Kalyani, Rishra. Two factories namely Mother Dairy and Bharat Engineering drain their water in the nearby agricultural lands. The organic nature of the liquid waste from the dairy may be beneficial for agriculture. The result can be just the opposite for the discharges from an iron foundry. The paint factory in Naihati discharges their waste in the river Hooghly itself. The result may be disastrous for not only the aquatic life but for the human habitations around it. Similarly, Organon discharges the wastes from the synthetic drug factory in the open municipal drain. We reserve our comment about the long run effect of such a practice. The water may trickle through the soil and cause long run

problem for the surrounding population. The same result would wait for the practice of Jayshree Textile, if the selection of site for the pit is not good enough.

Coming to Table 6, we listed the reasons for installation of pollution control equipments. Nine of the ten companies did it for legal reasons, though three of them added to it self-awareness and social responsibility. Only the steel rolling mill at Panihati reported pressure from the neighbouring population. All these factories are aware that they belong to the GPI, red category industry. But they did not go for any sort of pollution control mechanism if not forced by the law or community pressure. Mother Dairy started with an effluent treatment plant, but it had to be upgraded for complying with the stricter regulation.

Table 5
DISCHARGE IN WATER

INDUSTRY	NUMBER OF OUTLETS	LOCATION
JENSON & NICHOLSON	1	through a canal to Ganga
ARORA MATTHEY	1	KMC drainage system
KATTYA STEEL ROLLING MILLS	1	municipal drain
UNITED BREWERIES	2	municipal drain
ALSTOM	2	municipal drain
ORGANON		open drain
BHARAT ENGG.		agricultural land
MOTHER DAIRY	1	dankuni canal to agricultural lands
JAYSHREE TEXTILE	1	municipal surface drain and by digging pits inside the industry premises
BERGER PAINTS	2	howrah municipal drain

Source: Field Survey

The story is same for Berger Paints. We can have a more clear idea about this point if we look into Table.7. Most of the instruments were installed in the late nineties, even early part of 2000. Some companies had older systems of pollution control which either has been upgraded for legal compliance, or in the process of upgradation.

Table 6
REASON BEHIND INSTALLATION OF POLLUTION CONTROL EQUIPMENT

INDUSTRY	SELF AWARENESS	LOCAL DEMAND	LEGAL ORDER
JENSON & NICHOLSON			*
ARORA MATTHEY			*
KATTYA STEEL ROLLING MILLS		*	
UNITED BREWERIES	*		
ALSTOM			*
ORGANON	*		*
BHARAT ENGG WORKS			*
MOTHER DAIRY	*		*
JAYSHREE TEXTILE			*
BERGER PAINTS			*

Source: Field Survey

Table 7
TYPE OF INSTRUMENT AND DATE OF INSTALLATION

INDUSTRY	TYPE	DATE
JENSON & NICHOLSON	ETP	1995, upgraded in 2000
ARORA MATTHEY	ETP, Scrubber,	1996
	fire-fighting system,	2001
	noise monitoring system	2002
KATIYA STEEL ROLLING MILLS	wet scrubber cyclone	1998
	separator	
UNITED BREWERIES	ETP	1996
ALSTHOM	Spectrophotometer	N.A.
	and Biological treatment plant for water	
ORGANON	ETP	1969, upgraded in 1998
BHARAT ENGG WORKS	3 stage wet cap arrestor	1996, 1997
	and high efficiency variable throat ventury	
MOTHER DAIRY	ETP	1978, and upgraded in
		1986-87
JAYSHREE TEX.	ETP	1980
BERGER PAINTS	ETP, dust extraction system, dust collector	1980, upgraded in 1992

Source: Field Survey

From the next two tables, we would have an idea about the cost of the pollution control equipments. Table 8 gives the data on fixed cost of installation, whereas, Table 9 describes the running (variable) cost along with the hours of operation. It would be difficult to calculate any relationship of this cost with the annual turnover. It is not that the company with highest turnover would spend a high proportion on pollution control. Rationally, it would depend on the nature of pollution and its absolute volume. However, we were not able to find out either of these, from the financial data disclosed by the companies. The equipments are run by the existing staff, may be they were given some short-term training. So the assertion by a group of economists that pollution control would create employment also fails here. As most of the equipments are new, the figures on repairs and maintenance are not very authentic.

Table 8
APPROXIMATE COST OF INSTALLATION

INDUSTRY	TOTAL COST (in Rs. Lakhs)	
	TOTAL COST OF INSTALLATION	OTHER COST
	(in Rs. Lakhs)	LABOUR COST (in Rs lakhs)
JENSON & NICHOLSON (for water)	46	6
(for air)	3.75	0.15
ARORA MATTHEY	12-15	2
KATIYA STEEL ROLLING MILLS	5 (all inclusive)	
UNITED BREWERIES	125	
ALSTHOM	6	
ORGANON	250	
BHARAT ENGG WORKS (for air)	6	
(for water)	40	
MOTHER DAIRY	30	
JAYSHREE TEXTILE	100	
BERGER PAINTS	60	

Source: Field Survey

Lastly, we come to Table 10, which describes the satisfaction on the part of the companies. It also describes the perception of the companies about the reaction of the surrounding communities about the reduction in pollution in the factories. All the factories admitted that they themselves benefited from installation of pollution control equipment. The working atmosphere within the factory improved. They were also happy to do something about the environment. But they were not very sure about the attitude of the people living around the factories. Only, Arora Mathey admitted that they no more received complaints from the neighbours.

Table 10
PSYCHOLOGICAL EFFECTS

INDUSTRY	IN-HOUSE BENEFIT	REACTION OF PEOPLE IF ANY
J & N	working environment became better	public image improved
AM	relieved from the presence of neighbours	no more complains
KATIYA	good working condition with ecological balance	no idea
UB	nothing	the industry is not in a residential area
ALTH	cost reduction	
ORG	better working condition	they are supposed to be glad
BHARAT	workers are better off	situated in industrial belt
MD	sanitised environment	satisfied
JAYSHREE	environmental hazard prevention	no idea
BERGER	reduction of hazards to the employees	people are very conscious

Source: Field Survey

TABLE 9
APPROXIMATE COST OF OPERATING POLLUTION CONTROL EQUIPMENTS

Industry	Number of Hours Operated per Day	Who Operates		Total Cost of Operation (in Rs. Lakhs)	Other Running Cost (in Rs. thousand)				Repair and Maintenance (in Rs. thousand)
		Existing	New		Fuel	Chemical	Labour	Power	
		Staff	Engagement						
JENSON & NICHOLSON	24	trained		not avail.	1000		not appl.		not specified
ARORA MATTHEY	4	existing staff	contracted	not avail.		40	not appl.	not avail.	300
KATIYA STEEL ROLLING MILLS	8	existing staff			10		not appl.	8	2
UNITED BREWERIES	24	existing staff		1.1	not avail.	40	not appl.	50	2
ALSTOM		existing staff		4200	not avail.		not appl.	not avail.	not specified
ORGANON	24	existing staff		30	not avail.		not appl.	not avail.	not specified
BHARAT ENGG. WORKS	2	existing staff		0.1	not avail.		not appl.		not specified
	2	existing staff		2	not avail.		not appl.	not avail.	not specified
MOTHER DAIRY	24	existing staff		not avail.	not avail.		not appl.	not avail.	300
JAYSHREE TEXT.	24	existing staff		not avail.	not avail.	550	not appl.	not avail.	60
BERGER PAINTS	not available	existing staff		75	not avail.		not appl.	not avail.	1500

Source : Field Survey

The Households and Industrial Pollution

In this section, we will concentrate on the households' perception about industrial pollution, their decision about residential location, the impact of pollution on their daily lives in terms of deterioration of health and whether the unbearable situation has led to any type of protests. As the common people are not familiar with the technicalities of industrial pollution, the questions were free of any technical jargon, related to the daily lives of the residents.

Table11**Information about the Existence of the Factory Before Moving in the Locality**

Reply	Yes	No	Not Available
J&N	100.00	0.00	0.00
AM	68.57	31.43	0.00
Katiya	100.00	0.00	0.00
UB	46.88	53.13	0.00
Alth.	68.57	31.43	0.00
Org.	46.88	53.13	0.00
Bharat	6.56	6.56	86.89
MD	5.00	95.00	0.00
Jayshree	56.94	43.06	0.00
Berger	63.01	0.00	36.00
Allhh.	55.25	19.71	25.05

Source: Field Survey.

The first question asked was about the residential location decision of the households. This was about whether they had any information about the existence of the factory before they moved in the locality. This question was specifically asked to the people who have come to stay within the last ten years. The cut-off period of ten years was taken deliberately as we think the consciousness about environmental pollution has increased since the early nineties. We have also seen that the Environmental Protection Act passed in the late eighties permitted the common people to go for PILs in the law court to protest against pollution. As we have noted most of the households live in their own houses, we expected that replies to this question would tell us whether industrial pollution affects the residential decision of the households.

Here we can see that about a quarter of the total households did not reply the question. The replies of the other respondents are also quite interesting. More than half of the respondents knew about the factory, even then they have come to reside in the area. The other 20% did not any idea about the presence of the factory. This leads us to two conclusions, which are not very conducive to a healthy pattern of development. Firstly, in a situation of extremely mixed land use, the existence of a factory in the locality or the threat of potential pollution does not matter much to the resident. Secondly, with the absence of a well-developed real estate market, sometimes people have to take such decisions in the dark. For specific cases, like for the residents

around J&N, it reflects the character of the industrial labour. May be, they took deliberate decisions, as staying near the factory gate may increase the chances of getting daily or casual employment for the family members.

This takes us to the next question that what is their present idea about the factory in the locality or its product. The replies are tabulated in Table 12. The broad results indicate that 95% of the population knows about the existence of the factory in the locality, whereas about 25% of them do not have any idea about the product of the neighbouring factory. The most interesting reply was from the residents around AM. Considering the fact that the factory is situated in a densely populated residential area, though 88% of them know about the existence of the factory, nobody knows anything about its product. Unknowingly, they have to bear the burden of air, water and noise pollution. Similar conclusions can be drawn about the residents around Alth. As the people in both these localities are highly educated, this ignorance is surprising.

Table 12
Present Idea about the Factory

Idea about	Factory		Product	
	Yes	No	Yes	No
J&N	100.00	0.00	100.00	0.00
AM	87.84	12.16	0.00	100.00
Katiya	100.00	0.00	74.14	25.86
UB	100.00	0.00	100.00	0.00
Alth	68.57	31.43	48.57	51.43
Org.	98.44	1.56	93.75	6.25
Bharat	100.00	0.00	85.25	14.75
MD	100.00	0.00	100.00	0.00
Jayshree	98.00	2.00	84.00	16.00
Berger	100.00	0.00	94.52	5.48
Allhh.	95.95	4.05	75.69	24.31

Source: Field Survey

In the next table, we have tabulated the replies about a specific question on industrial pollution. We wanted to know whether they think the factory in the locality creates pollution.

Table 13
Idea about Pollution from the Factory

Idea	Yes	No	No comment
J&N	0.00	100.00	0.00
AM	60.81	39.19	0.00
Katiya	0.00	0.00	100.00
UB	4.17	95.83	0.00
Alth	57.14	42.86	0.00
Org.	46.88	53.13	0.00
Bharat	37.70	62.30	0.00
MD	37.50	62.50	0.00
Jayshree	28.00	72.00	0.00
Berger	0.00	100.00	0.00
Allhh.	27.62	61.69	10.68

Source: Field Survey

Here an interesting result is revealed. About 10% of the respondents reserved their comments. Our fieldworkers found that that the local people are sometimes indirectly related to the factories. May be some members of the family had worked there, or he is doing some informal business with the factory. So they did not want to say anything about the factory. Some of the negative answers like that in case of J&N is also the result of the same consideration. However, in case of Berger, our fieldworkers also found no trace of pollution in the days they spent in surveying the locality. The same is true for UB. For the other factories, the opinions received are quite divided. In case of AM and Alth., a majority of the people reports that factories pollute the local atmosphere. This may be due to the composition of respondents. We have already showed that in both the localities, the people belong to the high income group and they are more educated. Of course, the lower income households around Org. and MD also reported about pollution.

The next two questions were more specific about the two types of pollution under our study. The first is about the disposal of liquid waste from the factories. Are the neighbours aware about nature of the liquid waste and how it is disposed? We found that if the respondent knew about the location of its disposal, he also has a rough idea about its nature like colour and smell. So in Table 13, we are just reporting about their knowledge about liquid waste.

The table clearly shows the local peoples' ignorance about the disposal of liquid waste by the factory. We have to look at this table with Table 5, which lists the number of outlets and where they drain. Most of the factories dispose their waste in municipal drains. Knowing the fact, the predominant system in these areas is open municipal drain; this simply indicates the lack awareness of the people. There are two factories which send their liquid wastes to the agricultural fields. Of these, the people around MD are totally ignorant about it. But as we know the high organic component of the dairy waste, this ignorance may be a blessing in disguise. The fertility

of the fields may be enhances. However, just the opposite may happen in case of residents around Bharat. They know that their fields receive waste from the engineering factory, But in most of the cases, they may not have idea about the composition of waste from a steel mill. (We have discussed them in detail in Chapter 4). So, not only these residents are exposed to some harmful effluents, but the agricultural products fro these fields would harm a larger section of the population in the long run.

Table 13
Disposal of Liquid Waste

Idea about Disposal	Yes	No
J&N	100.00	0.00
AM	17.14	82.86
Katiya	48.28	51.72
UB	56.06	31.94
Alth	17.14	82.86
Org.	96.88	3.12
Bharat	72.13	27.87
MD	0.00	100.00
Jayshree	98.00	2.00
Berger	56.16	43.84
Allhh.	67.96	32.04

Source: Field Survey

The next question was about the emissions in the air. The question had two parts. At first, we wanted to know about their knowledge about the existence of the chimneys in the factories. Those who answered positively, they were asked about the nature of smoke and its duration. The replies from residents around Org. were expected, as the process of drug manufacturing did not emit anything in the air (vide Table 4).

The table shows that the knowledge of the people about the emissions in the air by the local factories is somehow varied. Overall, half of the respondents are aware about the existence and number of chimneys. The others probably did not bother to look into these trivialities. Now, the people who know about the chimneys also know about the nature of the smoke (its colour etc.). However, except for all the respondents around UB and 20% of the aware people around AM, nobody have an idea about the duration of the emission during the day.

Table 14
Idea about Emission in Air

Idea about emiss.	Existence of chimney	Nature of emission	
		Smoke	Duration
J&N	56.25	100.00	0.00
AM	64.86	100.00	20.83
Katiya	46.55	96.30	0.00
UB	54.17	100.00	100.00
Alth.	0.00	0.00	0.00
Org.	NA	NA	NA
Bharat	77.05	4.26	0.00
MD	12.50	0.00	0.00
Jayshree	82.00	100.00	0.00
Berger	65.75	100.00	0.00
Allhh.	48.52	82.58	18.56

Source: Field Survey

The next question was about an important component of life, i.e. water. We specifically asked about the source of drinking water for the households and the existence any additional facility of in-house filtration.

Table 15
Source of Drinking Water

Source	DeepTW	Well	Muntap	Other
J&N	0.00	0.00	100.00	0.00
AM	0.00	0.00	100.00	0.00
Katiya	0.00	0.00	100.00	0.00
UB	100.00	0.00	0.00	0.00
Alth.	34.28	0.00	65.72	0.00
Org.	38.00	60.94	1.56	0.00
Bharat	0.00	0.00	0.00	100.00
MD	2.50	87.50	10.00	0.00
Jayshree	0.00	0.00	100.00	0.00
Berger	0.00	0.00	100.00	0.00
Allhh	20.00	13.63	55.06	11.23

Source: Field Survey.

The table shows that at least half of the surveyed people depend on the municipal water supply. About one-fifth depends on deep tubewells and 13% on wells. The people of Kalyani depend entirely on deep tubewells, whereas the population around Bharat draw their water from local ponds. (Sometimes an NGO named Jayshree Seba Samiti supplies drinking water in the area). This finding, in particular, may have grave consequences considering the fact that Bharat drains its waste water in agricultural fields. We did not report anything about in-house filtration facility in the table. This is because of the minuscule percentage of population possessing it. Only 11% of the respondents have any such facility, and those are concentrated around Alth. (about 80% of the respondents) and AM (40%).

The next three tables report our findings about the health situation in the areas surrounding the factories. This is an important component of the survey, as the direct impact of pollution is the health of the population exposed to that. We will discuss the results together.

Table 16
Common Diseases Suffered by the Respondents

(The figures are absolute numbers)

Diseases	Cold&Cough	Resp.	Gastro.	Skin	TB	Cancer	Ment.dis
J&N	0	0	0	0	0	0	0
AM	13	10	0	0	0	0	1
Katiya	1	0	0	0	0	0	0
UB	0	0	0	0	3	0	0
Alth.	23	16	13	0	0	0	0
Org.	11	18	0	0	0	0	1
Bharat	5	4	2	1	1	1	0
MD	0	3	0	0	0	0	0
Jayshree	13	4	2	0	0	0	0
Berger	7	2	0	0	0	0	0

Source: Field Survey

Table 17
Monthly Medical Expenditure

(in rupees)

Med.exp.	Not.Av.	<100	101-500	>100
J&N	92.5	0.00	7.5	0.00
AM	74.32	2.70	18.92	4.05
Katiya	98.28	0.00	1.72	0.00
UB	97.22	0.00	0.00	2.78
Alth.	14.29	17.14	2.86	65.71
Org.	90.63	6.25	0.00	3.12
Bharat	91.80	8.20	0.00	0.00
MD	92.5	0.00	7.50	0.00
Jayshree	60.00	6.00	14.00	20.00
Berger	87.67	6.85	4.11	1.37
Allhh	82.50	4.60	5.34	7.55

Source: Field Survey

Table 18
Perception about the Cause of Disease

Polluting factory as source	Yes
J&N	0.00
AM	5.41
Katiya	12.07
UB	0.00
Alth.	71.43
Org.	50.00
Bharat	4.92
MD	0.00
Jayshree	18.00
Berger	0.00
Allhh.	14.73

Source: Field Survey

These three tables give some interesting insights of the public attitude towards health. People do not want to disclose about their diseases. This is revealed by Table 16. We kept the absolute numbers to show that except for common coughs and cold and some cases of gastroenteritis, no other disease is not reported. Our field workers could recognise cancer patients, but the family members refused to admit. This is also corroborated by the data in Table 17. More than 80% of the respondents did not want to disclose anything about their monthly medical bill. However, the next table i.e. Table 18 shows that 15% people make the neighbouring factories responsible for the sufferings. This perception is as high as 72% for the people residing near Alth. and for half of the respondents around Org. So people suffer from diseases, but for social inhibitions, refuse to admit publicly.

The next three questions were about their reaction against the pollution in the neighbourhood. If they think the pollution has become intolerable, what is their reaction? Do they think of moving away? Do they complain to the relevant authority? Or, rather than acting alone, they become part of any public protest? The responses are tabulated in the following three tables.

Table 19
Decision about Moving away from the Locality

Decision to move	Yes
J&N	0.00
AM	2.70
Katiya	0.00
UB	0.00
Alth.	0.00
Org.	2.7
Bharat	1.64
MD	0.00
Berger	0.00
Allhh.	1.3

(in percentage terms)

Source: Field Survey

So, it is seen that only 1.3% of the total population would move away in case of unbearable limits of pollution. This result was expected as we have already seen that most of the people live in their own houses. In our country, owning a house of his own is a life-time achievement. Secondly, given the uneven distribution of amenities like education and health facilities, people here dare to take decisions about changing residences, unless compelled by a stronger reason. We also noticed earlier that existence of a factory in the neighbourhood was not an important variable in residential location decision.

Table 20
Complaint against the Factory and its Result

	Complaint	Successful Result
J&N	0.00	not applicable
AM	32.43	45.83
Katiya	10.43	0.00
UB	0.00	not applicable
Alth.	0.00	not applicable
Org.	78.12	0.00
Bharat	0.00	not applicable
MD	0.00	not applicable
Berger	0.00	not applicable
Allhh.	14.73	13.75

Source: Field Survey

This table shows that some of the respondents living around the three factories of AM, Katiya and Org. did complain to the relevant authorities for the high level of pollution caused by the factories. Of which around 45% of the complainants received some success in abating pollution. This fact is substantiated by the response of AM as given in Table 5.10. The factory does not hear any complain from the neighbours. The next table looks into the matter from the point of view of organisation of public protest. Such incidence is very small. One of the factories again is Org., where about 73% of the respondents have joined. In case of the other factory, i.e. Jayshree, only 6% of the respondents joined in it.

Table 21
Participation in Public Protest

	Participation (%)
J&N	0.00
AM	0.00
Katiya	0.00
UB	0.00
Alth.	0.00
Org.	73.44
Bharat	0.00
MD	0.00
Jayshree	6.00
Berger	0.00

Source: Field Survey

The last two tables are about the perception of the people in general about the changing level of pollution and the psychological impact of pollution on them.

Table 22
Perception About the Changing Level of Pollution (in %)

Level of Pollution	Increase	Decrease	Same	No Idea
J&N	6.25	37.50	50.00	6.25
AM	18.92	17.57	55.41	8.11
Katiya	22.41	15.52	18.97	43.10
UB	15.28	22.22	8.33	54.17
Alth.	85.71	0.00	8.57	5.71
Org.	81.25	10.94	0.00	7.81
Bharat	4.92	67.21	1.64	26.23
MD	0.00	20.00	80.00	0.00
Jayshree	18.00	12.00	38.00	32.00
Berger	0.00	17.81	0.00	82.19
Allhh.	24.49	21.92	22.88	31.31

Source: Field Survey

So, we can see that about 31% of the responding people do not have any idea about any change in the level of population. About a quarter of them, think that it is increasing and almost 20% think that it is decreasing. One can relate the differences in the perception with the spatial distribution of the industries. Those, who think pollution is decreasing or remaining constant, are residents of outskirts, except in case of Org.

Lastly, we wanted to know how pollution affects their daily lives. The results are in Table 23.

Table 23
Effect of Pollution on Daily Lives

Effect	Positive	Negative	No Idea
J&N	0.00	0.00	100.00
AM	70.27	20.27	9.46
Katiya	12.07	3.45	84.48
UB	0.00	100.00	0.00
Alth	25.71	22.86	51.43
Org.	80.80	13.33	6.67
Bharat	0.00	3.28	96.72
MD	0.00	0.00	100.00
Jayshree	78.00	22.00	0.00
Berger	0.00	98.63	1.37
Allhh	28.55	38.67	32.78

Source: Field Survey.

The opinions of the people are evenly distributed in this respect. The responses in this Table are quite similar to the previous one. One-third of the population admit that pollution affects their lives, this is more for people around those factories where the intolerable limit of pollution led to complaint and protest against the factories, i.e. AM and Org. and Jayshree. People living in comparatively less congested areas do not bother about pollution, as revealed by the respondents around Bharat and MD.

3. Conclusion

After going through the results of the household survey, we have reached some interesting conclusions. As we have showed in section 6.2, our sample population can be taken as a representative population in terms of socio-economic classifications, the opinion of these households reflect the psychology of the society as a whole.

Everyone is affected by the deterioration of the environment around, but the reaction to this particular issue is quite perplexing. The existence of a factory in the neighbourhood does not become an important variable in deciding the residential location. Even the existence of a factory and its activities do not bother its neighbours, sometimes they do not even know about the main product of the family. The main sources of industrial pollution are the disposal of the waste water and emission from the chimneys. Here, we have seen that people, who were aware about the location of the outlet of waste water, they also know about the nature of the disposed water. It is easier for common people to recognise bad smell and abnormal colour of water. Surprisingly, in case of emission from the chimneys, sometimes people are not able to recount the number of chimneys. A proportion of people aware about the chimneys, also know about the nature of smoke, but they are not at all aware about the duration of such emission.

The questions about health did not get very good response. They do not admit about having diseases other than common cold and cough, some respiratory and gastro enteric diseases. They are numb about their monthly medical expenditure also. However, when asked about the exposure to pollution from the local factory as the source of such diseases, some of them replied in positive.

Most of the households have their drinking water from the municipal source or deep tubewells. In the outskirts, there are instances of using well as the source. The lack of information and awareness is prominent in the particular case where the water from other uses is drawn from the local pond and local foundry disposes its waste in the nearby field.

Coming to the reaction of the people, a very small percentage of respondents think of moving away. They sometimes complain to the relevant authority, but the results are not very encouraging. The same happens in case of public protest. So the general public do not have much to do. Even if they think that the level of pollution is increasing, they have to accept it as a part of urban life and they carry on their daily lives with the burden of pollution.

Thus, we find that the existing methods for pollution control may not lead to full-proof solutions. One has to think of other alternatives. From the point of view of the industries, they should change their technology and move to cleaner production process (e.g. reverting to oil-based boilers from old coal-based boilers). An initiative has started in West Bengal by the Indian Chamber of Commerce by the opening of a cleaner production centre. They guide the

manufacturers about the options available in this respect. On the other hand, we are not degrading the role of the community. They can become the major force in pollution control with proper education and involvement. Here comes the role of environmental education so that the power of the people cannot be misused by the groups with stake elsewhere. The non-governmental organisations (NGOs) can take a leading role here. Lastly, there should be greater interaction between the manufacturers and neighbouring population. This needs transparency on the part of the industrialists and of course, a change in attitude. They should take the issue of pollution control as a service to the society and not just as legal compliance. For the establishment of new industries, the pollution control boards have introduced a system of public hearing. For existing industries, a periodic discussion between the factory owners and the neighbouring community may be declared mandatory. There may be frank discussions between the two parties about the disadvantages and future course of action.

Economists sometimes depend on the marginal values for decision making. So if we take the pollution caused by each factory as a marginal case, then if the problems can be solved by the joint initiative and cooperation between the manufacturer and the community, nothing can be better than that. With this word of hope, we would end this discourse.

Appendix I

The final list of industries is as follows:

1. Berger Paints (Berger)
14/15 Swarnamoyee Road, Sibpore, Howrah
2. Mother Dairy (MD)
Dankuni Coal Complex, Dankuni, Hooghly
3. Organon India Limited (Org.)
Ganganagar, 24 Parganas (North)
4. Jenson & Nicholson India Limited (J&N)
68 Patterson Road, Naihati, 24 Parganas (North)
5. Jayshree Textile Limited (Indian Rayon and Industries Limited) (Jayshree) Rishra,
Hooghly.
6. Althsom India Limited (Alth.)
P 1, Taratalla Road, 700 088
7. Aurora Mathey Limited (AM)
102 NSC Bose Road, Kolkata 700 040
8. United Breweries (UB)
Sector 18, Block D, Kalyani, Nadia
9. Katiya Steel Rolling Works (Katiya)
32 B T Road, Khardah, 24 Parganas (North)
10. Bharat Engineering Works (Bharat)
P.O Chamrail, P.S. Bally,
National Highway 6, Howrah.

The abbreviated names of the companies as used in the tables are given in parentheses.

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