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Gordon McGranahan
Stockholm Environment Institute

* **Contact address:** University of Ghana, Department of Geography and Resource Development, P.O. Box 59, Legon, Ghana

Stockholm Environment Institute
Box 2142
S-103 14 Stockholm
Sweden
Tel +46 8 723 0260
Fax +46 8 723 0348

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LIST OF ABBREVIATIONS

ARI	Acute Respiratory Infection
CDR	Committee for the Defence of the Revolution
EPC	Environmental Protection Council
GAMA	Greater Accra Metropolitan Area
GWSC	Ghana Water and Sewerage Corporation
KVIP	Kumasi Ventilated Improved Pit Latrine
LPG	bottled gas
PEF	Peak Expiratory Flow
UN	United Nations
WHO	World Health Organisation

Note: At the time of the survey (end 1991) there were approximately 400 cedis to one US$.

TABLE OF CONTENTS

FOREWORD

For many low income urban dwellers, there is no need to predict life-threatening environmental degradation: it is already a fact of life. Indeed, many of the worst features of urban poverty in the Third World are environmental: poor access to safe water, unsanitary conditions, smoky kitchens, contaminated food, uncollected solid waste, insect infestation. Like most environmental problems, these are closely interrelated. The need for a multisectoral strategy to address these problems is generally recognised. Most research, however, continues to proceed along disciplinary lines. An environmental perspective, with its inherently transdisciplinary nature, is the appropriate approach. Moreover, it is important that the local environmental problems which currently plague the poor be addressed with due regard for the broader environmental context. As the experience of many middle-income megacities indicates, economic expansion and rapid urbanization can create a host of new environmental problems, without necessarily resolving those typically associated with poverty.

In 1991, SEI, working in collaboration with local research institutions, initiated a scoping study of household environmental problems in Accra, Jakarta and Sao Paulo. Drawing upon both local and international expertise, a comparable approach was developed and applied in each of these cities. Surveys of 1,000 households were undertaken in each city, along with physical testing in subsamples of about 200. The study is both trans-disciplinary and action-oriented. The empirical results range from indicators of faecal contamination in drinking water, to people's perceptions of what should be done by whom to improve the situation. The analysis examines the physical severity of the problems, and also the institutional context from which practical solutions must emerge.

This report summarizes the results of the Accra case study. It is hoped that the report will be of interest not only within Accra, but also to other researchers and policy-makers concerned with urban environmental issues. Sao Paulo and Jakarta are both megacities, renowned as the sites of severe environmental distress. Accra does not yet face the megacity problems. Yet the local environmental problems described in this report on Accra are probably a far greater burden for local inhabitants than, for example, the widely publicised ambient air pollution in Sao Paulo. Moreover, Accra is probably typical of hundreds of other medium-sized cities in this regard. This report aims to demonstrate not only that something needs to be done, but that, with better information, something can be done.

Preliminary results were presented at the SEI/IIED/SIDA workshop on *Urban Environments and Human Welfare in Southern Cities: Lessons from five case studies* (SEI, Stockholm, February, 1993). The case studies included not only Accra, Jakarta and Sao Paulo, but also IIED co-ordinated studies of Nairobi and Lagos. Papers on health and environmental aspects in all five cities are appearing in the journal *Environment and Urbanization* (for Accra and Jakarta, see Vol. 5, No.2). Further publications are anticipated. Details on the publications arising from the studies of Accra, Jakarta and Sao Paulo will be available from SEI. For further details on the studies of Nairobi and Lagos, please contact David Satterthwaite or Diana Mitlin, Human Settlements, IIED, 3 Endsleigh Street, London WC1H 0DD, U.K.

Gordon McGranahan
Urban Environment, Stockholm Environment Institute

ACKNOWLEDGEMENTS

Research work is a collective enterprise, the success of which depends on the co-operation of many actors. While the responsibility for the contents of this report is the authors', much of the credit must go to those who may not have written the text, but without whom this study would not have been successful.

Thanks are due to the students of the University of Ghana who served as research assistants and supervisors for the main survey. Among this group, Patience Djietror, Benjamin K. B. Amoyaw, Godwin A. Djietror, Ernest Y. Asante and S.A. Tetteh need special mention for the continued support they showed for the study beyond the field research stage. The physical tests of water and air quality were carried out by two separate teams based at the Water Resources Research Institute of the CSIR. Special mention is made of E.K. Bosque-Hamilton and W. Doudu for the water sampling; and E. Nana-Amankwah and Ms. P.D. Atsakpo for the air monitoring.

We are also grateful to the computer programmer Mr. K.K. Etsibah who did the data processing at the University of Ghana-Legon, and Mr. S.A. Otchere who handled all the secretarial work, especially the typing of the draft report

Christer Persson created the data base at SEI, upon which the statistical analysis of health and environment is based. Solveig Nilsson provided critical support during the revision process. Anna Bratt conducted the statistical analysis of the physical test results, and helped in numerous ways to get the final document into shape. All deserve thanks.

Carolyn Stephens, of the London School of Hygiene and Tropical Medicine, reviewed the draft report, providing many perceptive comments and suggestions.

Among the policy makers, we are especially grateful for the support of the Mayor of the Accra Metropolitan Authority, and the Heads of Department of the Waste Management, Environmental Health, and Town and Country Planning Departments. The same also goes for the Area Manager, Ghana Water and Sewerage Corporation ATMA and the Heads of the various Departments within the organisation.

All of the participants at the workshop held in preparation for the three-city study (SEI, Stockholm, June 17-21, 1991) contributed substantially to developing the approach taken. Special thanks go to: Anders Ellegård, who not only provided guidelines for the air quality monitoring, but helped supervise the field-testing; Josef Leitmann, whose help, especially at the critical early stages of the study, was invaluable; and Yvonne Andersson of the Swedish State Bacteriological Laboratory, whose continuing interest and support has been greatly appreciated.

The discussions held at the SEI/IIED/SIDA workshop on *Urban Environments and Human Welfare in Southern Cities: Lessons from five case studies* (SEI, Stockholm, February, 1993) were also extremely helpful. David Satterthwaite and Göran Tannerfeldt deserve thanks for helping create this opportunity.

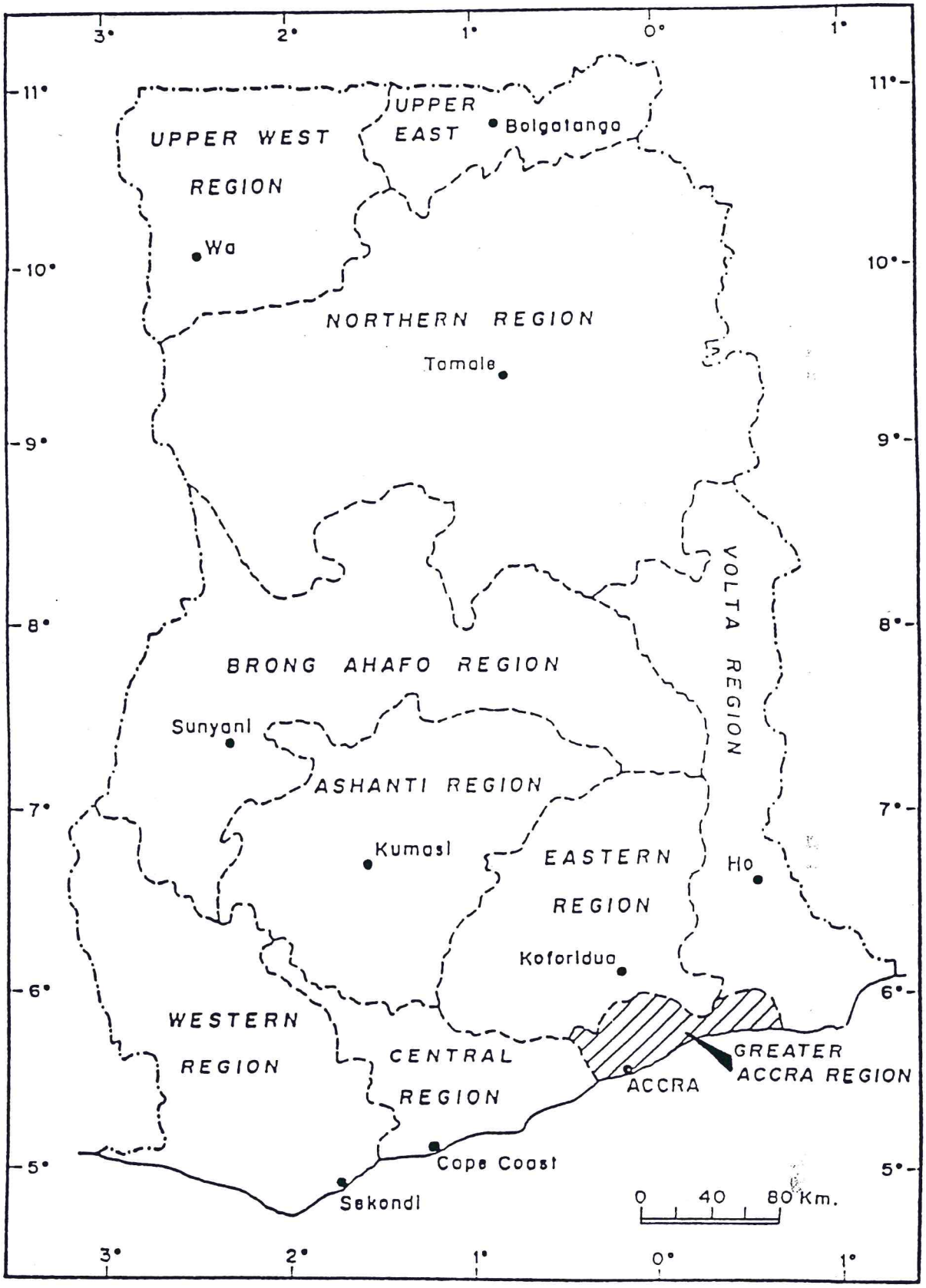
A Seminar on Environmental Problems and the Urban Household in the Greater Accra Metropolitan Area was organised in Accra on the 9th and 10th of December 1993 to present the results. We were honoured to have the Minister for the Environment, Dr. (Mrs.) Christine Amoako-Nuamah provide an introduction, clearly placing the study in context. Professor E. A. Boateng deserves thanks for expertly chairing the sessions, as well as making a number of critical interventions. The seminar was attended by numerous representatives of governmental and non-

governmental organisations involved in environmental improvement, whose contributions to the discussions were invaluable.

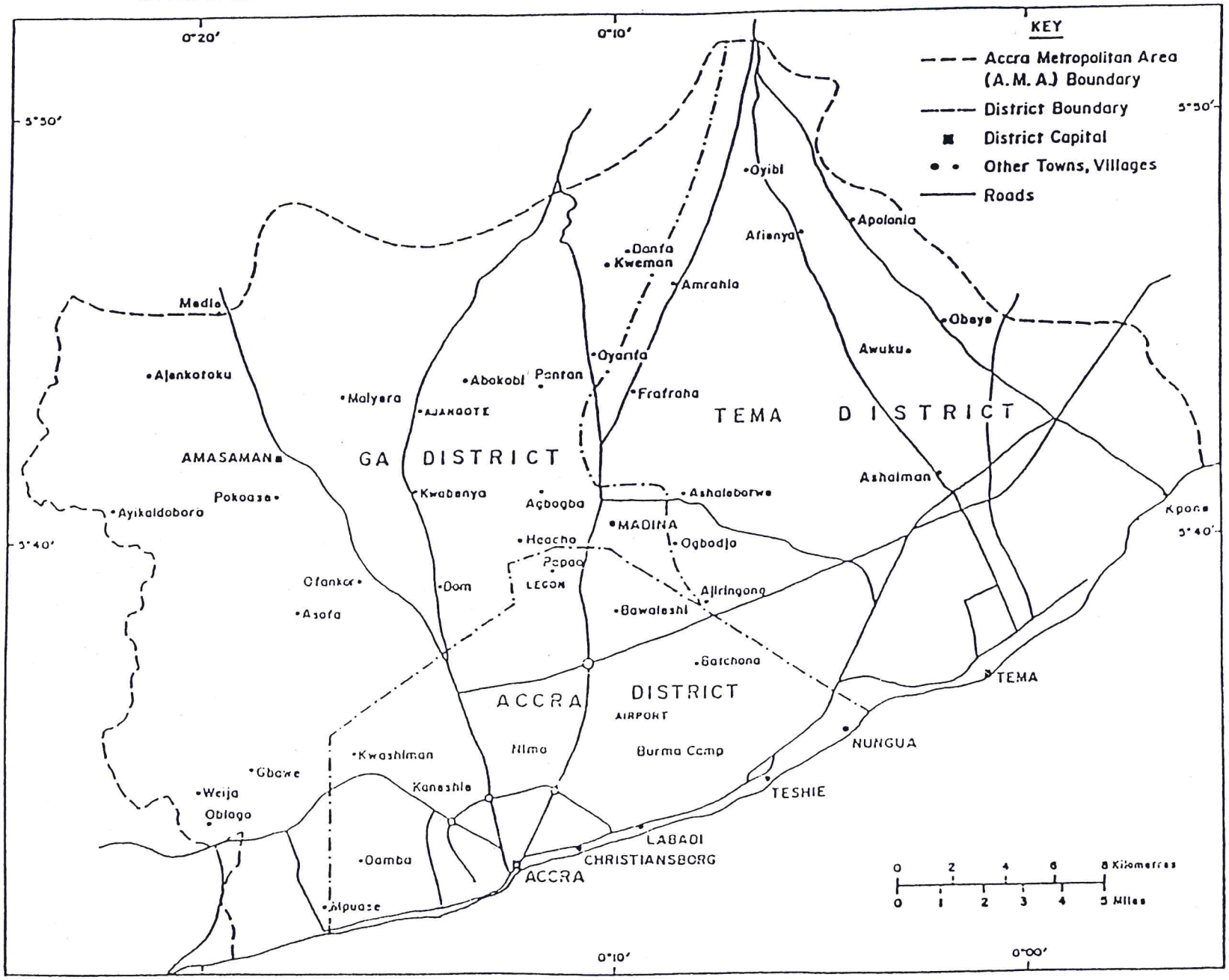
SAREC and SIDA provided financial support at critical junctures.

And of course, a very special thanks goes to the thousand or so respondents who answered a trying questionnaire. We can only hope that the results of the study will contribute to a better environment for them and their neighbours.

GHANA SHOWING GREATER ACCRA REGION



GREATER ACCRA METROPOLITAN AREA SHOWING DISTRICTS



EXECUTIVE SUMMARY

This report summarises the results of a study of household environmental problems in the Greater Accra Metropolitan Area (GAMA), undertaken jointly by the Department of Geography and Resource Development of the University of Ghana and the Stockholm Environment Institute. The study is action oriented, and is intended to enhance the understanding of household environmental problems with a view towards improving them. Past environmental assessments of Accra have emphasised the larger scale problems, which range from marine pollution to ambient air pollution. In time, these large scale problems may indeed become critical, as they continue to undermine the sustainability of the city. Currently, however, it is the problems which GAMA dwellers face in their homes and neighbourhoods which are of primary concern.

A combination of poverty, demographic growth, economic fluctuations, and fiscal austerity is placing a considerable strain on household environments in GAMA. GAMA is both the national capital and the major industrial centre of Ghana. In 1990 it had an estimated population of 1.7 million, and by 2010 its population is projected to reach the 4 million mark. By international standards, the majority of the population lives in poverty. With 10% of the country's population, GAMA accounts for between 15% and 20% of the gross domestic product. These percentages are expected to increase in the coming years. The economic environment is very uncertain, however. Following a severe economic recession in Ghana during the 1970s and early 1980s, an economic recovery programme was introduced in 1983. While there has been a strong turn-around in the economy in recent years, government finances remain severely constrained. This makes it all the more critical that environmental efforts target priority problems and areas, and are well designed.

Given the previous lack of information on household environmental problems, this report concentrates on providing a summary of existing conditions. The problem areas covered include water, sanitation, solid waste, pests and pesticides, food contamination and household air pollution. Special attention is given to issues of environment and health. In addition, the report provides information on the households' own views on what needs to be done and by whom, and summarises the institutional context within which household environmental management takes place. Finally, some of the policy implications are discussed briefly.

The empirical basis for this study includes a questionnaire survey of 1,000 representative households, physical tests of water and air quality among sub-sets of about 200, focus group discussion in selected low-income neighbourhoods, and unstructured interviews with policy makers and implementors.

Household Water Supplies - Conditions:

The vast majority of households surveyed in GAMA depend, either directly or indirectly, on piped water supplies. Access to drinking water varies considerably, however. Roughly one third of households surveyed had indoor piping, another third got their water from private or public standpipes, and the bulk of the remaining households bought water from vendors. Only about 3% of households relied on the largely polluted wells and waterways. Not surprisingly, it was the wealthy households who tended to have indoor piping, and poor households who relied most heavily on water vendors. Wells and waterways were largely restricted to poor peri-urban households.

The physical tests indicated some faecal contamination of the tap water, particularly from taps in poor areas of the city. Overall, 10% of the (136) samples of tap water had positive counts of faecal coliform. The quality of the water in household storage containers was considerably worse, however: 87% of the (149) tests had positive counts. Faecal contamination is likely to be a greater health risk when it originates outside of the immediate household. Nevertheless, the levels encountered in storage containers were disturbingly high, especially in light of the fact that less than 10% of households boiled or filtered their water prior to drinking. Also, this in-home contamination reflects a more general finding that the household water problems of GAMA lie more in access and its effects on hygiene than in water quality problems at the tap.

Compared to other areas of Ghana, water access is relatively good. About half of the households had a water source in their house compound, and 95% of households had a drinking water source within 100 metres of their home. The results suggest, however, that even the difference between having water in the house compound and having to fetch it from a short distance away bears a relation to health. Among households with small children, the prevalence of childhood diarrhoea was 7% when there was a water source in the house compound, as compared to 20% when there was not. The same households who had no water source in the house compound may also face other risk factors, but there is good reason to believe that difficulties in obtaining water are a contributing factor. Having to fetch water reduces water consumption, thereby creating various hygiene problems.

Water supply interruptions are common throughout GAMA, and are less dependent on wealth than is the location of the water source. As a result, almost all households had some form of water storage in their home. The overhead tank was the most common container among wealthy households, while the barrel was the most common among poor and medium-wealth households. Buckets were also popular among the poor, and pots are used by some 6%. By increasing the need to store water, water irregularities are contributing to water contamination problems. Moreover, by creating periodic water shortages, water interruptions can lead to hygiene problems. This may explain why, in the health results described below, households facing regular water interruptions were also found to have a higher prevalence of childhood diarrhoea.

For the poor, access to water is further compromised by the pricing system. The official water tariff is intended to be progressive, with higher prices charged to high-volume consumers. This intention is undermined by the fact that poor households are more likely to share water connections, thereby increasing the water use per connection. More significant, the most common water source among poor households was water vendors, who charge significantly more than the highest tariff level, although the purchasers typically collected the water themselves. Vendors serve an important role in the water distribution system, but in conditions of general water scarcity, those who purchase from vendors lose out.

Sanitation and Hygiene - Conditions:

GAMA has two of the three public water-borne sewerage systems in the country, but except in the planned township of Tema, only a very small share of households are served. This is reflected in the types of toilets used: 36% used flush toilets, 31% conventional pit latrines (broadly defined), 10% Kumasi Ventilated Improved Pit (KVIP) latrines, 20% pan latrines, and about 3% had no access to a toilet at all.

Flush toilets were used by almost all of the wealthy households and most of the medium-wealth households, many of which have septic tanks. Pit latrines or pan latrines were used by most poor households. Households with flush toilets had a considerably lower prevalence of childhood diarrhoea than those using other types of facilities, though this may be a reflection of the crowding of these other facilities.

While the sanitation technology profile may be superficially superior to that of the rest of Ghana, crowding has created a serious sanitation problem for a large share of GAMA's population. Almost three out of four households shared their toilet, and about 41% relied on communal facilities open to the whole neighbourhood. The communal facilities are so overcrowded that almost two out of three users claimed that there were times when these toilets were, in effect, unusable (e.g. they were out-of-order or the queues were too long). Residents of Ga, the peri-urban district, relied more heavily on conventional pit latrines than residents of Accra or Tema Districts, but less often complained that their toilets were unusable. This probably reflects a more general phenomenon. Toilets in GAMA may be technologically superior to those in other parts of Ghana. For a small elite with private flush toilets conditions are indeed better. But for the poor majority, crowding more than eliminates any technological advantage.

Crowding of sanitary facilities creates problems on at least two fronts. On the one hand the conditions of the toilets deteriorate. This was evident in the higher prevalence of dirty floors, flies and other indicators of unhygienic conditions in the more widely shared toilets. On the other hand, crowding can lead to open defecation, which is itself a greater public health risk in more densely populated areas. About half of the adults, on finding their usual toilet unusable, say that they used another toilet. A third, however, used open land or a beach under such circumstances. One would expect more open defecation among children, as their knowledge of personal hygiene and need for privacy is lower. Yet children are more vulnerable, and their faeces a greater health risk. Overall, 36% of households said children in their neighbourhood sometimes practised open defecation, with the highest percentages in poor areas. Both crowding of sanitary facilities and open defecation by neighbourhood children were associated with higher prevalences of childhood diarrhoea.

The costs of using sanitary facilities place a significant burden on poor households, despite the inadequacy of their facilities. A typical charge for a communal latrine was 5 cedis per use, and an additional 5 for toilet paper (and a penalty on the order of 20 cedis for those who bring excreta in pans). Most (82%) of households paying user fees incurred costs of between 10 and 60 cedis per day. Relatively few households cited cost as a reason for not always being able to use their usual toilet. Nevertheless, one can assume that these costs, which are sometimes intended to cover not only maintenance of the facilities but also other environmental maintenance, are contributing to the open defecation problems.

More generally, hygiene in GAMA is not simply a matter of household habits: it is intimately linked to the water and sanitation conditions. Open defecation is just one example. Much the same applies to hand washing practices, though in this case the link is with water rather than sanitary facilities. The results indicate that while factors like education may be associated with better hand washing practices, the type of water supply has an independent and probably more significant effect.

Solid Waste - Conditions:

Solid waste disposal is not as important to health as water and sanitation, but has become one of the more intractable environmental management problems. Despite recent upgrading, the Waste Management Department is still only capable of collecting some 60% of refuse. Only about 10% of the surveyed households had home collection, though the share rose to 39% among wealthy households. Most dumped their waste locally, about 70% at collection points or official dumps, and 13% on empty land or other unofficial sites.

The first point at which solid waste can become a problem is within the home. Open storage of solid waste was practised by some 42% of households, and was associated with a higher prevalence of flies and rodents. Outdoor storage of waste in the house compound was relatively rare, reflecting in part the low level of home collection.

Accumulations of waste within the neighbourhood are the most visible problem in this sector. Even collection points and official dumps can become environmental hazards, especially given the very intermittent collection, and the tendency for faecal material to become intermixed with household refuse. Almost half of the households perceived local accumulations of solid waste to be a problem, and more than one third mentioned open dump sites in their neighbourhood where waste went uncollected for a week or more. In addition to being unsightly and generally unpleasant, such sites are a health risk for children, exacerbating fly and rodent problems, and when washed away can block the drains.

Final waste disposal is also a problem. The most common method is dumping in pits, designated as landfills but actually little more than open dumps. Most existing sites have already been used up to, or beyond, capacity, and there is an urgent need for new sites.

Unlike water or sanitation, the wealthy pay considerably more for waste disposal than the poorer households. This is not only because the charge for home collection is considerably higher than that for using a collection site, but also because most households who do not have home collection do not actually pay the fee for using official sites.

Pests and Pesticides - Conditions:

Malarial mosquitoes remain a major health hazard in GAMA. While past urbanization has lowered the incidence of malaria in GAMA, there is no reason to assume this trend will continue unaided. Past studies suggest that some malarial mosquitoes are adapting to GAMA's urban environment, with, for example, increased breeding in household water containers. While only a relatively small share of the mosquitoes are malarial species, malaria remains by far the most frequently reported health problem at out-patient facilities.

Moreover, continual urban water use combined with poor drainage has created a situation where mosquitoes are common throughout the year. Almost all households surveyed said they were at least occasionally bitten by mosquitoes indoors at night throughout the year, with about three out of four being bitten regularly in both wet and dry seasons. Excluding households with full screening, the responses were quite similar in different areas of the city and among poor and wealthy households. Barring explicit efforts to control mosquitoes, the only influential factor was indoor water storage, which was associated with more mosquito biting. While this should not be taken to suggest that the risk of malaria is similar throughout the city (the prevalence of malarial mosquitoes is likely to be

more varied than that of mosquitoes in general), it does help explain the widespread concern. Also, if the presence of malarial mosquitoes breeding in household water containers is increasing, these findings also indicate that indoor water storage may be increasing malaria prevalence.

House flies are also known to be a health risk, especially given generally unsanitary conditions. The results of the survey indicate that this risk should be taken seriously: childhood diarrhoea prevalence was considerably higher in households with more flies in their kitchens or toilets. House flies were common in all neighbourhoods, in both kitchens and toilets. The prevalence of house flies was considerably higher among poor households than wealthy households, however. Thus, for example, more than four out of five wealthy households said they almost never had flies in their toilets, compared to about one poor household in seven.

Environmental management to control insects is not generally practised in GAMA. However, about 90% of the households used some form of insect control, principally for mosquitoes. The most popular methods include screening, mosquito coils, and aerosol and pump insecticides. Mosquito coils are the most common means of control among poor households, while screening and spray insecticides are more common among wealthy households. The use of chemicals to control insects creates its own health risks. The childhood prevalence of acute respiratory infection (or at least reported symptoms thereof) was significantly higher when mosquito coils were used. Among the principal women of the households, who were likely to be the ones applying the pesticides, the prevalence of respiratory problem symptoms was higher where pump-spray insecticides were used.

Food Contamination - Conditions:

Food can be chemically or microbially contaminated. This report is only concerned with the latter. Most households in GAMA obtain their food from open markets, where the risks of contamination are significant. Prepared vendor food is likely to pose the highest risks, however. Most households patronised vendors of prepared food regularly, but the percentage was lower among wealthy households. Also, the foods purchased by poor households were more likely to fall into potentially high risk categories. Overall, the prevalence of childhood diarrhoea was roughly twice as high among households who patronised food vendors.

Food contamination and deterioration in the home is also a concern. As indicated above, flies in the kitchen pose a health risk, principally due to the dangers of food contamination. Serving cold leftovers is also a potential risk, but well under 10% of the households said they did so regularly, and there was no association with diarrhoea prevalence. Food storage practices varied widely. For example, while virtually all wealthy households stored meat in refrigerators, almost half of the poor households who had meat to store simply used covered bowls. Again, however, there was no clear association with diarrhoea prevalence. Quite possibly, the principal effect is that poor households store foods less long: a considerably higher share of poor households said that leftover food would spoil in less than twelve hours than did wealthy households.

Households with sick children were more inclined to blame food eaten outside the house than food prepared at home. Indeed, 28 of the 72 households whose children had recently had diarrhoea identified food eaten out as the probable cause. While this is likely to be a far higher share than those who actually contracted diarrhoea from such food, it does indicate considerable awareness of the dangers of food contamination.

Household Smoke (and Crowding) - Conditions:

Cooking fuels are the most significant source of household air pollution in GAMA. Households not only use a range of fuels, but individual households typically use more than one. Charcoal was the principal cooking fuel for 69% of the households surveyed, followed by bottled gas or LPG (14%), fuelwood (8%), kerosene (6%), and electricity (3%).

Generally, the wealthier households used cleaner fuels. Past studies suggest that respirable particulate concentrations are likely to be highest among fuelwood users, followed by charcoal, kerosene, LPG and electricity. These are precisely the household preferences suggested by the relationship between fuel choice and wealth, with charcoal and wood the two principal fuels of poor households, charcoal and LPG the principal fuels of medium wealth households, and LPG and electricity the principal fuels of the wealthy. However, even LPG and electricity users often also use charcoal, which was used at least intermittently by 81% of the households.

Particulate exposure measurements undertaken for this study indicate that wood users are indeed the most exposed, followed by charcoal users and finally kerosene, LPG and electricity users (these last three fuels were combined due to small sub-samples). The levels encountered among wood and charcoal users were significantly high so as to raise concern about health effects. Carbon monoxide exposure was highest among charcoal users, followed by wood users. Again, levels were sufficiently high to raise concern, but were not as high as some studies in other locations have encountered.

In addition to cooking fuels, exposure depends upon cooking practices. Among poor households separate kitchens are rare, though in the rural fringe cooking huts are common. However, most wood and charcoal users cook outdoors, at least when it is not raining. Children's exposure also depends on whether they are present during cooking. Among households with small children, 25% usually had children present during cooking, and most had children present at least occasionally.

While the relationship between respiratory problems and cooking fuel choice was not statistically significant, perhaps due to the predominance of charcoal, use patterns did display significant associations. Among women (principal homemakers) the prevalence of respiratory problem symptoms was higher among those using a cooking hut. It was also higher among those who never cooked out-of-doors. Among children, symptoms of acute respiratory infection were more common when children were usually present during cooking.

Health and Environmental Risk Factors

Between 1987 and 1990, malaria, upper respiratory tract infections, and diarrhoea were consistently the three most commonly reported health problems at out-patient facilities in the Greater Accra Region. All three are also closely related to a variety of environmental factors. A sustained analysis of malaria and its association with environmental conditions is beyond the scope of this study: self diagnosis of malaria is notoriously inaccurate, households cannot identify malarial mosquito species, and neither blood tests nor mosquito counts were undertaken during the survey. Both respiratory problems and diarrhoea are the outcome of complex combinations of interrelated factors, but the results of this study clearly indicate the importance of environmental inadequacies.

The prevalence of diarrhoea among children under six was, not surprisingly, associated with wealth and type of residential area: wealthy households and households in high class areas had considerably less childhood diarrhoea. The results suggest that most of these differences are related to the environmental conditions households face. In a multifactorial statistical analysis of childhood diarrhoea prevalence, all of the following were found to be significantly associated with higher diarrhoea prevalence:

1. Sharing toilet with more than 5 other households.
2. Using pot for storing water.
3. Storing water in an open container.
4. Outdoor defecation by neighbourhood children
5. The presence of many flies in the cooking area.
6. Not always washing hand before preparing food.
7. Experiencing water interruptions at certain times of day.
8. Buying prepared food from vendors.

Once these risk factors were included in the analysis, social and economic factors were no longer significant. Of the 69 households with small children who faced at most one of these risk factors, there were no recent cases of diarrhoea. Of the 102 households facing more than four risk factors, 37 had children who had had diarrhoea in the past two weeks.

Symptoms of acute respiratory infection in young children were also more prevalent among poor households and in low class areas, though the differences were not as striking. Again the results suggest that these differences could be due to environmental conditions. In this case, the following risk factors were found to be significant in the multivariate analysis:

1. Children often present during cooking.
2. Presence of many flies in the cooking area.
3. Less than four square meters per person in the most crowded sleeping room.
4. Experiencing water interruptions at certain times of day.
5. Using mosquito coils
6. Never cooking outdoors
7. Leaky roof.

Again, social and economic factors were no longer significant once these risk factors were included. Among the 51 households facing at most one risk factor, there were two in which young children had had acute respiratory infection symptoms in the past two weeks. Among the 107 households facing five or more, there were 29.

Respiratory problem symptoms in the principal women of the households bore no clear association with either the wealth of the household or the type of area they lived in. Various environmental risk factors were significant, however, and several of these factors were not so prevalent among poor households (it is also possible, as other studies of Accra have suggested in the past, that wealthy respondents are more likely to report minor health problems). More specifically, the following risk factors were found to be significant:

1. Smoking cigarettes
2. Using pump-spray insecticides
3. Experiencing water interruptions at certain times of day.
4. Never cooking outdoors
5. Leaky roof.

While fewer significant factors were identified than in the previous two examples, the health differences remain striking. Of the 79 women not exposed to any risk factors, six had respiratory problem symptoms, as compared with 56 of the 178 women who faced three or more risk factors.

It is important not to over interpret individual factors. Some could reflect other, unmeasured, factors. The presence of flies, for example, could be an indicator of generally poor sanitary conditions. Some factors could be statistically significant just by chance (though virtually by definition the probability of this occurring are relatively small). However, taken together the results clearly illustrate the importance of environmental improvement to the health of the residents of Accra, and particularly the children.

Environmental Values and Household Economics

The values the respondents placed on environmental improvements (ascertained through contingent valuation questions) were at least roughly consistent with existing knowledge of the health burdens imposed. Malaria is the most evident health problem, and insect control was the most valued improvement. Diarrhoea is also a major health problem, and water improvements were also highly valued. (Sanitation improvements were not included in the survey, but there is every indication that they too would have been highly valued.) Air quality improvements were less highly valued, despite the importance of respiratory infection. However, the link between air pollution and respiratory problems may well be less significant than that between water and diarrhoea. Solid waste collection was quite highly valued, despite having a very uncertain link to health. In this case, it is probably best to assume that health was not the principal motivation.

The results support the notion that people place considerable value on environmental improvements, and are willing to make significant economic concessions in order to achieve them. The economic burden of paying for existing environmental services is considerable. In several cases (e.g. water) poor households are already paying high prices for an inadequate amenity. Under such circumstances, it is an indication of the importance people attach to the household environment that most are willing to pay still more for improvements. However, it is unrealistic to expect to achieve adequate home and neighbourhood environments without significant improvements in the economic status of the majority of households. Ability to pay is clearly a major constraint, especially in poor areas.

On the other hand, even if households value environmental benefits, individually they often have relatively little control over the environment they face. Indeed, the immediate economic incentive may be to degrade the environment, despite the costs this incurs on others. Such problems arise in poor as well as wealthy areas. Outdoor defecation in an urban setting, for example, is in part a symptom of severe poverty. But it is also an indication that individual and collective interests are not in harmony. Similarly, inadequate water access may be symptomatic of poverty, but poverty does not dictate that water prices should be

especially high. Economics suggests that some form of collective action may be required when public benefits are involved.

Just as households seemed to place a higher priority on improvements which would have a major health impact, so also households tended to identify a need for more collective action the more public the benefits. Respondents were asked whether they felt action was required in each of the major problem areas covered in the survey, and if so whether they thought individual action, neighbourhood action or government action was most important. Indoor air improvement, which benefits largely the household making the improvement, was seen principally as a household affair. For other problems, the respondents most often identified a need for government action, though neighbourhood action received considerable support for garbage, insect and especially sanitation problems.

Institutional Aspects of Urban Environmental Management

Environmental management institutions range from government agencies and utilities to the households themselves, and include a number of critical intermediate institutions. Even conventional environmental services, such as water, sanitation and solid waste disposal, are more often provided to groups of households than to individual homes. Especially in poor areas, this is likely to remain the case for some time to come. This has created a situation in which co-ordination among institutions is as critical to environmental management as their individual efficiency.

The government already has a key role in environmental management, and its role in environmental management is likely to increase relative to many of its other more traditional roles. More than half of the government ministries are directly involved in one way or another in urban environmental management. The Ministry of Finance and Economic Planning has the overall task of allocating funds for research into environment-related issues and for the execution of environmental action plans. The Ministry of Works and Housing has at least a supervisory role in almost all public construction activities, and the Ghana Water and Sewerage Corporation is a service agency within this ministry. Within the Ministry of Local Government, the Town and Country Planning Department has the responsibility for ensuring the planned development of the metropolis, while the Environmental Protection Council is responsible for ensuring that development projects take proper measures to avoid environmental destruction. The District Assemblies of Accra, Tema and Ga have, among their responsibilities, that of general management of waste and sanitation. Co-ordinating the activities of the numerous ministries and different levels of government is a formidable task. The current climate of financial austerity makes efficient co-ordination all the more important. However, just as important, these numerous governmental institutions must interact with the far more numerous and ever changing non-governmental institutions.

The local institutions involved in environmental management vary considerably in importance from neighbourhood to neighbourhood, but tend to be more significant in low-wealth areas. In a number of areas, political groups (Committees for the Defence of the Revolution or C.D.R.s) took the initiative in the early 1980s, organising not only the provision of sanitary facilities, but a wide range of environmental improvement activities. Some have been notably successful, not only in organising improvement efforts, but also in generating local support for environmental management. C.D.R.s are by no means the only local groups involved in environmental management, however, and given current political and

economic trends, they are likely to continue to decline in importance. In some areas, official neighbourhood groups are growing in importance, while in others spontaneous neighbourhood organisations have made considerable headway. The need for such local groups is heightened by the lack of comprehensive services. Their strengths lie in their ability to respond directly to local concerns. Almost all of the more successful examples, however, have obtained outside support at critical times in their development.

In much of GAMA, the compound housing unit is also central to household environmental management. As noted above, individual household water taps, sanitary facilities, and waste collection are largely restricted to wealthy areas. Many compound housing units even lack shared facilities. However, within compound housing units, many environment related tasks are typically shared, and the informal institutional arrangements which develop are an important locus of activity. Indeed, to view the informal relations among members of different households living at such close quarters as simply inter-household co-ordination is to underestimate their importance. Households themselves are made up of members with different priorities and perceptions. The gender based division of labour within groups of households can be as central to local environmental management as individual household environmental management strategies.

Policy Implications

The principal purpose of this report is to present action-relevant results, not to draw specific policy conclusions. The analysis of health and environment clearly demonstrates that household environmental improvement is a major concern. The analysis of particular problem areas indicates what some of the priorities are. The analysis of environmental valuation and household economics suggests that people want action, and that their priorities and perceptions of what needs to be done should be taken seriously. The institutional analysis indicates many of the opportunities and obstacles to improved environmental management at the household level. Concrete proposals and effective strategies cannot be read off the results of a study, however. At this point, it is only appropriate to indicate some general policy implications.

Especially in relatively poor areas, integrated improvement efforts are more likely to be effective. The problems are interrelated. Only an integrated approach can be expected to respond effectively to local concerns. For the purposes of exposition, however, it is simpler to examine each problem area separately.

Water

There are serious deficiencies in the water supply system in GAMA, but probably less serious than in most of the country. Access to water is currently a more serious deficiency that quality of the water at the tap. However, extending the water supply system and increasing throughput is costly. Given prevailing economic conditions, providing all households with in-house piping must remain a long term goal. In the medium term, the results suggest that providing standpipes in house compounds may bring significant health benefits at considerably lower cost. Increasing water supply within the existing system, and reducing interruptions, could also have health benefits. Increased water supply in low-income areas could have the added benefit of decreasing vendor water prices. Overall, while the health benefits of water supply system improvements would likely be considerable, economic considerations will necessarily guide which

measures ought to be taken. Even disregarding costly improvement efforts, the results clearly demonstrate that the existing system places the greatest health burden on the poor households, who also end up paying the highest price for their water. This is very much counter to the government's intentions, and deserves special attention. To address this problem effectively is likely to require institutional innovation catering to the particular needs of low income households living predominantly in compound housing units.

Sanitation

Overall, alleviating the sanitation problems of GAMA is clearly a major priority. The most serious problem is the overcrowding of the facilities. If the health of the population is the principal concern, increasing the quantity of toilet facilities available is probably more critical than introducing improved technologies. Improved maintenance is also important, but extremely difficult given the severe overcrowding. Owing to the communal character of a large share of the facilities, the government and local community groups are already direct involved in determining the quantity of facilities available. More support to community groups involved in improving sanitary conditions would be very beneficial. Measures to increase the incentives for private provision could also be important. While sanitary facilities require both land and investment, given the health risks of inadequate provision, it seems likely that the benefits would be substantially greater than the costs.

Hygiene

Hygiene problems are severe, but are closly linked to water, sanitation and even solid waste problems. It is often noted that water and sanitation improvements can fail when hygiene practices remain the same. The results suggest that the reverse is probably equally true. In any case, it is difficult to prescribe household hygiene habits. Education and awareness programmes are potentially important, but are likely to be far more convincing if accompanied by improved conditions.

Solid Waste

While solid waste problems are not a priority health concern, the capacity for solid waste collection and disposal remains weak, and the costs of allowing refuse to accumulate locally are considerable. Effective arrangements for handling waste problems at the local level could help redress at least some of the capacity deficiencies. As with sanitation, many local groups are already involved in solid waste management, and probably deserve more support. However, it is difficult to envisage major improvements in the solid waste situation without increasing the collection and disposal capacity. There are indications that most households are willing to pay for improved solid waste management, even if they are not willing to pay for poor service.

Pests and Pesticides

Insects, and especially malarial mosquitoes, account for a large share of illness in GAMA. The results indicate that improvements in insect control are a priority for the households themselves. Currently, households are spending considerable sums of money on chemical insect control. There is some doubt as to the effectiveness of these measures in reducing malaria prevalence, however. Moreover, the use of these chemicals is not only environmentally hazardous, but may be having

detrimental effects on health too. There is a need to investigate the dangers of existing methods of insect control further. Furthermore, new approaches to insect control should be considered. Environmental management as a means of controlling mosquitoes could prove to be far more cost effective than existing measures. As an urban area, GAMA already stands at a considerable advantage in comparison with most of Ghana: most malarial mosquito species are better adapted to rural conditions. Exploiting this advantage could yield major benefits.

Food Contamination

The relative importance of food contamination to health is difficult to discern, but could be considerable. Women with sick children often blamed food eaten outside the home, and there were other indications that food prepared by vendors may be contributing significantly to health problems. Unfortunately, government policies to reduce food contamination are difficult to devise. Improved hygiene education is possible, but acting to control the practices of food vendors is difficult. On the other hand, some local groups are already acting to improve the hygiene of food vendors. Providing support for these local activities could well be the most effective means of improving food quality, especially if combined with more attention to food hygiene within educational activities.

Household Air Pollution

Both charcoal and fuelwood, but especially fuelwood, give rise to potentially damaging levels of pollution exposure for women and children in GAMA. However, conditions are probably worse in other parts of the country where wood is the predominant fuel. Promoting the increased use of LPG or electricity for cooking would reduce exposure for those households who switch fuels. However, subsidies large enough to influence fuel choice are likely to be very costly, and will benefit principally the relatively well off who can afford the necessary equipment. At least in the short run, improved cooking practices, possibly in conjunction with improved stoves, are of more relevance to the poor majority.

CHAPTER ONE

1 INTRODUCTION

This study of household environmental problems in the Greater Accra Metropolitan Area (GAMA) is a component of a research project co-ordinated by the Stockholm Environment Institute, and also covering Jakarta (Indonesia) and Sao Paulo (Brazil). Of the three cities, GAMA stands out as being an order of magnitude smaller in population. That does not make its environmental problems any more tractable, however. Despite vast differences, not only in size, but also in economy, climate and culture, households in all three cities face at least superficially similar types of environmental problems. In all three cities, these problems are particularly severe in low-income areas. In order to allow the results to be compared across the three cities, a similar approach was adopted in each city. The following section summarises the scope of the GAMA study and the methods employed.

While the kinds of environmental problems households in GAMA face may not be untypical, their severity, incidence and socio-economic basis are radically different from those in the other cities studied. Following the discussion of the scope and methods, this introductory chapter continues with an overview of the urban growth dynamics of GAMA, and the local context within which household and neighbourhood level environmental problems arise. Ghana's recent economic and demographic history is critical to understanding not only the current situation in GAMA, but, more important, the constraints on and possibilities for improvement.

1.1 Scope and Approach

This study was designed to provide a coherent assessment of household environmental problems in Accra, with an emphasis on those problems faced by the poor. The study is action-oriented; the research is intended to improve understanding of household environmental problems and help develop strategies to alleviate them. Various assessments of Accra's environmental problems have been conducted in the past (e.g. Environmental Management Associates, 1989; Amuzu and Leitmann, 1991). For the most part, such assessments have concentrated on larger scale environmental problems, in part because of a lack of information on household and neighbourhood level. Yet, as the results of this study clearly demonstrate, small scale environmental problems can have large effects. While perhaps less critical to the environmental sustainability of the city, these problems are central to the health and well-being of the inhabitants.

1.1.1 Scope

The problem areas covered include: water (Chapter Two), sanitation (Chapter Three); solid waste (Chapter Four); pests and pesticides (Chapter Five); food contamination (Chapter Six); and air pollution and housing conditions (Chapter Seven). The study sets out to examine the physical severity of these problems among households with differing socio-economic backgrounds and living conditions. Where possible, the analysis attempts to draw out the interconnections, both among the environmental problems and more generally with other physical, social and economic conditions. Some of the health risks associated with each of the problem areas are also assessed.

A more integrated analysis of the relation between environmental conditions and diarrhoea and respiratory problems was also conducted (Chapter Eight). These health problems are not only extremely serious, particularly for children, but relate to a variety of environmental problems. Only by analysing the environmental risks simultaneously is it possible to address the complex of environmental and social factors involved.

In order to better understand some of the critical constraints and possibilities for environmental improvement, an assessment of the economics of household environmental management was undertaken (Chapter Nine). Due to the public nature of many environmental problems, prices can rarely be used to ascertain households' concern for environmental improvement. Contingent valuation methods were employed to ascertain the value households would place on improvements. An attempt was also made to identify householders' perceptions of what needs to be done by whom.

Any attempt to improve environmental management in GAMA must, of course, build on existing institutional capacities. An assessment of the institutional aspects of urban environmental management was undertaken (Chapter Ten), with a view towards identifying some of the key actors, and the role they could play in improving environmental management at the local level.

Making specific strategic recommendations is beyond the scope of this study. The information presented does have important implications for strategy development, however. The final task of the study was, therefore, to highlight some of these implications, and demonstrate that the results are indeed action-oriented.

Given the paucity of pre-existing information on household environmental problems, a large part of the effort undertaken for this study was devoted to collecting and analysing new data. The methods employed are summarised below.

1.1.2 Research Design

The field work involved the use of the following instruments:

(a) A detailed and structured questionnaire survey of households together with physical tests of water quality and exposure to air pollution for a sub-set of the households covered in the questionnaire survey.
(b) A few selected focus group discussions on grassroots environmental concerns and action with rank and file members and some executives of women's groups, ethnic associations, neighbourhood welfare associations, and other community based organisations.
(c) Unstructured discussions or interviews with policy makers and implementors.

1.1.3 Sampling Procedure for Household Survey

A survey of 1,000 households in GAMA provides the core empirical base of the study. The survey was administered to the principal homemaker of each household, generally a woman. The principal topics covered are summarised in Table 1.1.

Table 1.1: Selected Topics Covered in Household Environment Surveys of Accra Jakarta and Sao Paulo.

Background Information
- Household Size and age structure
- Indicators of income/wealth
- Gender of household head
- Education (principal male & female)
- Migratory status (principal homemaker)
- Type and quality of residence
- Size of residence and plot
- Tenure of residence
- Time householders spend at home

Water:
- Type of water supply by use
- Ease of access to drinking water supply
- Water storage practices
- Water filtration or boiling practices
- Water supply disruptions

Sanitation & Hygiene:
- Type of toilet
- Toilet sharing
- Toilet use practices(e.g. use of toilets by children)
- Indications of unhygienic toilets
- Hand cleansing practices of principal homemaker

Pests:
- Presence of flies in kitchens and toilets
- Mosquito biting
- Animals kept at home
- Rodent problems
- Cockroach problems

Housing Problems:
- Crowding
- Damp problems
- Building materials

"Indoor" Air Pollution:
- Fuels used for cooking and heating
- Location of cooking place
- Cooking practices
- Pesticide use
- Smoking practices

Food Contamination:
- Food storage practices and facilities
- Food preparation practices
- Indications of poor food hygiene
- Use of food vendors

Solid Waste:
- Waste storage and collection
- Waste picking and selling
- Location of waste problems
- Valuation of improved waste collection service

Health:
- Children's diarrhoea problems
- Children's respiratory problems
- Respiratory problems of principal homemaker

The sampling procedure was designed to provide a representative sample of households. The first step of the sampling procedure involved proportional

stratification according to the residential categories outlined in Table 1.2; an adaptation of the strata employed in the recent *Housing Needs Assessment Study* (Housing and Urban Development Associates, 1990) of the Accra Metropolitan Area (AMA). The sample was apportioned across the first seven categories according to the relative share of households estimated to be residing in each stratum. The apportioning was based on the results of the 1984 Census, adjusted to allow for a more rapid rate of growth since 1984 in the "Low Density Newly Developing Sector". The share of households in the last category, "Rural Fringe" is not known accurately, but has become significant due to the recent inclusion of the Ga district within GAMA. It was apportioned 5% of the sample as a rough estimate of its share of households. The resulting sample size in each stratum is given in Table 1.2 (with some rounding). For details of sampling procedure, see Appendix 1.1.

Table 1.2: Stratification by Residential Category.

Stratum	Sample share	Sample Size
High Density Indigenous Sector (HDIS)	17%	170
Low Density High Class Sector (LDHCS)	2%	20
Middle Density Middle Class Sector (MDMCS)	5%	50
Low Density Middle Class Sector (LDMCS)	11%	110
Low Density Newly Developing Sector (LDNDS)	3%	30
Middle Density Indigenous Sector (MDIS)	12%	115
High Density Low Class Sector (HDLCS)	46%	455
Rural Fringe (RF)	5%	50
Total	100%	1000

As their names suggest, the strata were designed to distinguish areas of the city principally on the basis of population density and amenity values. The indigenous sectors (HDIS and MDIS) consist of settlement nuclei along the coast. They are termed indigenous because they were founded by the Ga ethnic group who occupied the Accra plains before the early period of European coastal trade. A number of residents are still engaged in coastal canoe fishing. These settlements, and especially the HDIS, share common traits with other low class areas. The low density newly developing sector (LDNDS), on the other hand, includes areas likely to become high class, but as yet having a poorly defined community character and in some cases having public amenities which lag behind the private development. The rural fringe (RF) consists of rural settlement nuclei which have now been incorporated into the metropolis through an extension of the metropolitan boundary. Large open spaces still exist, allowing for peri-urban agriculture. These Ga villages, like most rural localities, are generally bereft of service provisions.

For the purposes of presentation, two forms of post-stratification were applied. Low, middle and high wealth households have been grouped according to a wealth index constructed from the following indicators (weights applied are in brackets): lamps (1); iron (5); fan (5); black and white television (10); colour television (20); video (20); refrigerator (30); air conditioner (50); bicycle (10); motorcycle (40); automobile (100). Households scoring less than 96 have been

designated Low Wealth, those scoring between 96 and 190 have been designated Medium Wealth, and those scoring over 190 have been designated High Wealth. Of the 1,000 households surveyed, 818 are Low Wealth, 131 are Medium Wealth and 51 are High Wealth. While imperfect, the ownership of consumer durables was deemed a better indicator of wealth than the inaccurate estimates of income and expenditure which could be obtained rapidly in a household survey.

Reapplying the household wealth index to the strata confirmed the wealth classification of the strata themselves: The high density indigenous sector, the high density low class sector, the middle density indigenous sector and the rural fringe all have average scores significantly below the low and middle density middle class sectors, which in turn scored lower than the low density high class sector and the low density newly developing sector. This trichotomy provides the basis for the distinction between low, middle and high class areas applied in some of the chapters which follow.

1.1.4 Physical Tests

As another component of the study, physical tests for water and air quality were carried out in a subset of 200 of the 1000 households covered by the questionnaire survey. One of the five households surveyed in each block was selected for the physical tests, allowing maximum spread. The water tests were for faecal coliform, both at source and in storage containers when possible. The air tests were designed to assess women's exposure to particulates and carbon monoxide during the cooking period. Details of the methods employed for the physical tests are presented in Appendix 1.2 and 1.3.

1.1.5 Focus Group Discussions

Focus group discussions were undertaken in 14 low income neighbourhoods where environmental quality was poor, thereby indicating a need for community action. The neighbourhoods include Ashiaman, Tema New Town and Old Ashale Botwe in Tema District; Labadi (La), Darkuman, Sabon Zongo, Maamobi, Accra New Town, Nima, Mamprobi, Jamestown and Mataheko in Accra District; and Ofankor and Madina for Ga District.

This field work, including the survey, the physical tests and the focus group discussions, provides a "snap shot" of Accra at one point in time. In order to appreciate the context from which this "snap shot" was taken, the following sections of this chapter review the urban growth dynamics of GAMA, and draw out some of the implications for local environmental management.

1.2 Overview of the Urban Growth Dynamics of GAMA

An estimated 1.5 billion people currently live in the cities and towns of the Third World. Already much larger than the combined populations of Europe, North America and Japan, this figure is still growing by some 70 million per year (Hardoy, Mitlin and Satterthwaite, 1992, p. 29). While sub-Saharan Africa is the least urbanized of all regions, its rate of urbanization is the highest. The largest cities have been growing particularly rapidly (White, 1989, p.2).

The global economic problems of recent decades have helped drive sub-Saharan Africa into a grave economic crisis. Most countries in the region have had to adopt Structural Adjustment Programmes under the auspices of the World Bank and the IMF. Proponents argue that structural adjustment is the best means of coming to terms with hard economic realities. Detractors argue that it compounds

the economic crisis for the poor, and helps create the "hard" economic conditions. Regardless, most governments are clearly facing a period of severe financial austerity.

These demographic and economic conditions have combined to place severe pressures on governments attempting to maintain public facilities and services, let alone improve and expand coverage (Stren, 1989). Perhaps nowhere is this more true than in the Greater Accra Metropolitan Area (GAMA), which serves as both the capital of Ghana and the major industrial growth pole (Songsore, 1992, p.1).

1.2.1 Population Growth and Physical Developments within GAMA

Founded in the 16th century as a small coastal fishing village close to the eastern shore of the Korle Lagoon, Accra soon became a pre-eminent centre in Ghana. In the 17th century it became one of the most important European trading centres along the Gold Coast (as Ghana was then known). As many as three trading forts or castles were built in Accra: the Dutch built Ussher Fort (1650), the Swedish Christiansborg Castle (1657), and the British James Fort (1673). In 1877, having established themselves as the sole colonial power in the country, the British decided to transfer the seat of British Administration from Cape Coast to Accra. This event was of seminal importance in the development of Accra (Dickson, 1969, p. 259). Accra grew rapidly but in a generally unplanned manner. The population of the settlement increased from 16,000 in 1891 to around 42,000 in 1921 and in 1948 (at the last census before political independence in 1957) recorded a population of 136,000 (Plan Consult 1989, p. ii).

A new industrial satellite township of Tema was developed in the wake of independence, a period when a large share of public investment was being diverted towards large cities and towns. Planned by Doxiades and Associates, this industrial satellite grew from a population of only 23,000 in 1960 to 181,000 in 1984. Tema is the site of a modern deep sea harbour and a major industrial estate. Accra and Tema were planned to grow into one big metropolitan area.

The Greater Accra Metropolitan Area (GAMA), as defined here, includes the Accra Metropolitan Area (narrowly defined as the Accra District) in addition to Tema and Ga Districts (Fig. 1.1 and Fig.1.2). These three districts have become physically and functionally one single urbanized area. The GAMA had a combined population of 450,000 in 1960, which almost doubled by 1970, and stood at 1,300,000 as of the 1984 census. The estimated population for the metropolitan area was put at 1.7 million in 1990. It is expected to reach the 4 million mark by 2010, accounting for about 15% of estimated national population at that time (Accra Planning Development Programme (Draft) 1992, p.35).

The average annual intercensal growth rates (6% between 1960 and 1970 and 3.5% between 1970-84) were both well above the national growth rate (Table 1.3). The much higher growth rate between 1960 and 1970 coincides with the economic boom period for the metropolitan area consequent to the creation of the industrial township of Tema and the general rapid expansion of administrative, commercial, business and industrial activities in Accra township itself.

Table 1.3: Population Trends within GAMA, 1960, 1970, 1984.

District	Population Totals 1960	1970	1984	Annual Growth Rate 1960-70	1970-84
Accra	388,396	636,667	969,195	5.1	3.1
Tema	27,127	102,431	190,917	14.2	4.5
Ga	33,907	66,336	136,358	6.9	5.3
Total GAMA	449,430	805,434	1 296,470	6.0	3.5

Data source: Ghana Population Census, 1984.

Although about 75% of the total population is located in Accra District, the more rapid growth rates are found in the industrial district of Tema and the peri-urban District of Ga, which have been accommodating much of the over-spill of urban development from Accra District. Given these differential growth rates it is anticipated that Tema and Ga districts will account for an increasing share of the total population, as shown in Table 1.4 below. By 2010, Accra's relative share of the total population of GAMA is expected to have dropped to 66%, from 75% in 1984. The relative share of these two districts could even be higher than these other figures suggest, given the saturation of the built residential environment within Accra District.

Table 1.4: Population Projections for Districts in GAMA 1990-2000 ('000s).

District	1990	1995	2000	2005	2010
Accra	1,243	1,514	1,843	2,231	2,686
Tema	268	351	459	547	772
Ga	197	262	348	461	607
Total GAMA	1,708	2,126	2,650	3,239	4,065

Data source: Accra Planning and Development Programme, 1991.

GAMA's rapid population growth has led to urban sprawl and uncontrolled physical expansion from the municipal boundary of Accra into Ga District, which until 1960 was largely rural in character. Some of the more notable residential satellites that have sprung up include Madina, Adenta, Haatcho, McCarthy Hill, Kwashieman, New Achimota, Dome and Ofankor.

In addition to expansion, there has also been increased crowding in existing residential areas. This has resulted in higher occupancy ratios in existing housing units and the infilling of vacant plots in the existing residential areas (Benneh, et al, 1990, pp. 17-19). The overcrowding has been particularly severe in the numerous unserviced and unplanned slum areas within the Accra District and Ashiaman in Tema District.

In Accra District, except for the few high and medium class residential areas, the bulk of the population lives in largely unplanned residential developments. This dual structure reflects the character of all Ghanaian cities of colonial origin: whilst the European sector was planned, the African or indigenous city was often left on its own, except for a few regulations to control the frequent outbreak of epidemics (Songsore, in press).

Tema industrial township had the singular privilege of having a planned sewerage system and other municipal facilities. Ashiaman, however, which developed as a squatter settlement next to Tema, lacks any meaningful service infrastructure, whilst Tema New Town, where the original Ga fishermen were resettled, is inadequately serviced. The Ga District, which urbanized during the crisis decades of the 70s and 80s, is characterised by uncontrolled physical development and a poor coverage of municipal services.

One cannot fully understand the failures in service delivery except through an analysis of the trends in urban economic performance. Both the ambitious planning of Tema and the laissez faire character of recent developments in Ga reflect changes in the economic as well as political climates.

1.2.2 Urban Economic Growth Trends

Having been chosen as the national capital, a chain of agglomerative processes were soon set in motion, further consolidating Accra's pre-eminent position in the national economy. Compounding the over-centralisation of governmental decision-making power and control in Accra, many head offices of business firms were established in Accra to be next to the seat of government. The metropolis was also host to the most dynamic firms and industries in the country. With just over 10% of the total population, it has the most diversified economy in the country, and contributes between 15 and 20% of GDP (Accra Planning Development Programme (Draft) 1992, p. 17).

About 32% of the country's manufacturing industries are located in the metropolis. It is the commercial, business, educational and cultural centre of the country. It lies at the hub of internal and international communications networks with the most modern deep-sea port at Tema and the only international airport. Moreover, the metropolis is well served by road links to other parts of the country, and is the most important coastal terminus of the railway network in Ghana.

However, the economy of the metropolitan area is also characterised by structural imbalances. It is estimated that services alone account for 26% of total employment followed closely by wholesale and retail trade with 24%. Manufacturing activity accounts for only 19% of the total labour employed (Amuzu and Leitman, 1991, p. i).

During the 1970s and early 1980s, Ghana's Gross Domestic Product persistently declined. Output shrunk in almost all sectors, inflation was high, and there were acute shortages of consumer goods. This led to declining per capita incomes and a general deterioration in the welfare of the population. The metropolitan economy was particularly affected by the economic crisis, given its dependence on imports. Industrial production was at an all time low with capacity utilisation for most establishments generally below 25% (Plan Consult, 1989, p. 104).

In 1983, Ghana initiated an Economic Recovery/Structural Adjustment Programme (ERP/SAP), with the object of arresting the decline in the economic and social conditions in Ghana. Table 1.5 indicates the extent of the recovery in

GDP. For the years 1984-1987, GDP recorded an average annual growth rate of 6%, with industry growing at 12%, services at 8%, and agriculture at 3%.

Table 1.5: Growth of Ghana's GDP by kind of economic activity in constant 1975 prices (per cent per annum).

	1980	1981	1982	1983	1984	1985	1986	1987
Agriculture	2.17	-2.56	-3.25	-9.11	9.71	0.65	3.31	0.04
Industry	-1.85	-14.46	-16.67	-6.77	11.94	17.60	7.56	11.34
Services	-2.79	2.73	-4.65	-4.54	6.63	7.52	6.50	9.38
Total GDP	-0.23	-3.18	-5.85	-4.34	8.96	5.09	5.20	4.80

Data source: Jebuni et al., 1991, p.8.

Since GAMA has a high concentration of industry and service activities, these figures would seem to suggest that its recovery has been strong. This impression should be qualified by the fact that mining accounts for much of the growth in the industrial sector, and is insignificant in GAMA. The manufacturing industry faces stiff competition from imported goods under the liberalisation programme. The balance of payments position has remained precarious throughout the period, and there are doubts about the long term sustainability of recent growth trends (Jebuni et al., 1991). Moreover, even if growth in production can be maintained, the economic prospects for the majority of the population are uncertain.

The increasing economic activity is generating greater industrial, commercial and municipal wastes. Yet the government is likely to continue to face severe budget constraints. Combined with the pressing needs of households in the burgeoning residential areas, the environmental challenge is immense.

1.3 The Challenge of GAMA's Growth at the Local Level

The rapid growth of GAMA in an unfavourable economic environment has led to a rapid increase in the number of its inhabitants living in substandard housing and overcrowded conditions, without the resources for decent shelter. Our survey results indicate that about 67% of households live in the single storey traditional house compounds, occupied by several households, and often sharing sanitary and kitchen facilities. About 35% of households live crowded into one room and another 33% into two rooms.

The general shortage of housing has forced some people to resort to other means of shelter including the occupation of buildings under construction, kiosks, garages and verandas. It is estimated that about 3% of the population of GAMA is homeless (Accra Planning Development Programme, 1992, p.7). Even among the households surveyed, there was evidence that in the more crowded houses it is not uncommon for some householders to sleep away from home.

The *Housing Needs Assessment* study indicates that on average there are 4.2 households or 23.3 persons per dwelling. There are on average 1.8 rooms per household and 8.1 rooms per dwelling with an average of 2.9 persons per room. The mean occupancy rate of 2.9 per room is above the United Nations recommended standard of 2.5. (Housing and Urban Development Associates, 1990, Vol.1, p.103).

About 20% of the household heads and principal homemakers from our survey were illiterate, whilst the majority (65%) had not had education beyond elementary school level. Most people with very low skills can be assumed to work in the informal sector which accounts for about 57% of the total employment of GAMA. Women dominate in this sector, often working close to home. About 40% of the population covered in our survey was below 15, mostly young children who spend the bulk of their time at home. Overall, the survey results indicate that about 30% of household members spend 4 hours or less away from home, 50% spend between 5-8 hours away from home, and only 4% of the population spend 12 hours or more away from home. These results underscore the potential importance of the household environment to the welfare of Accra's inhabitants.

Reflecting the prevailing gender division of labour, it was found to be mainly women and female children who cook and manage the household environment, and are most at risk. Moreover, as would be expected, the women were generally less educated.

As regards poverty, the evidence for Accra would seem to suggest that the high economic growth rates recorded since the inception of Ghana's Structural Adjustment Programme have brought minimal relief to the average urban household. For example, the average urban worker is still much poorer than in 1970. Although poverty is still more prevalent in rural areas, with the metropolis having the highest mean per capita household expenditure in Ghana, in a recent study about 95% of those surveyed earned below the poverty line of $4.00 per day as stipulated by the International Labour Organisation (Housing and Urban Development Associates, 1990). Indeed, given the pressures of day to day survival, the capacity of poor households to manage their local environment may well have continued to decline under structural adjustment.

CHAPTER TWO

2 HOUSEHOLD WATER SUPPLY

2.1 Introduction

This chapter provides a physical overview of water access and use among GAMA households. It covers the types and location of water sources, water storage and handling, water payments and use patterns, and the association between water source and diarrhoea prevalence among children. Finally, the physical quality of the water, both at the households' water sources and in their storage containers, are examined. Intra-urban differences in access to facilities are discussed in terms of both geographical areas and household wealth. Both of these dimensions are relevant to policy since it is important to know the areas of intervention and the target groups involved.

2.2 Water Supply Systems

An adequate supply of easily accessible, potable water is central to households' welfare, and a prerequisite to good hygiene and sanitation (Songsore, 1992, p.5). Many health problems are linked to water quality, availability, ease of access and provisions for disposal (see Hardoy, Mitlin and Satterthwaite, 1992; Cairncross, 1990).

GAMA has a more comprehensive piped water system than other urban centres in Ghana. It accounts for 90 x 10^6 m^3 (million cubic metres) out of the total annual water production by piped systems of about 130 x 10^6 m^3.

Table 2.1: Distribution of Households in GAMA by Source of Drinking Water.

Source	Accra		Tema		Ga		GAMA	
	No.	%	No.	%	No.	%	No.	%
Indoor Piping	248	34.7	65	40.6	39	31.2	352	35.2
Private Standpipe	221	30.9	10	6.3	12	9.6	243	24.3
Water Vendor	167	23.4	72	45.0	41	32.8	280	28.0
Other Private Source	9	1.3	2	1.3	4	3.2	15	1.5
Communal Standpipe	68	9.5	11	6.9	3	2.4	82	8.2
Well	2	0.3	-	-	7	5.6	9	0.9
Rainwater Collector	-	-	-	-	4	3.2	4	0.4
Open Waterway	-	-	-	-	15	12.0	15	1.5
Total	715	100.0	160	100.0	125	100.0	1000	100.0

Data source: Questionnaire Survey of GAMA, 1991.

Table 2.1 shows the different sources of water supply for the metropolis as a whole, with indoor piping accounting for 35% whilst private standpipes and water vending account for 24% and 28% respectively of the sample of households interviewed. Virtually all of the households in Accra and Tema depend on the piped water system, either directly or indirectly. Tema District has the highest share with indoor piping as this is the norm in all the planned residential areas of Tema Township. In Ga, however, more than 20% of the households obtain their drinking water from rainwater collection or open waterways and wells.

Access to piped water is closely related to the degree of planning, but also to household wealth. As described in Chapter 1, households were divided into three wealth categories: low wealth (poor), medium wealth and high wealth (wealthy). Table 2.2 indicates the importance of household wealth in determining access to the best water supply system. Whereas 98% of wealthy households and 70% of medium-wealth households respectively have access to indoor piping, only 26% of all poor households have such a facility. About 33% of poor households rely on the water vendor as the principal drinking water source.

Table 2.2: Relationship Between Principal Source of Drinking Water and Household Wealth (%).

	Wealth Index of Household			
Source	**Low**	**Medium**	**High**	**All**
Indoor Piping	25.7	70.2	98.0	35.2
Standpipe (Private)	27.1	15.3	2.0	24.3
Water Vendor	32.9	8.4	-	28.0
Communal Standpipe	9.2	5.3	-	8.2
Others	5.1	0.8	-	4.3
Total	100	100	100	100
(N)	(818)	(131)	(51)	(1000)

Data source: Questionnaire Survey of GAMA, 1991.

2.3 Convenience of Access and Reliability of Supply

About 83% of all households in GAMA depend on shared water supply sources (including vendors), which not only can lead to the problem of queues, but in some cases may cause contamination problems. Some 20% of the households get their drinking water from sources they share with at least ten other households; usually sources open to the whole neighbourhood. The vendors, who serve another 28% of the households, also typically have a large number of customers. Reflecting the overall availability of piped water, households in Ga District were the most likely to have to share a water source with large numbers of other households, while high levels of sharing were relatively uncommon in Tema.

Table 2.3: Relationship between Household Sharing Same Water Supply and Wealth of Household in GAMA (%).

No. of Households	Wealth Index of Household Low	Medium	High	All
No Sharing (0)	9.0	39.9	76.6	16.2
1 - 2	6.6	15.6	23.4	8.6
3 - 4	13.9	13.3	-	4.9
5 - 7	8.5	7.7	-	8.0
8 - 10	6.1	3.1	-	13.6
Above 10	22.5	11.6	-	20.0
From Vendor	33.5	8.6	-	28.6
Total	100.0	100.0	100.0	100.0
(N)	(803)	(128)	(47)	(978)

Data source: Questionnaire Survey of GAMA, 1991.
N.B. This table excludes 22 households who did not respond to question on sharing.

Table 2.3 shows that whereas 77% of all wealthy households have exclusive use of their water supply, most poor households either share their source of water with at least ten other households or buy from vendors.

If one is to regard households within 100 metres of water source as having adequate supply of potable water then the bulk of the population within GAMA is adequately served with water, as Table 2.4 illustrates. As many as 54% of all households have access to water supply within their house compound, and only 5% have supply sources beyond 100 metres distance from home. Again, the best served district is Tema and the worst is Ga.

Table 2.4: Average Distance of Households from Water Source.

Distance from Home (metres)	District Accra		Tema		Ga		Total GAMA	
	No.	%	No.	%	No.	%	No.	%
In Home (0)	408	57.1	75	46.9	52	41.6	535	53.5
1 - 50	238	33.3	75	46.9	34	27.2	347	34.7
51 - 100	55	7.7	5	3.1	13	10.4	73	7.3
101 - 200	5	0.7	2	1.3	16	12.8	23	2.3
Above 200	9	1.3	3	1.9	10	8.0	22	2.2
Total	715	100.0	160	100.0	125	100.0	1000	100.0

Data source: Questionnaire Survey of GAMA, 1991.

Whilst all but 2 households within the high class residential areas (for definition see section 1.1.3) have in-house water supplies and only a small proportion within the medium class residential areas lack in-house supplies, all households whose water supply sources were beyond 50 metres from the house

were found in the low class residential areas. Even here, however, about 5% of all households had water sources beyond 100 metres from the house.

This gives the impression of adequate overall coverage. However, even short distances can lead to water supply deficiencies. Moreover, water supply in GAMA is often disrupted by the breakdown of obsolete equipment in treatment plants at the Weija and Kpong water works, which supply the bulk of potable water to the metropolis. The present estimated water demand for Accra and Tema, excluding the fast growing Ga District, is 76 million gallons per day (MGD) as against the actual estimated production of 60 MGD (Table 2.5). According to the management of the Ghana Water and Sewerage Corporation (GWSC), an additional 30% of total production is lost through leakages. Supply is particularly erratic and precarious for the low pressure zone in the western parts of Accra served by the old Weija Water Works.

Table 2.5: Water Production at the Weija and Kpong Treatment Plants.

Treatment Plant	Installed Capacity MGD	Actual Production MGD	Remarks
A. Weija			
New Works	15.00	15.00	Candy Plant
Bamag	4.00	3.00	broken down
Candy	8.00	0.00	since 1986.
Weija Sub-total	27.00	18.00	
B. Kpong			
New Works	40.0	35.6	1.2MGD is
Old Works	10.5	6.75	supplied daily to Akwapim Ridge.
Kpong Sub-total	50.5	42.35	
Grand Total	77.5	60.35	

Data source: Data compiled for study by GWSC, Accra, 1992.

The worst affected areas include Dansoman Housing Estates, South Odorkor, Bubuashie, and Darkoman to the West, and Teshie-Nungua Housing Estates to the East. In addition most new housing estates and high density low class areas in Ga district, such as Madina, also suffer acute water shortages. This is aggravated in the dry season when the only available source of water for household use, gardening, washing of cars, etc., is the GWSC system.

Data from the questionnaire survey tend to support the observation that the water supply from the GWSC system is unreliable and irregular. About 66% of households indicated a regular daily interruption of their principal drinking water supply. These reported interruptions were widespread in the metropolis, affecting neighbourhoods in low, medium and high class residential areas alike. They also arise throughout the year: most of the households (91%) who reported interruptions indicated that they occurred in both the wet and dry seasons. The problem is particularly severe in the dry season, however, especially for residents within the Ga District where some communities rely on natural sources such as streams, rainwater harvesting and shallow wells.

Owing to the unreliability of water supply, the practice of water storage is widespread even among households who have indoor piping. In addition to the inconvenience, this creates a danger of contamination.

The source of water supply, the number of households sharing water, the distance to source and supply interruptions are all dimensions of water availability and ease of access. Most of these factors are also related to water quality. Evidence from the bacteriological quality of drinking water (see below) suggests that although water quality from the piped system is generally good, it is often contaminated due to poor storage and handling practices by households.

2.4 Water Storage and Handling Practices

Most landlords and housing agencies who build in high and medium class residential areas provide overhead tanks or other relatively efficient storage facilities in the houses they construct. Especially in the low class residential areas with inadequate service facilities, individual households have devised coping strategies by providing their own small storage containers such as barrels, pigfeet containers, jerrycans, pots and buckets of various sizes. The high incidence of water storage is confirmed by the survey data; about 96% of all households within GAMA stored water (Table 2.6).

Table 2.6: Practice of Water Storage in the Metropolis.

District	Response					
	No		Yes		Total	
	No.	%	No.	%	No.	%
Accra	32	4.5	683	95.5	715	100.0
Tema	2	1.3	158	98.8	160	100.0
Ga	9	7.2	116	92.8	125	100.0
Total GAMA	43	4.3	957	95.7	1000	100.0

Data source: Questionnaire Survey of GAMA, 1991.

The most common storage container is the engine oil drum or barrel, followed by the bucket, the pigfeet container, the jerry can, the overhead water tank and the pot in descending order of importance. Table 2.7 shows that whereas the overhead tank tends to be the predominant means of water storage among the wealthy households, the barrel is popular among poor and medium income groups.

Table 2.7: Relationship Between Type of Storage Container Used and Household Wealth in percentages.

Container (typical size)	Wealth Index of Household Low	Medium	High	All
Overhead Tank (2,250)	2.6	16.3	48.9	6.6
Barrel (225 litres)	48.6	48.0	25.5	47.4
Pig Feet Container (45 litres)	15.0	15.4	12.8	15.0
Jerrycan (22.5 litres)	8.4	9.8	8.5	8.5
Pot (13.5-100 litres)	6.3	3.3	-	5.6
Bucket (13.5-18 litres)	19.2	7.3	4.3	16.9
Total	100.0	100.0	100.0	100
(N)	(778)	(123)	(47)	(948)

Data source: Questionnaire Survey of GAMA, 1991.

About 43% of all households had to carry water to their homes, using such rudimentary methods as head portage and hand carriage. The hygiene practices surrounding water portage is poor as most people use open buckets and containers to convey the water.

Although 83% of households in the metropolis had their water stored in closed containers, a significant number of these (i.e. 28%) kept these containers outside. Only 17% of households storing water used open containers. The use of closed water containers was related to the educational status of the principal homemakers. For example, whereas only 76% of principal homemakers with no formal education stored water in closed containers, 83% of those with only some elementary school education, 88% of those with some secondary education, and 94% of those with post-secondary education stored water in closed containers.

Given the high incidence of water storage discussed above, and irregular washing of storage containers (Table 2.8), one would anticipate significant in-house water contamination. However, the practice of boiling water or filtering before drinking is negligible. About 90% of all households interviewed drank their water without boiling or filtering it (Table 2.9). The only neighbourhoods where a majority of the respondents boiled or filtered their water were the high class residential areas of Airport and Ringway Estate, which have a high concentration of foreign embassy staff and top business executives. Even among the 24 households using wells or open waterways, only 5 boiled or filtered the water prior to drinking (indeed, almost half of the households boiling or filtering water had in-house piping).

Table 2.8: Frequency of Cleaning of Storage Containers by Households.

Cleansing Frequency	District Accra		Tema		Ga		GAMA Total	
	No.	%	No.	%	No.	%	No.	%
Daily	297	43.5	64	40.5	32	27.8	393	41.0
Weekly	278	40.8	54	34.2	64	55.7	396	41.5
Monthly	60	8.8	14	8.9	9	7.8	83	8.7
Rarely or Never	47	6.9	26	16.5	10	8.7	83	8.7
Total	682	100.0	158	100.0	115	100.0	955	100.0

Data source: Questionnaire Survey of GAMA, 1991.

Table 2.9: General Practice of Water Boiling or Filtering Before Drinking by Households.

District	Response No		Yes		Total	
	No.	%	No.	%	No.	%
Accra	635	88.8	80	11.2	715	100.0
Tema	154	96.3	6	3.8	160	100.0
Ga	113	90.4	12	9.6	125	100.0
Total GAMA	902	90.2	98	9.8	1000	100.0

Data source: Questionnaire Survey of GAMA, 1991.

Most households failed to boil their water because of the popular perception that overall water quality was good. Even when they perceived an inadequacy in the water quality, they generally did not care, perhaps implying a lack of understanding of the health risks involved. Few people indicated time or fuel cost/scarcity as being the constraint for the low practice of water boiling or filtering.

Drinking water directly from rivers, streams and other waterways was, on the other hand, relatively rare, even among children. Only three per cent of the respondents said their children drank regularly from such sources, whilst about five per cent said they did occasionally. These children were mainly found in deprived communities in the peri-urban and rural fringe areas in Ga and Tema Districts. The worst affected communities are Danfa and Amasaman in Ga District. In Accra district, it was mainly children of poorly educated slum dwellers who occasionally drank water from such sources.

2.5 Water Utilisation Patterns

Unlike some cities with well-planned neighbourhood utility services, such as bath houses, the metropolitan area in general lacks such public bathing facilities, and the few that existed in the past have fallen into disrepair. A few commercial shower units have started developing: some were noted in the low class residential area of Sabon Zongo in Accra and Tema New Town in Tema. Overall, for the low class

residential zones which lack indoor piping, the practice of water utilisation at site whether for drinking, bathing, cooking, washing or other uses was negligible.

Although the practice of drinking ice water and ice-kenkey from unhygienic ice-water sellers is popular in commercial, industrial and other workplaces, very few of those without regular in-house water supply drank water at the point of water collection. Bathing and washing at the water source was limited to the rural fringe zone in Ga District especially in the most deprived and isolated communities such as Oyarifa, Danfa and Old Ofankor.

2.6 Water Payments

Since the inception of Ghana's Economic Recovery/Structural Adjustment Programme, the prevailing ethos has been the removal of subsidies from all services including water. The cost recovery measures for water use have meant the very regular revision of water tariffs upwards. At the time of the survey, for metered premises the rates vary from 741 for the first 3,000 gallons per month (equivalent to 247 cedis per thousand gallons if the full 3,000 was consumed) to 814 cedis per thousand gallons consumed in excess of 10 thousand gallons per month. Unmetered premises were charged a flat rate of 741 cedis per house per month. Those who rely on public stand pipes were charged a flat rate of 247 cedis per house per month. For residents who rely on boreholes, wells and hand pumps a flat monthly charge of 146 cedis was levied per house. More recently, these rates have increased by between 27 and 161%.

About 90% of households in the metropolis had to pay for water. The bulk of GAMA's population, however, was unmetered and had to pay by the bucket to water vendors or a fixed monthly rate to GWSC. For the metropolis as a whole only 38% of households who paid for water use lived in metered premises (Table 2.10).

Table 2.10: Mode of Water Payment among Households Paying for Water.

Mode of Payment	Accra		Tema		Ga		Total GAMA	
	No.	%	No.	%	No.	%	No.	%
Fixed Monthly Rate	117	18.9	48	31.4	19	20.0	184	21.2
Metered	254	41.1	39	25.5	37	38.9	330	38.1
Bucket	239	38.7	64	41.8	39	41.1	342	39.5
Other Container	4	0.6	-	-	-	-	4	0.5
Pay for Each Use	4	0.6	2	1.3	-	-	6	0.7
Total	618	100.0	153	100.0	95	100.0	866	100.0

Source: Questionnaire Survey of GAMA, 1991.

As a result of the widespread practice of water vending in low income areas, about 40% of all households who paid for water use did so on a daily basis. Each buyer pays five or ten cedis per bucket, indicating an average cost of roughly one cedi per gallon. This is well above the price for households purchasing water directly from the utility. A metered or unmetered household using 3,000 gallons per month, or a household collecting a 1,000 from a public standpipe, paid a quarter of this rate. The cost of purchasing water from a vendor could easily come

to 10% of the monthly income of a low income household. This almost certainly serves as a constraint on the amount of daily water use.

Also, while the graduated tariff may serve to dissuade some wealthy households from using water carelessly, it can also be a burden on households who share water meters. The survey results indicate that more than three out of four metered connections used by poor households are shared, while sharing is an exception among wealthy households. Thus wealthy households can consume considerably more water before falling into the high tariff blocks.

Table 2.11 illustrates the close relationship between the wealth of households and the mode of payment for water, establishing the case that the poorest groups are having to pay by the bucket to water vendors.

Table 2.11: Relationship Between Wealth Status of Household and Mode of Water Payments (%).

	Wealth Index of Household			
Mode of Payment	**Low**	**Medium**	**High**	**All**
Fixed Monthly Rate	22.4	16.2	15.2	21.2
Metered	29.2	74.8	84.8	38.1
Bucket	47.0	8.1	-	39.5
Other Container	0.7	-	-	0.5
Pay for each Use	0.7	0.9	-	0.7
Total	100.0	100.0	100.0	100.0
(N)	(708)	(108)	(46)	(866)

Data source: Questionnaire Survey of GAMA, 1991.

Households with a sewerage connection have to pay a 35% surcharge. From January 1992, a surcharge of 3% has been added for the public use of water for fire fighting and for the promotion of rural water development. Only about 10% of total households who paid for water indicated that they were aware of an additional service charge for sewerage connection. These are principally in the planned main township of Tema and the high to medium class residential areas in Accra District.

According to the GWSC, most residents in the metropolis do not want to pay for water services. Among the reasons are the following:

- Consumers subject to supply interruptions may feel they should not have to pay. Residents do not seem to appreciate that with inadequate funds for operational expenses, it is difficult for the GWSC to provide a reliable service.
- Consumers can fall back on neighbours or even a tanker service in the event of a disconnection for non-payment of water bills.
- Consumers in the high class residential areas, living in fenced in bungalows with guard dogs, may feel that no one should dare to enter and demand payment, let alone attempt disconnection, and;
- In rural areas in particular, people may have become accustomed to the notion that water is free, and hence be unwilling to pay.

Also, as the GWSC puts it, "sight should not be lost of some consumers' inability to pay even at below economic rates. The percentage of payment to the earnings of the average income earner significantly affects his decision to pay for water consumed as well as to meet other pressing commitments. Faced with this dilemma, the consumer becomes apathetic to the need to pay. All these factors hamper the flow of revenue to the producer and consequently the cost recovery as well." (GWSC Materials provided for study, 1992).

Given the widespread practice of unhygienic storage and handling of water, the virtual absence of water boiling or filtering and the use of dubious water sources by some households, it is not enough to focus on bringing "water to the tap" what is happening "between tap and mouth" may also be critical (Lindskog and Lundqvist, 1989, p. 16). The evidence from the physical tests of water quality described below tends to support this view.

Table 2.12 illustrates the strong association between principal source of drinking water and self-reported prevalence of childhood diarrhoea among households with children under six. The location of the water source also displays a close association: the two-week prevalence of childhood diarrhoea among households with children was only 7% if the water source was within the house, in contrast to a prevalence of 20% among households who had their water source located outside the house compound. Even among poor households with water in the house compound, the diarrhoea prevalence was low (7%). This has potentially important implications for health policy, as it indicates that the provision of standpipes within compound housing units, which is less costly than in-house piping, may have similar health benefits.

Table 2.12: Relationship Between Drinking Water Source and Prevalence of Diarrhoea in Children Under Six.

Water Source	Number of households with children <6 yrs	% two-week prevalence of diarrhoea
Indoor Piping	162	6.8
Private Standpipe	139	14.0
Water Vendor	165	10.1
Communal Standpipe	50	42.0
Others	21	14.3
Total	537	13.8

Data source: Questionnaire Survey of GAMA, 1991.

2.7 Bacteriological Examination of Drinking Water Supply

Tests were conducted to determine the levels of both faecal coliform and faecal streptococci in the water households drink. Where possible, samples were taken from both the households' water sources and their storage containers. All together, samples were taken from 199 households.

The detection of faecal coliforms (F.C.) in water is confirmatory evidence of faecal pollution of human or animal origin. It is among the most reliable indicators of excretal contamination of water. Apart from contamination from excretal material, F.C. are rarely found naturally in soil, vegetation or water. High counts indicate heavy and recent pollution, low counts slight or relatively remote

pollution. The absence of F.C., however, is not an absolute indication that the supply is free from F.C., as the coliforms die out rather rapidly in water.

Chlorinated drinking water supplies should ideally contain no faecal coliform (WHO, 1984). However, it is sometimes argued that such standards can be too rigorous and impractical to follow, and lead to an overemphasis on water quality in circumstances where it is the lack of water which is more detrimental to public health (Cairncross, 1990). In unchlorinated supplies such as boreholes and hand-dug wells, F.C. should not exceed 3 organisms/100ml of sample, according to WHO guidelines.

Faecal streptococci (F.S.) are unlikely to multiply in water, but may also die out less rapidly than F.C. They may therefore be used to confirm remote pollution of faecal origin (Kenner, 1978). They tend to persist in water even after chlorination (WHO 1984).

The results of the household water tests are summarised in Table 2.13-2.15. The following discussion examines first the contamination at the households' water sources (principally tap water), and then the contamination of the water in household containers.

Table 2.13: Counts of Faecal coliforms and Faecal streptococci per 100 ml water (Households grouped according to Class of Area).

1. Low Class Areas	**Tap**		**Container**	
	Faecal coliforms	Faecal streptococci	Faecal coliforms	Faecal streptococci
n	98	98	129	129
mean	2.6	28.4	32.6	338.2
standard deviation	16.3	83.4	34.0	297.5
minimum	0	0	0	1
maximum	150	620	160	1480
% contaminated	13	76	88	100
2. Middle and High Class Areas				
n	38	38	20	20
mean	0.02	27.8	14.8	144.9
standard deviation	0.2	48.3	17.1	152.5
minimum	0	0	0	12
maximum	1	160	53	430
% contaminated	3	39	75	100

Table 2.14: Bacteriological Results (District Level).

1. Accra District	**Tap**		**Container**	
	Faecal coliforms	Faecal streptococci	Faecal coliforms	Faecal streptococci
n	110	110	113	113
mean	2.3	26.7	30.9	261.5
standard deviation	15.4	82.4	35.2	241.8
minimum	0	0	0	1
maximum	150	620	160	1280
% contaminated	12	66	85	100
2. Tema District				
n	18	18	18	18
mean	0.06	29.5	27.1	604.3
standard deviation	0.2	27.4	22.5	452.9
minimum	0	0	0	70
maximum	1	82	66	1480
% contaminated	6	94	83	100
3. Ga Rural District				
n	8	8	18	18
mean	0	47.8	28.6	339.2
standard deviation	-	29.3	25.6	177.9
minimum	0	5	1	54
maximum	0	90	84	580
% contaminated	0	100	100	100

Table 2.15: Bacteriological Results (GAMA).

4. Total GAMA	**Tap**		**Container**	
	Faecal coliforms	Faecal streptococci	Faecal coliforms	Faecal streptococci
n	136	136	149	149
mean	1.9	28.3	30.2	312.3
standard deviation	13.9	75.1	32.8	289.6
minimum	0	0	0	1
maximum	150	620	160	1480
% contaminated	10	71	87	100

Data source: Tests undertaken for this study.

2.7.1 Bacteriological Quality of Household Water Sources

Nearly 56% of the taps sampled in the GAMA during the survey were in house compounds. The others were typically outdoor standpipes, either private or public. Households which had no in-house supplies and had no free access to standpipes, purchased water from private standpipes (water vendors).

Water supplies from the GWSC treatment plants are regularly tested and generally found to be of good quality and bacterial-free. Therefore, the presence of faecal bacteria in the water source suggests contamination within the distribution system.

As indicated in Table 2.13, about 13% of the 98 taps sampled in Low Class Areas exceeded the WHO guideline of 0/100ml for F.C. Only one of the 38 samples in the Middle-and-High Class areas exceeded this guideline. Chi-square values indicate that if the extent of contamination were the same in Low Class and

Medium-and-High Class Areas, such differences would be unlikely (pr. < 07) to arise in the samples. Moreover, there are good reasons to expect the water quality to be lower in poor areas of GAMA. Illegal and improperly fitted connections, breakages and loose joints of pipes which run through cesspools and gutters cause local contamination of water supply. These are normally found in the low income and economically depressed areas. F.C. counts ranged from 0 to 150/100ml in tap samples for supplies in the Low Class Areas (Table 2.13). Specifically, some taps in Accra New Town, Nima and Maamobi neighbourhoods had F.C. counts greater than the recommended levels. F.C. counts in 13 samples from Accra New Town ranged from 0 to 6/100ml with a mean count of 2. Nima had the worst water quality, with a range of 0 to 150, and a mean of 37 counts among the 10 samples. In Accra District as a whole, 12% of tap water samples exceeded the guideline for F.C. levels, as compared to 6% in the Tema District.

Faecal streptococci counts were considerably higher than the faecal coliform levels. Samples from Sabon Zongo, Nima and Maamobi contained particularly high counts of F.S. The mean F.S. levels were of the same order of magnitude in the Accra and Tema District. The mean count of 48 in the Ga District was considerably higher than that of the other Districts. The supplies in the Ga district are however unchlorinated. The highest count of 620/100ml was obtained for a supply in the Accra District, as compared to maximum counts of 82 and 90 in the Tema and Ga Districts respectively (Table 2.14).

Overall, 10% of the tap water samples in GAMA exceeded the WHO faecal coliform guideline and 71% exceeded the guidelines on faecal streptococci (Table 2.15).

Groundwater and Pond (Ga Rural District)

A hand-dug well and a pond were sampled at Oyarifa and Danfa respectively, both in the Ga district. The well had a F.C. value of 1/100ml and a F.S. count of 470/100ml. F.C. count for the pond was 16/100ml while the F.S. level was 480/100ml.

'Ice-water' vendors

Two surveys were specifically carried out on the quality of 'ice-water' which is sold all over the metropolis. In most market places and bus stations, 'ice-water' vendors sell cold drinking water during the day. Blocks of ice are put in water contained in ice-boxes or pots for cooling. The chilled water is dispensed with aluminium or plastic cups from the pots or packaged in thin cellophane bags for sale.

In the first survey, faecal coliform and faecal streptococci numbers were determined. In the second survey total coliform, F.C. and F.S. counts were carried out. No F.C. were detected on either occasion. There were however significantly large counts of total coliforms and F.S., as indicated in Table 2.16. Indeed, the levels of F.S. were so high as to warrant further investigation.

Table 2.16: Bacterial concentration of drinking water from 'Ice -water' vendors.

counts/ 100 ml	Total coliform		Faecal coliform		Faecal streptococci	
	No.	%	No.	%	No.	%
0	0	0	42	100	0	0
1 - 10	5	22	0	0	0	0
11 - 100	18	78	0	0	14	33
101 - 1000	0	0	0	0	28	67
Total	23	100	42	100	42	100

Data source: Tests undertaken for this study.

When organisms of the coliform group other than faecal coliforms are detected in a water sample, the presence of faecal streptococci is sufficient confirmatory evidence of faecal contamination. Also the presence of coliform organisms in a water sample may indicate past faecal contamination at a time long enough ago to allow F.C. to die out.

The faecal contamination of 'ice-water' clearly originates from sources outside the consumers' households, and is therefore likely to be a greater health risk. Assuming the tap water used by the ice-water vendors is of a quality comparable to that used by most households, the deterioration probably arises during the filling and dispensing of the containers.

2.7.2 In-House Water Contamination

In a study of water contamination and infantile diarrhoeal diseases in the Philippines, VanDerslice et al. (1991) stressed the need to improve the quality of water at the household's water source, rather than eliminating in-house contamination. Among householders already in close contact with each other, there are a variety of non-water-borne routes. Exposure to pathogens harboured by other household members through in-house water contamination is, therefore, less likely to be critical. Such considerations may apply in Accra. A higher level of in-house than at-tap contamination does not necessarily imply that in-house contamination plays a greater role in the spread of diarrhoeal disease. In-house contamination should not be entirely discounted, however. Indeed, in areas where children are likely to drink from other households' water sources, even the distinction is questionable.

Generally, as indicated in Table 2.15, water samples from storage containers were found to be more contaminated with faecal bacteria than running water from taps. In-house contamination was estimated by finding the difference between 83 paired samples of source water and stored water. The level of in-house contamination was approximated to be the difference between faecal bacteria in stored water and source water. The cumulative effect of in-house or intra-family contamination of stored water is most likely to be reflected by the increase in bacterial counts. Bacterial regrowth during water storage was assumed to be negligible at the time of sampling. Levels of in-house contamination are shown in Table 2.17. Five households in GAMA showed a decrease in bacterial concentrations, which may indicate bacterial die-off or changes in the quality of the

tap water between the time of collection for storage and the time of sampling. About 78% of stored water samples had net increases.

Table 2.17: Levels of in-house water contamination in GAMA.

Change in F. *coliform*	N	%
Net Decrease		
-100 to -10	2	2.4
-10 to -1	3	3.6
Total net decrease	5	5.8
No change		
	12	14.5
Net Increase		
1 to 10	13	15.7
10 to 100	49	59.0
100 to 1000	4	4.8
Total net increase	67	78
Total Observation	86	100.0

Data source: Tests undertaken for this study.

There are a number of possible sources of contamination. The results of a small questionnaire survey (199 households) indicate that the majority of households (91.6%) use dipping cups. (The use of ladles accounts for 3%.) The high incidence of the multiple use of dipping cups within households could explain the high in-house bacterial contamination and possible cross-contamination across family members. Furthermore, to the extent that people, and perhaps children in particular, visit and drink water in other homes, the contamination could spread disease among households in the neighbourhood. Dirty surroundings and poor personal hygiene could itself contribute to contamination of dipping cups. About 75% of the 199 households surveyed in GAMA kept their dipping cups in their rooms. As described below, about 5% of the principal homemakers in GAMA never wash their hands with soap and about 50% only washed their hands with soap one to three times a day. The survey revealed poor hygiene practices in the low income neighbourhoods where all the households which did not wash their hands with soap even once a day were identified.

Buckets are mostly used for collection of water either from public standpipes or from water vendors. The risk of contamination is high because buckets are used for bathing and other household chores.

Box 2.1: Water and Wealth

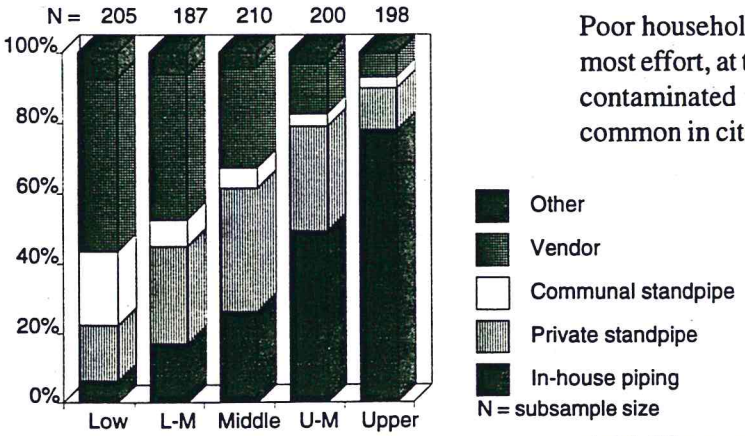


Figure 2.1: Principal drinking water sources in Accra by wealth group

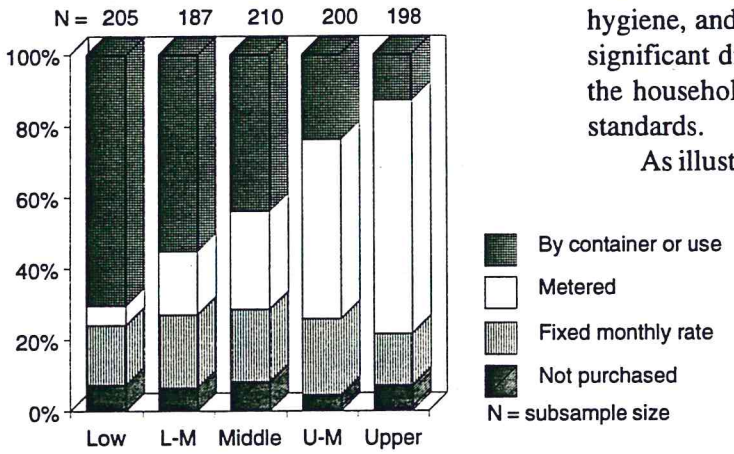


Figure 2.2: Distribution of households by mode of water payment in Accra by wealth group

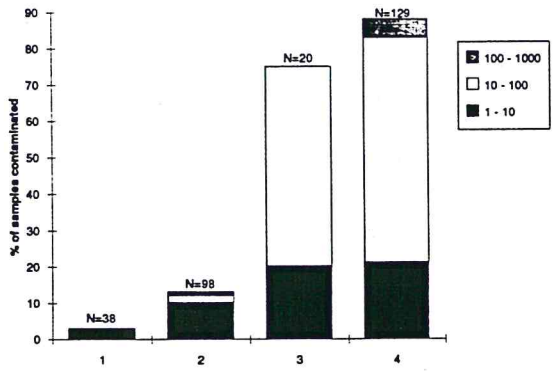


Figure 2.3: Faecal coliform contamination levels at tap and in storage by wealth groups

Data source: Questionnaire survey and physical tests, Accra, 1991.

Poor households in GAMA get the least water, with the most effort, at the highest price, and it is more likely to be contaminated too. This phenomenon, probably all too common in cities where everyone depends on piped water but only the relatively wealthy can afford home connections, is clearly illustrated in these diagrams.

Figure 2.1 portrays the shifts in drinking water sources as one moves from the poorest 20% of households on the left, through the intermediate wealth quintiles, to the wealthiest 20% on the right. The poorer households use sources which are inherently less convenient, and typically involve fetching water to the home. There are strong indications that these households are not getting enough water to practice good hygiene, and that it is affecting their health. There are significant differences even among the poorest 80% of the households, all of which are poor by international standards.

As illustrated in Figure 2.2, these shifts also involve changes in the way water is paid for, with poorer households paying by container or by use, and wealthier households paying monthly bills for metered water. Poor households find it difficult to pay relatively large lump sums once a month, and are better able to make the small payments involved in purchasing by container or use. But the price per litre for metered water is often less than half that for vendor water.

Compounding these problems, water from taps in the low-wealth areas were more often found to be contaminated than in medium to high wealth areas, as illustrated in Figure 2.3. This could be due to the inadequate *ad hoc* piping which local residents sometimes lay. In all areas the samples from storage containers were considerably worse than from the tap, indicating the importance of household hygiene.

Code:
1 - Tap in medium-high wealth area
2 - Tap in low wealth area
3 - Storage container in medium-high wealth area
4 - Storage container in low wealth area
N - Subsample size

Note: The wealth groups employed in these diagrams are based on the same wealth index employed in the rest of the report. However, rather than three unequal groups (the poor majority, a small wealthy elite, and a somewhat larger medium-wealth group), five groups of roughly equal size have been created for the graphical presentation.

CHAPTER THREE

3 SANITATION FACILITIES

3.1 Introduction

Sanitation management is closely linked to potable water supply, and is also an important facet of the household environment, with important health implications (Esrey and Habicht, 1986). This chapter addresses access to sanitation facilities, prevalence of outdoor defecation and hygiene behaviour. The disposal of sullage or grey water is also briefly discussed.

3.2 Access to Sanitation Facilities

Of the three community water-borne sewerage systems in the country, two are in Tema and Accra Districts, within the Metropolitan Area. In Accra District there is a central sewerage system which was designed in 1971 and intended for the Accra and Tema townships and their future extensions. Due to lack of funds, only the first phase was constructed and this is known as the Central Accra Sewerage System and is under the management of the Ghana Water and Sewerage Corporation (GWSC). As of the end of the first quarter of 1992, there have been 482 connections consisting of the following:

- 187 commercial properties,
- 166 domestic properties,
- 15 industrial properties, and
- 114 institutional and public services.

Since the Central Accra Sewerage System falls within the Central Business District of Accra, together with some densely populated inner city residential areas, the layout has been deliberately made to pick up flows from about 40 public toilets in the area. Due to lack of awareness of the existence of such a facility, coupled with high connection fees, there are not as many connections as anticipated in the design. Prospective connectors to the system are further dissuaded by the surcharge of 35% of the monthly water bill for sewerage services. This creates low flows and subsequent sewer maintenance problems (GWSC, documents compiled for current study, 1992).

Other para-statal organisations provide even more limited sewer systems and treatment plants in various parts of Accra. These are restricted to Teshie-Nungua, Labone and Dansoman Estates, military barracks, hospitals, ministries and the University of Ghana. These systems together serve only a privileged few in the high and medium class residential areas.

By contrast, the planned township of Tema within Tema District has a modern sewerage system which has continued to expand to new housing developments. This however, excludes Tema New Town, the squatter settlement of Ashiaman and other outlying settlements within the district. Ga District has no sewerage system. Consequently the range of sanitation facilities is quite diverse, depending on the community or neighbourhood character.

Table 3.1 below shows the proportions of households served by different types of toilet facility. In the metropolis as a whole, about 35% are served by flush toilet facilities. (Flush-sewered and flush septic tanks are classed together because of the confusion respondents sometimes made between the two.) The more common facilities are the pit latrines, which together serve about 40% of the population.

About one in four pit latrine users reported that they were using Kumasi Ventilated Improved Pit (KVIP) latrines, which are pit latrines with an improved design being promoted as an alternative to the pan latrines. Almost 20% of the households still used pan or bucket latrines, which must be emptied frequently, typically through a hatch in the outer wall of the toilet. Three per cent of the respondents claimed to have no access to any toilet facility.

Table 3.1: Distribution of Households by Type of Toilet Facility.

Type of Toilet	District Accra		Tema		Ga		Total GAMA	
	No.	%	No.	%	No.	%	No.	%
No Toilet	11	1.5	6	3.8	13	10.4	30	3.0
Flush Toilet	240	33.6	91	56.9	24	19.2	355	35.5
Pit Latrine	232	32.4	26	16.3	52	41.6	310	31.0
KVIP Latrine	59	8.3	33	20.6	12	9.6	104	10.4
Pan Latrine	170	23.8	4	2.5	21	16.8	195	19.5
Other	3	0.4	-	-	3	2.4	6	0.6
Total	715	100.0	160	100.0	125	100.0	1000	100.0

Data source: Questionnaire Survey of GAMA, 1991.

Whereas 98% of all wealthy households had access to flush toilet facilities, 68% and 26% of medium income and poor households respectively benefited from such facilities. The most popular single facility for the poor is the standard pit latrine, as 36% of the poor depended on it (Table 3.2). About 22% of the poor were using pan latrines, which are not only considered to be sub-standard for the households themselves, but degrading for the collectors.

Table 3.2: Relationship Between Type of Toilet Facility and Household Wealth (%).

Type of Toilet	Wealth Index of Household Low	Medium	High
Flush-sewered	12.3	35.9	49.0
Flush-septic	14.1	32.1	49.0
Pit Latrine	35.8	12.2	2.0
KVIP	12.1	3.8	-
Pan Latrine	22.1	10.7	-
Other	0.7	-	-
No Toilet	2.8	5.3	-
Total	100.0	100.0	100.0
(N)	(818)	(131)	(51)

Data source: Questionnaire Survey of GAMA, 1991.

Table 3.3 shows the relationship between the type of toilet facility and the self-reported prevalence of childhood diarrhoea (two week recall) among households with children under six.

Table 3.3: Type of Toilet Facility and Prevalence of Diarrhoea in Children Under 6 (%).

Type of Toilet	Number of Households with Children <6 yrs	% prevalence of diarrhoea
Flush Toilet	164	6.7
Pit Latrine	175	15.4
KVIP Latrine	66	21.2
Pan Latrine	113	16.0
No Toilet	17	11.8
Total	535	14.0

Data source: Questionnaire Survey of GAMA, 1991.

The low-cost facilities, including the potentially more hygienic KVIP latrines, are associated with a considerably higher diarrhoeal prevalence. It has been found that the KVIP technology, when used as a communal facility, often does not operate well, and many of those built for communal use have not been constructed according to standard. More generally, these results are at least as likely to reflect problems of maintenance and crowding as they are to reflect deficiencies inherent to the technologies themselves.

There is a high incidence of toilet sharing. Table 3.4 indicates that only 28% of households did not share their toilet facilities. By contrast, about 41% of the population within the metropolis relied on communal facilities open to the whole neighbourhood. Although most people using pan latrines also shared facilities, this was normally restricted to tenants within the housing unit.

Table 3.4: Number of Households Sharing Toilet Facility.

Number of Households Sharing	District Accra		Tema		Ga		Total GAMA	
	No.	%	No.	%	No.	%	No.	%
No Sharing	192	27.5	48	31.2	26	23.2	266	27.6
1 - 5	119	17.1	18	11.7	31	27.7	168	17.4
6 - 10	65	9.3	8	5.2	12	10.7	85	8.8
Above 10	45	6.5	6	3.9	4	3.6	55	5.7
Whole Neighbourhood	276	39.6	74	48.1	39	34.8	389	40.5
Total	697	100.0	154	100.0	112	100.0	963	100.0

Data source: Questionnaire Survey of GAMA, 1991.

About 33% of the households surveyed reported that they did not make regular payments for the use of the toilet, with the highest percentage in Ga District, where the enforcement of user charges is not as strict as for Accra and Tema Districts. In Accra and Tema, the households indicating free access to toilet

facilities were generally those with in-house flush toilet facilities. Many of these households have to pay for the removal of sewage from their septic tanks at the rate of about 7,000 cedis per trip made by the cesspool emptiers. Some 82% of households paying daily user charges spent between 10 to 60 cedis per day. This is the common practice in low class residential areas with public pit latrines and KVIPs. The most common charge is five cedis per use and another five cedis for paper to be used as anal cleansing material for those without their own paper. Households bringing human excreta in bowls may be charged a 20 cedis penalty.

3.3 Prevalence of Outdoor Defecation

Insufficient communal facilities can lead to open defecation along beaches, drains and open spaces. Indeed, the results indicate that open defecation is closely related to the percentage of the population who rely on the pit latrine and the public KVIPs. It would seem that outdoor defecation is an outcome of long queues at communal toilet facilities as well as poor maintenance. These factors do not only pose inconvenience for users but also create a major public hazard.

About 35% of the population in the metropolis reported that there were times when household members found it inconvenient to use their regular toilets, and had to use an alternative site. Not surprisingly, such problems are more prevalent among the poor. For example, about 96% of all households who felt inconvenienced in the use of toilet facilities were poor. However, the Ga District, which lies in the peri-urban zone, had a value well below the average for GAMA, although is has the highest proportion of poor households (Table 3.5).

Table 3.5: Households Having had to Find Alternative Site Due to Problems Accessing or Using Regular Toilet by District.

District	No		Yes		Total	
	No.	%	No.	%	No.	%
Accra	464	66.0	239	34.0	703	100.0
Tema	82	53.2	72	46.8	154	100.0
Ga	85	76.6	26	23.4	111	100.0
Total GAMA	631	65.1	337	34.9	968	100.0

Data source: Questionnaire Survey of GAMA, 1991.

Of the households affected, a disproportionate number were households sharing toilets with more than five other households (Table 3.6). Indeed, more than three quarters of the households sharing communal toilets encountered such problems, compared to less than one in ten households with their own, unshared, toilet.

Table 3.6: Households Encountering Problems Accessing or Using by Level of Sharing.

Sharing	Number	Percentage
No Sharing	16	4.8
1 - 5	32	9.6
6 - 10	41	12.2
Above 10	29	8.7
Whole Neighbourhood	217	64.8
Total	335	100.0

Data source: Questionnaire Survey of GAMA, 1991.
Note: This table only includes households which encountered problems.

The most common reasons households gave for having to find another location to defecate were directly related to accessibility: of those affected, 56% mentioned that the toilet was sometimes out of order or locked-up, 47% that the queues were sometimes too long, and 45% that the toilet was sometimes locked (more than one response was allowed for). No other reasons were cited by more than a quarter of those households affected, with cost only mentioned by about 12%. A breakdown of the frequency of different responses in each district is provided in Table 3.7. In Accra, long queues were the most commonly cited reason, while in both Tema and Ga the toilets being out of order was cited more than twice as often as long queues.

Table 3.7: Reasons Given for Seeking Alternative Location for Defecation.

Circumstances	District Accra		Tema		Ga		Total GAMA	
	No.	%	No.	%	No.	%	No.	%
Children Don't Always Use Toilet	39	7.9	14	8.5	7	16.3	60	8.5
Out of Order	107	21.6	62	37.8	16	37.2	185	26.3
Night time	15	3.0	12	7.3	3	7.0	30	4.3
Cost	35	7.0	4	2.4	1	2.3	40	5.7
Early Morning	69	13.9	6	3.7	6	13.9	81	11.5
Queue too long	131	26.4	18	11.0	7	16.3	156	22.2
Locked up	100	20.2	48	29.3	3	7.0	151	21.5
Number of Responses	496		164		43		703	

Data source: Questionnaire Survey of GAMA, 1991.
Note: As some households gave more than one response, the percentages are not equal to the percentage of responding households. Only households saying they had had to seek alternative locations are included.

These problems quite clearly lead to open defecation, not only on the part of children, but also adults. Table 3.8 pertains only to those 30% of all households where adults are affected. About half report using other toilets, while most of the remainder admit to defecating in the open. (Of the households who indicated "other place", most would have used the bush or the "wrapper method" in which people defecate in polythene bags or paper which is then thrown in gutters or into

communal waste containers.) This may underestimate the extent of the problem, as under-reporting is common when people are questioned on practices known to be frowned upon.

Table 3.8: Place for Outdoor Defecation for Adults.

Place	District Accra		Tema		Ga		Total GAMA	
	No.	%	No.	%	No.	%	No.	%
On Land	19	9.7	27	36.5	12	34.3	58	19.0
River or Stream	2	1.0	-	-	1	2.9	3	1.2
Beach	45	23.1	7	9.5	-	-	52	17.1
Other Toilet	126	64.6	18	24.4	10	28.6	154	50.6
Other Place	3	1.5	22	29.7	12	34.3	37	12.1
Total	195	100.0	74	100.0	35	100.0	304	100.0

Data source: Questionnaire Survey of GAMA, 1991.
Note: Only includes households whose adults had encountered problems using regular toilet.

One would expect more open defecation among children, as their knowledge of personal hygiene and the need for privacy is lower. Yet it is precisely children who are most at risk because of their greater vulnerability. Moreover, children's faeces tend to create a higher health risk, due to a higher concentration of dangerous pathogens. For the metropolis as a whole, about 100 respondents (10%) reported that children in their neighbourhood frequently defecated outdoors and 263 respondents (26%) indicated that children sometimes practised open defecation (Table 3.9). In the majority of cases, this involved defecating on land (58%) or at a beach (13%). Low class residential areas were the most severely affected.

Table 3.9: Incidence of Outdoor Defecation by Children within the Neighbourhood.

District	Response Never		Sometimes		Regularly		Total	
	No.	%	No.	%	No.	%	No.	%
Accra	502	70.2	191	26.7	22	3.1	715	100.0
Tema	72	45.0	36	22.5	52	32.5	160	100.0
Ga	63	50.4	36	28.8	26	20.8	125	100.0
Total GAMA	637	63.7	263	26.3	100	10.0	1000	100.0

Data source: Questionnaire Survey of GAMA, 1991.

The two-week prevalence of childhood diarrhoea among the (145) households saying neighbourhood children at least sometimes defecate out-of-doors at the beach or on open land is 26%; more than three times the prevalence among households saying that children never defecate outdoors.

3.4 Hygiene and Hand washing Practices

Given the low amenity value of most neighbourhood environments, characterised by inadequate sanitary and solid waste disposal facilities, good hygiene is necessary if households (more especially women and children) are to reduce the environmental risks they are exposed to. And yet, as already indicated, access to water, which is vital for household hygiene, is far from satisfactory. Hand washing practices of the principal homemaker are used here as an indicator of hygiene. If one can expect open defecation to be under-reported, the opposite is true of hand washing. Respondents may sometimes describe the hand washing practices they believe they should follow, rather than those they actually do. The responses are therefore likely to fall somewhere between actual and desired practice on the part of the respondents.

Virtually all principal homemakers reported washing their hands with at least water at least once a day, and about 63% claimed to wash their hands more than seven times. A small percentage (5%) did not report washing their hands with soap even once a day, with the majority (63%) using soap between one and 4 times a day. Table 3.10 shows that low levels of hand washing were reported more frequently in Ga District, while high levels were most often reported in Accra District. The differences between types of neighbourhood are more striking. Only one of the fifty principal homemakers living in high class areas reported washing her hands less than five times a day, as compared to 14% in the low class areas. Moreover, all principal homemakers living in high class areas wash their hands with soap at least twice, whereas 13% of those in low class areas do not.

Table 3.10: Frequency of Hand Washing by Principal Homemaker by District.

Times/ Day	District						Total	
	Accra		Tema		Ga		GAMA	
	No.	%	No.	%	No.	%	No.	%
- 0 to 4	83	11.6	16	10.3	28	22.8	127	12.8
- 5 to 8	150	21.0	57	36.5	36	29.3	243	24.5
- 8+	480	67.3	83	53.2	59	48.0	622	62.7
Total	713	100.0	156	100.0	123	100.0	992	100.0

Data source: Questionnaire Survey of GAMA, 1991.

Two of the times when hand washing is critical are after defecation and prior to preparing food. The principal homemakers were asked at which times they always wash their hands. About 91% said they always washed their hands after using the toilet, while only 74% said they did before preparing food. Moreover, among those who did wash their hands, it was more common to use soap after using the toilet than before preparing food.

There is quite a close relation between diarrhoea prevalence and hand washing, particularly hand washing prior to food preparation. As indicated in Table 3.11, among households where hands were not washed before food preparation, the prevalence of diarrhoea was several times higher than among households where hands are regularly washed with soap and water. Hand washing, and indeed the use of soap, is less difficult when water is easily accessible, however. Thus, like many

hygiene practices, hand washing is likely to involve a combination of household norms and facilities.

Table 3.11: Hand washing Before Preparing Food and the Prevalence of Diarrhoea in Children Under 6.

Response	Number of Households with Children <6	Two week Diarrhoea Prevalence (%)
Doesn't Mention	132	22.1
Water	223	12.1
Water or Soap	105	12.4
Soap and Water	60	3.0
Total	520	13.7

Data source: Questionnaire Survey of GAMA, 1991.

As indicated in Table 3.12, the use of standpipes, especially public ones, was associated with low levels of hand washing whether or not the principal homemaker had received any formal education. Indeed, the differences in hand washing are more evident across households using different water sources than across education levels. It is often argued that water improvements should be accompanied by hygiene programmes to ensure the benefits of the water are fully utilised. These results suggest an alternative message may be equally valid: without better water supplies, improved hygiene awareness may prove ineffective.

Table 3.12: Percentage of Principal Homemakers Washing Hands Prior to Food Preparation by Education and Water Source.

Drinking Water Source	Level of Education: No Education		Level of Education: Some Education	
	Number of Respondents	Per cent Not Washing Hands	Number of Respondents	Per cent Not Washing Hands
Indoor piping	57	21.1	291	17.2
Vendors	102	21.6	171	22.2
Private standpipe	54	38.9	183	38.9
Public standpipe	27	55.6	54	40.7
Other	18	33.3	24	22.3
Total	258	29.5	723	24.9

Data source: Questionnaire Survey of GAMA, 1991.

While soap is not a large item in household budgets, its price is sufficiently high to influence some households. Also, toilets and kitchens in wealthy households are more likely to be designed to make hand washing easy. The results indicate that not only was hand washing less common among poor homemakers, but when they did wash their hands they were less likely to use soap. For example, among homemakers who washed hands prior to food preparation, only 41% from poor households at least sometimes used soap, as compared to 54% and 74% from

medium-wealth and wealthy households respectively. Table 3.13 illustrates the relation between wealth and hygiene even more clearly, using the example of hand washing after using the toilet. About 94% of principal homemakers from wealthy households washed their hands and at least sometimes used soap. Only 57% of poor households practised this good hygiene behaviour, although overall these values are higher for toilet use than for food preparation.

Table 3.13: Relationship Between Household Wealth Status and Hand Washing After Toilet(%).

Response	Wealth Index of Household Low	Medium	High
Doesn't always wash	9.5	10.2	-
Water only	32.1	15.0	5.9
Water or Soap and Water	29.4	40.2	39.2
Always Soap and Water	29.1	34.6	54.9
Total	100.0	100.0	100.0
(N)	(814)	(127)	(51)

Data source: Questionnaire Survey of GAMA, 1991.

3.5 Sullage and Storm Water Drainage

"Sullage or grey water is the liquid waste water discharged from domestic premises and consists of effluents from kitchens, bathrooms and laundries. Sullage is normally discharged into street drains or into soak-aways. The bulk of household water use becomes sullage. Even in those households with flush toilets it is estimated that sullage amounts to 60% of total water use" (Tahal, 1981, p. C.2-12). Table 3.14 illustrates the patterns of sullage disposal within the metropolis.

Table 3.14: Methods of Household Sullage (Grey Water) Disposal.

Disposal Practice	District Accra		Tema		Ga		Total GAMA	
	No.	%	No.	%	No.	%	No.	%
Same as Sewerage	11	1.5	20	12.5	11	8.8	42	4.2
Closed Separate drains	43	6.0	19	11.9	7	5.6	69	6.9
Open Separate drains	383	53.6	65	40.6	12	9.6	460	46.0
Nearby Waterway	44	6.2	-	-	6	4.8	50	5.0
Dumped in Street	87	12.2	5	3.1	35	28.0	127	12.7
Dumped in Yard	145	20.3	50	31.3	52	41.6	247	24.7
Other	2	0.3	1	0.6	2	1.6	5	0.5
Total	715	100.0	160	100.0	125	100.0	1000	100.0

Data source: Questionnaire Survey of GAMA, 1991.

Open separate drains were the principal means of sullage disposal among 46% of the households surveyed. The better methods, including closed separate drains

and sewerage or septic tanks, were hardly used. The least satisfactory methods of street and yard dumping account together for over 37% of household sullage disposal methods.

Table 3.15 shows the relationship between household wealth status and the means of sullage disposal available. Yard and street dumping were more commonly practised among poor and medium wealth households. To make matters worse, in low class residential areas and the slums, some of the open separate drains mentioned are nothing more than mere natural channels along which sullage flows from holes made through walls of buildings. This water often ends in a roadside ditch. Consequently, stagnant pools of water are common in these neighbourhoods.

Table 3.15: Relationship Between Household Wealth and Method of Sullage Disposal.

Disposal Practice	Low %	Medium %	High %	All %
Same as Sewage/Septic Tank	2.8	9.2	13.7	3.2
Closed Separate Drain	4.3	16.0	23.5	6.9
Open Separate Drain	46.0	42.7	54.9	46.0
Nearby Waterway	5.9	2.3	-	5.0
Dumped in Street	14.2	7.6	2.0	12.7
Dumped in Yard	26.4	21.4	5.9	24.7
Other	0.5	0.8	-	0.5
Total	100.0	100.0	100.0	100.0
(N)	(818)	(131	(51)	(1000)

Data source: Questionnaire Survey of GAMA, 1991.

As a result of the overall poor waste water disposal system, together with the fact that large areas lie in flood prone areas less than 20 metres above sea level, flooding has become common. As illustrated in Table 3.16, some of the more severe floods have caused serious damage and even loss of life.

Table 3.16: Major Flood Events in the Metropolitan Area.

Year	Damage caused
Accra District	
1963 floods	5 deaths and damage to property.
July 1973 floods	Extensive floods with 3 deaths and loss of property.
May 1986 floods	Loss of 3 lives, damage of property & telephone switching equipment worth US$10 million and loss of property of residents.
Tema District	
1. 1988 floods	Inundation of part of Tema Sewage. System and damage of property in communities.

Data source: Environmental Management Associates Ltd., 1989, p. 114.

Box 3.1: Sanitation Facilities and Wealth

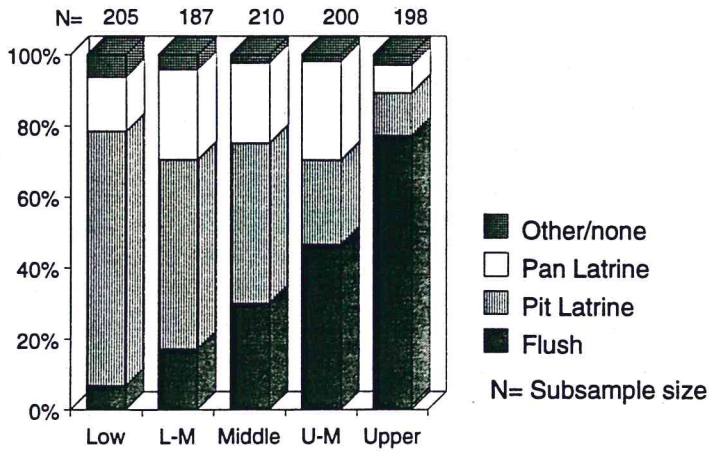


Figure 3.1: Distribution of households by type of toilet facility in Accra by wealth group

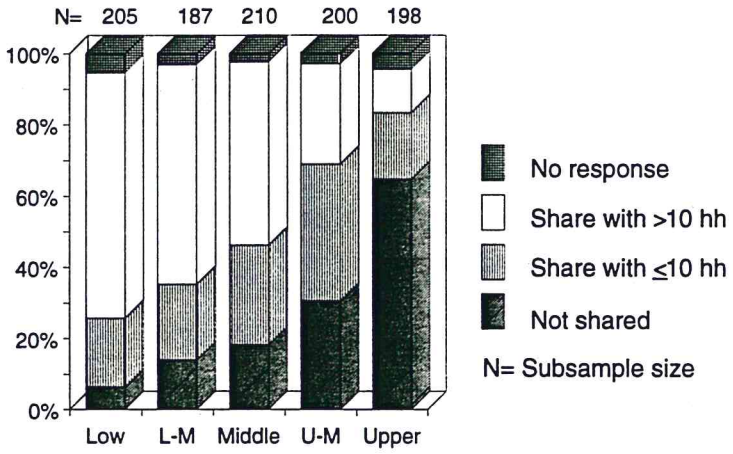


Figure 3.2: Distribution of households by number sharing toilet facility in Accra by wealth group (hh=households)

GAMA's overall profile of sanitation technologies is superior to that for most of Ghana, with more than a third of households having flush toilets. But as illustrated in Figure 3.1, sanitation technology is closely linked to wealth, and for GAMA's poor majority the flush toilets are largely irrelevant and communal pit latrines are the most common facility. Pit latrines of improved design (KVIP) are becoming increasingly common, but existing facilities are so overused that any technological advantage is lost.

As illustrated in Figure 3.2, most poor households shared latrines with more than ten other households. Almost two out of three households using communal facilities complained that there were times when the latrines were unusable because, for example, the queues were too long in the mornings or the latrines were simply out of order. In neighbourhoods with overcrowded sanitary facilities, children often practised open defecation. Not surprisingly, recent cases of diarrhoea were common among children in households using heavily shared toilets.

Data source: Questionnaire survey of Accra, 1991.

Note: The wealth groups employed in these diagrams are based on the same wealth index employed in the rest of the report. However, rather than three unequal groups (the poor majority, a small wealthy elite, and a somewhat larger medium-wealth group), five groups of roughly equal size have been created for the graphical presentation.

CHAPTER FOUR

4 SOLID WASTE DISPOSAL SYSTEMS AND PRACTICES

4.1 Introduction

This chapter is primarily concerned with refuse rather than night soil. However, owing to the sanitation problems of GAMA, night soil often finds its way into the refuse. Furthermore, night soil collection, like refuse collection, is the responsibility of the Waste Management Department. The collection and disposal of solid wastes and night soil deteriorated progressively from 1976, reaching a crisis in 1985. As a result, the entire city was "engulfed with refuse heaps, drains and gutters choked and public septic tank latrines over-flowing. In the homes, a similar situation also could be found with septic tanks of Water Closets discharging effluents freely into drains and compounds." (Chief Mechanical Engineer, Waste Management Department, 1992).

The problem of solid waste disposal, excluding night soil, may not have as serious health implications as the water and sanitation problems described in the previous two chapters, but has become one of the more intractable waste management problems. This problem developed with the economic crisis of the mid '70s and early '80s, as the public collection service declined due to:

- lack of funds for the acquisition of capital equipment and the operation of the services,
- regular breakdown of vehicles, plant and equipment,
- lack of adequate, trained and motivated personnel
- inappropriate management organisation.

With the establishment of the Waste Management Department in 1985, equipped and funded with German assistance, the problem started to be tackled. However, the Department "is still capable of collecting only 60% of the 900 tons per diem of refuse and about 300 tons of night soil." (Chief Mechanical Engineer, Waste Management Department, 1992).

4.2 Handling of Solid Wastes

4.2.1 Household-Level Storage and Disposal Practices

Residential domestic waste forms the bulk of all sources of solid waste produced in Ghanaian urban areas. These household solid wastes are known to have high densities with a high moisture content. The organic component of solid waste which is putrescible probably accounts for between 70-90% of the total refuse produced. Tins, cans and paper are probably responsible for about 5 to 10% of total waste produced (Songsore, 1992, p.13).

The first point at which solid waste can create problems is within the houses themselves. Table 4.1 below shows household-level waste storage practices. About 21% of all households within the metropolis did not store solid waste within the home, 42% stored in open containers and only 36% stored in closed containers.

Table 4.1: Waste Storage Practices within the Home.

District	Don't Store		Open Container		Closed Container		Total
	No.	%	No.	%	No.	%	No.
Accra	136	19.0	304	42.5	275	38.5	715
Tema	40	25.0	57	35.6	63	39.4	160
Ga	37	29.6	63	50.4	25	20.0	125
Total GAMA	213	21.3	424	42.4	363	36.3	1000

Data source: Questionnaire Survey of GAMA, 1991.

The Ga District had the highest incidence of both non-storage and storage in open containers, increasing the risk of attracting disease causing pests such as flies, cockroaches and rats. Among the wealth groups, it was the wealthy households who were most likely to use closed containers. Whereas 65% of all wealthy households stored their waste in closed containers, about 50% of medium income households and only 32% of poor households stored in closed containers. Non-storage, on the other hand, is similar in the different wealth groups.

The risks of increasing pest infestation through open waste storage are generally confirmed by the survey results. The enumerators observed more flies in the kitchens (or food preparation areas) of houses where solid waste was being stored indoors in open containers. Thus, many (>10) flies were observed in 38% of the such kitchens, but where waste was not stored or was stored in closed containers this percentage fell to 16% and 19% respectively. Similarly, households with open containers were significantly more likely to complain of rats or mice.

In contrast to indoor storage of refuse, outdoor storage is relatively rare, as house-to-house garbage collection is low. Only about 32% of all households stored wastes outside the home. Wealth was not significantly related to whether or not households stored waste outside, but again poor households generally used open containers while the rich more often used closed containers.

Closing waste containers is not generally expensive. In wealthy neighbourhoods there may be stronger social sanctions preventing open waste storage outside, and door-to-door refuse collection imposes certain standards. However, the fact that wealthy households also used more closed containers indoors also suggests a better understanding of safe waste storage practice.

The bulk of domestic waste finds its way to either unauthorised or authorised neighbourhood disposal sites where it is either collected or abandoned. Only a few households in the metropolis undertook final disposal of waste through burning or composting around the house. Just about 18% of households in GAMA burnt their refuse, 8% practised some composting, and a mere 5% buried their refuse.

4.2.2 Community Level Waste Management

The capacity to handle all of the household waste generated is still weak. About 83% of the population dumps their refuse in either authorised or unauthorised sites in their neighbourhood (Table 4.2). Waste dumping is most common in Accra District. This practice was not exclusive to the most run-down poor slum neighbourhoods, but was also found in medium and high class areas because of the overall poor coverage of waste collection service.

Table 4.2: Households Dumping Solid Waste in the Neighbourhood.

District	Response: No		Yes		Total	
	No.	%	No.	%	No.	%
Accra	96	13.4	619	86.6	715	100.0
Tema	43	26.9	117	73.1	160	100.0
Ga	29	23.2	96	76.8	125	100.0
Total GAMA	168	16.8	832	83.2	1000	100.0

Data source: Questionnaire Survey of GAMA, 1991.

The waste was typically dumped at a neighbourhood collection point or official dump, with only 15% of all households dumping refuse on empty land, waterway, gutters and such places (Table 4.3). However, some of the so-called official dumps may simply be unauthorised sites which have developed into accepted dumps in the absence of alternatives. One study identified some 100 unauthorised dumping sites in the metropolis (Tahal, 1981, pp. C.2-14).

Table 4.3: Neighbourhood Dumping Sites of Households.

Site	District: Accra		Tema		Ga		Total GAMA	
	No.	%	No.	%	No.	%	No.	%
Collection Point	292	45.8	30	25.6	16	16.2	338	39.6
Official Dump	280	44.0	79	67.5	29	29.3	388	45.5
Empty Land	56	8.8	7	6.0	50	50.5	113	13.2
Waterway	4	0.6	-	-	3	3.0	7	0.8
Other	5	0.8	1	0.9	1	1.0	7	0.8
Total	637	100.0	117	100.0	99	100.0	853	100.0

Data source: Questionnaire Survey of GAMA, 1991.
Note: Only households dumping their waste are included in this table.

Given the widespread inadequacies in waste management, it is not surprising that about 45% of the population in the metropolis consider waste mismanagement to be a problem in their neighbourhood (Table 4.4). The responses did not vary appreciably between districts. The concern with open dumping sites was clearly related to the overall amenity level of the area, however. Whereas only 12% in high class areas and 31% in middle class areas perceived a problem, the share rose to half in the low class areas. The most affected sites were open land, streets, waterways or gutters and private land, in descending order of importance. This would tend to confirm the view that some of the dumps, at least in the low class areas, are unauthorised sites.

Table 4.4: Households Perceiving Local Accumulations of Solid Waste to be a Problem.

District	Response					
	No		Yes		Total	
	No.	%	No.	%	No.	%
Accra	382	53.4	333	46.6	715	100.0
Tema	98	61.3	62	38.8	160	100.0
Ga	68	54.4	57	45.6	125	100.0
Total GAMA	548	54.8	452	45.2	1000	100.0

Data source: Questionnaire Survey of GAMA, 1991.

The risk to health from the existence of these sites is potentially high, as the waste sometimes remains uncollected for more than a week (Table 4.5). The most affected areas are within the Ga District. One would expect the problems to be more threatening in crowded areas, and indeed this would seem to be the perception of the residents. While in Ga District, with a relatively low population density, twice as large a share of respondents reported uncollected waste sites, they were no more likely than Accra residents to complain of a solid waste problem.

Table 4.5: Existence of Open Dump Sites of Uncollected Waste for a Week or More.

District	Response					
	No		Yes		Total	
	No.	%	No.	%	No.	%
Accra	514	71.9	201	28.1	715	100.0
Tema	78	48.8	82	51.3	160	100.0
Ga	47	37.6	78	62.4	125	100.0
Total GAMA	639	63.9	361	36.1	1000	100.0

Data source: Questionnaire Survey of GAMA, 1991.

Within Tema District, it is mainly areas outside the planned industrial township, such as the squatter settlement of Ashiaman, Tema New Town and other outlying centres, that are poorly served. Large areas of the Accra District are now benefiting from more regular servicing in terms of waste removal from communal collection points. Among residential areas which do not as yet benefit from regular service are those in the fringe areas of the city including North Teshie Estate, Achimota, Labadi, Roman Ridge and Cantonments. Most of these are far from being among the poorest communities which, with the exception of Jamestown and Mamprobi are now better serviced than before. The position in inner city areas of Accra District has improved because of the provision of communal containers to prevent the indiscriminate dumping of refuse and night soil.

Whilst solid waste management for the majority is generally unsatisfactory, there are a privileged few whose level of service delivery is exceptional. Table 4.6 indicates that 11% of the households have home collection. About 7% of poor households, 20% of medium-wealth households and 39% of wealthy households

benefited, leaving medium wealth households marginally less likely to have home collection than the average Tema resident.

Table 4.6: Home Collection Service for Household Solid Waste.

District	Response					
	No		Yes		Total	
	No.	%	No.	%	No.	%
Accra	640	90.7	66	9.3	706	100.0
Tema	122	77.7	35	22.2	157	100.0
Ga	115	95.0	6	5.0	121	100.0
Total GAMA	877	89.1	107	10.9	984	100.0

Data source: Questionnaire Survey of GAMA, 1991.

4.2.3 Household Level Service Charges for Garbage Removal

Currently, two main waste collection systems are in use in the metropolis:

- house to house collection service
- community refuse dump service or transfer stations with communal containers.

At the time of the survey, house to house collection once a week attracted a charge of 1,000 cedis a month for a 100 litre container and 3,500 cedis a month for a 240 litre container. On the other hand, the charge for a household using a community refuse dump or container was 2,500 cedis per year, or about two hundred and eight cedis per month. In Tema District, the waste collection charge is 500 cedis per month.

Out of about 82% of the population of the metropolis that relied on communal solid waste disposal sites, a mere 31% claimed to pay any levy at all. The proportions who paid were highest in the planned township of Tema, and the inner city slums such as Nima and Maamobi, where over 90% of respondents paid a levy. The majority, who paid nothing, may well have been using unauthorised sites, or authorised sites from which waste was not being evacuated. The collection rate for the levy is low in indigenous areas (about 10%), probably because in the past these areas were provided with a free "general service," with payments only being made for home collection. In the compound housing units with numerous households, there is also a problem of determining who should pay, especially when the landlord is not resident in the compound. In these neighbourhoods there is no enforceable penalty, as residents can always gain access to the open refuse collection containers to dump their household garbage, whether or not they paid the service charge.

4.3 Final Disposal Systems

Solid waste that is collected from households or from the neighbourhood collection points is generally transported to final disposal sites. The Waste Management Department operates compost plants and land fills. Incineration of refuse is rare. The most common method of final disposal is open dumping in pits, euphemistically called land fills, principally near Korle Lagoon, Korle Gonno

beach, Labadi, Ridge and at Apenkwa near CFC housing estate. Most of these have already been used to, or beyond, capacity, except for those at Apenkwa and Korle Lagoon.

The Department is badly in need of new sites, as residents are becoming more environmentally conscious. A new landfill has been opened at Mallam. Here, the Environmental Protection Council (EPC) has started monitoring groundwater as part of an attempt to prevent pollution. In addition the Department has a compost plant at Teshie-Nungua and a number of high-tech oxidation ponds at Achimota, both of which produce compost manure.

CHAPTER FIVE

5 URBAN PESTS AND PEST CONTROL

5.1 Urban Insect Vectors and Rodents

5.1.1 Introduction

Certain human diseases are transmitted from one host to another through the agency of an insect intermediary or vector. In Accra, inadequate drainage and sanitation, the general environmental conditions, and the behaviour patterns of the people in the various residential areas, all combine to provide favourable conditions for some of the more severe vector-borne diseases.

Many insect vectors exist in the Greater Accra Metropolitan Area (GAMA). This study focuses primarily on mosquitoes, flies, and cockroaches. The incidence of rodents - mice and rats - is also summarised briefly.

5.1.2 Mosquitoes

Poor sullage disposal, blocked drains, and the generally poor drainage system, facilitate mosquito breeding. As emphasised during many of the focus group discussions, while one might expect mosquitoes to be prevalent largely in the rainy season, over-crowding coupled with the poor drainage system has meant that some gutters, streams, storm canals, etc. contain water throughout the year. Many industrial and commercial establishments, especially chop-bars, restaurants, hospitals, and hotels, continuously use large amounts of water. Perhaps as a result, while the mosquito population undoubtedly increases during the rainy season, it is high throughout the year. Low lying areas with streams and choked up lagoons (the Korle, Chemu and Kpeshi lagoons in Accra District, for example) offer excellent breeding grounds.

It has been estimated that over 90% of the mosquitoes in Accra city are *Culex* and *Aedes* species (Chinery, 1969). *Anopheles* mosquitoes, the vectors of malaria, generally prefer unpolluted, natural breeding sites. Nevertheless, between 1987 and 1990, malaria accounted for between 41% and 53% of the cases reported at outpatient facilities in the Greater Accra Region (see Table 8.1). While such statistics may exaggerate the relative importance of malaria, there is little doubt that it remains an important cause of ill health. Thus, while *Anopheles* mosquitoes only account for a small share of mosquitoes, there are sufficient numbers to help create large scale health problems. Moreover, *Anopheles* mosquitoes can adapt to urban breeding sites over time. In India, the *A. Stephensi* "has developed into an urban species and is found in much higher numbers in many cities in India than in the surrounding countryside" (WHO, 1988a, p.17). There is evidence that *Anopheles* mosquitoes are likewise becoming better adapted to the breeding sites of Accra.

As outlined by Chinery (1984), the changing ecology of Accra has led to significant shifts in the composition of the mosquito population. On the one hand, "The almost complete elimination of *An. funestus* and decrease in breading intensity of *An gambiae* s.1. over the years have contributed to diminishing malaria parasite rates between 1912 and 1964 and may also account for low incidence of *W. bancrofti* infection in Accra in recent years" (Chinery, 1984, p. 75). On the other hand, "An. gambiae s.1. has adapted to breeding appreciably in water-filled domestic containers in recent times" and "breeding has also increased in the

numerous polluted water habitats created as a result of urbanization" (Chinery, 1984, p. 75).

Thus, while past urbanization has lowered the incidence of malaria in Accra, there is no reason to assume that continuing urbanization will automatically eliminate it as a major health problem. Indeed, further adaptation could actually lead to an increasing presence of Anopheles mosquitoes. Moreover, the shift to domestic water containers suggests that malaria is not only linked to poor drainage, but increasingly to household water management, and more generally the reliability of water supply (as outlined in Chapter 2, the unreliability of water is one of the main reasons for the high level of household water storage). The *Aedes* species also commonly breed in household water containers, and can be vectors of yellow fever and dengue haemorrhagic fever. The risks of urban yellow fever and outbreaks of dengue haemorrhagic fever should not be neglected, even if they are not currently a major health concern.

The survey undertaken for this study does not provide information on mosquito species, and as such provides limited insight into the relative risks different households are facing from mosquitoes. The survey results indicate that in almost all the sampled residential areas mosquito biting was prevalent during both dry and wet seasons, especially indoors at night when *Anopheles*, but also the more common *Culex*, mosquitoes are biting. Only 2% of the respondents said that they were not bothered by mosquitoes biting indoors at night during the wet season, with the percentage rising to 4% in the dry season. Some 17% in the dry season and 21% in the wet season said that there were only occasionally mosquitoes biting indoors at night. But the majority in both seasons often had biting mosquitoes. Moreover, excluding households with full window screening, the responses were quite similar in the different areas of the city and among poor and wealthy households.

One relationship which did emerge was a significant association between the location of stored water and the level of mosquito biting in the dry season. Whereas 44% of the (621) households storing water inside were often bothered by many biting mosquitoes at night during the dry season, this applied to only 31% of those (334) households who stored their water outside. Alternatively, only 3.2% of those storing water indoors were not bothered by biting mosquitoes at all, as opposed to 6.6% of those storing water outdoors. If there is indeed a growing presence of *Anopheles* mosquitoes in household water containers, indoor water storage may be increasingly risky.

Except when mosquitoes are breeding in household water containers, there is relatively little an individual household can do to control breeding. On the other hand, there are a number of measures which can be taken to kill adult mosquitoes or inhibit their entry into the home. As illustrated in Section 5.2.1, about 90% of households in Accra attempt some form of insect control, typically targeting mosquitoes. Very few, however, achieve anything like complete protection.

5.1.3 House Flies

Many insects other than mosquitoes serve as disease carriers in urban areas. These include house flies, sand flies, trickling filter flies, fleas, bed bugs, cockroaches, lice, mites and triatomine bugs (Table 5.1). Almost all the listed disease vectors are present at various levels throughout the study area. However, only house flies and cockroaches will be discussed.

Table 5.1: Habitats of urban disease vectors other than mosquitoes.

	House Flies	Sand Flies	Tricking filter flies	Fleas	Bedbugs
Refuse Sites	+				
Slaughter houses	+				
Food Stores	+				
Deficient houses	+	+		+	+
Dirty garments					+
Sewerage filters			+		
Animal shelters	+	+		+	
Excrement	+				
Unsanitary latrines	+				
Rodent burrows				+	

	Cockroach	Lice	Mites	Triatomine bugs
Refuse Sites	+			
Slaughter houses	+			
Food Stores	+			
Deficient houses	+	+	+	+
Dirty garments		+	+	
Sewerage filters				
Animal shelters	+			
Excrement				
Unsanitary latrines	+			
Rodent burrows				

WHO, 1988a

The house fly is both a filth feeder and breeder. Flies are mechanical carriers, and can contaminate human food or drink through direct contact or by defecating or regurgitating stomach contents. Unsanitary conditions lead to more flies, and a higher risk that the flies will spread disease.

House flies were common in all neighbourhoods, in both food preparation areas and toilets. The presence of flies in toilets varied more than in kitchens. More than twice as many households claimed never to have flies in their toilets as claimed the same for their food preparation areas (23% as opposed to 11%). On the other hand, about 50% more households said there were almost always flies in their toilets than that there were almost always flies in their food preparation areas (38% as opposed to 24%).

Similarly, the differences between poor and wealthy households were more striking with respect to flies in the toilet than with respect to flies in the kitchen (See Tables 5.2 and 5.3). More than four out of five wealthy households said they almost never had flies in their toilets, compared to about one poor household in seven. Indeed, about 44% of poor households almost always had flies in their toilets.

Table 5.2: Presence of Flies in Food Preparation Area by Household Wealth (%).

Wealth Index of Household	Presence of Flies: Almost Never	Occa-sionally	Usually	Almost Always	No Cooking	Total %	Total N
Low	6.4	24.0	41.2	28.0	0.4	100.0	818
Medium	30.5	29.0	29.8	9.9	0.8	100.0	131
High	39.3	43.1	13.7	3.9	-	100.0	51
Total	11.2	25.6	38.3	24.4	0.4	100.0	1000

Data source: Questionnaire Survey of GAMA, 1991.

Table 5.3: Presence of Flies in Toilets by Household Wealth (%).

Wealth Index of Household	Presence of Flies: Almost Never	Occa-sionally	Usually	Almost Always	Free Range	Total %	Total N
Low	14.3	16.3	23.8	44.4	1.2	100.0	818
Medium	54.2	17.6	16.7	10.7	0.8	100.0	131
High	82.4	9.8	5.8	2.0	-	100.0	51
Total	23.0	16.1	22.0	37.8	0.1	100.0	1000

Data source: Questionnaire Survey of GAMA, 1991.

In the discussion of solid waste (Chapter 4), it was shown that households storing waste inside their home were more likely to have flies in their kitchen. The relation between the sanitary condition of the toilet and the presence of flies was, as one would expect, far stronger. The 32% of households using toilets where faecal material was visible outside of the "bowl", accounted for more than half of the households with many flies in the toilet, and only 6% of the toilets without flies. Similar associations exist with other indicators of unsanitary toilets. Furthermore, unsanitary toilets are associated, though less strongly, with having more flies in the kitchens. Indeed, the multiplicity of interconnections is so strong that it is more reasonable to portray flies as a dangerous vector within a complex system of sanitary problems, than to attempt to single out particular reasons for fly prevalence.

Tables 5.4 and 5.5 illustrate clearly that childhood diarrhoea is more prevalent in households where respondents say there are more flies. In light of the multiplicity of interconnections noted above, this association should be taken to reflect not only the role of flies as carriers, but also the fact that the presence of flies is an indication of other high risk conditions.

Table 5.4: Presence of Flies in Kitchen and the Two Week Prevalence of Childhood Diarrhoea among Households with Children Under Six.

Presence of Houseflies	Child (<6) with Diarrhoea in Last Two Weeks		Total	
	%No	%Yes	%	N
Almost Never	92.7	7.3	100.0	41
Occasionally	93.4	6.6	100.0	136
Usually	87.6	12.4	100.0	209
Almost Always	77.3	22.7	100.0	150
Total	86.6	13.4	100.0	536

Data source: Questionnaire Survey of GAMA, 1991.

Table 5.5: Presence of Flies in Toilet and the Two Week Prevalence of Childhood Diarrhoea among Households with Children Under Six.

Presence of Houseflies	Child (<6) with Diarrhoea in Last Two Weeks		Total	
	%No	%Yes	%	N
Almost Never	94.1	5.9	100.0	101
Occasionally	90.8	9.2	100.0	87
Usually	86.2	13.8	100.0	138
Almost Always	81.2	18.8	100.0	207
Total	86.5	13.5	100.0	533

Data source: Questionnaire Survey of GAMA, 1991.

5.1.4 Cockroaches

Under some conditions, cockroaches, like flies, can be mechanical carriers of disease. While not inherently attracted to human faeces, they sometimes live in habitats where contact is likely. Pathogenic bacteria may then be deposited on food as the cockroaches forage in a kitchen or food area. A study of cockroaches in Accra (Agbodaze and Owusu, 1989) found evidence leading the authors to suggest that cockroaches could be playing a role in the transmission bacterial diarrhoea. (Out of 208 cockroaches collected from kitchens, 64 harboured coliforms, 13 harboured proteus species, six harboured *Salmonella*, two harboured *Pseudomonas* species, and one harboured *Shigella dysentariae*.) In addition to the potential health risk, cockroaches are generally considered a nuisance, and can produce an unpleasant odour.

Only 8% of the households surveyed for this study said they never saw cockroaches in their homes, and 44% claimed often to see large numbers. Cockroaches were associated with many of the same environmental indicators as flies, though the associations were somewhat less strong. As a result, while only 13% of (112) households with no flies in their kitchen often saw many cockroaches, this percentage climbed to 69% in the (244) households which almost always had flies in their kitchen. Again this indicates the complex combination of sanitary and insect-related conditions which many households face. Not

surprisingly, cockroaches, like flies, are more prevalent in poor households (see Table 5.6).

Table 5.6: Presence of Cockroaches in Homes by Household Wealth (%).

Wealth Index of Household	Prevalence				Total	
	Never	Occasionally	Often in Small Nos.	Often in Large Nos.	%	N
Low	7.7	15.4	30.1	46.8	100.0	818
Medium	4.6	32.1	31.9	32.1	100.0	131
High	21.6	35.3	21.6	21.6	100.0	51
Total	8.0	18.6	29.9	43.6	100.0	1000

Data source: Questionnaire Survey of GAMA, 1991.

5.1.5 Rodents

Several species of rats and mice are well adapted to urban environments. They consume stored food, damage property, and can contaminate human food with their faeces and urine, sometimes transmitting diseases in the process (WHO, 1988a). Historically, rats are infamous for their role in spreading the plague. While the rodents of Accra may not be a major health problem, they are a persistent nuisance, and at least a minor health problem.

Rodents tend to be common in certain neighbourhoods as a result of the quality of housing and the environment as a whole. Houses in the low income areas are not only closely built, but are typically in a very poor state of repair, both favourable conditions for these pests. The lack of adequate facilities to handle domestic waste in most low income households has compounded the problem. Furthermore, while rats and mice can adapt to urban conditions, they are more prevalent in the rural fringe. Tables 5.7 illustrates the extent to which these factors combine to place a large part of the burden on poorer households. However, like several other pest related problems, it is noteworthy that even the wealthy are affected. Indeed, about 16% of the wealthy households claimed that there were rats or mice in their homes every day.

Table 5.7: Presence of Rats or Mice in Homes by Household Wealth (%).

Wealth Index of Household	Prevalence				Total	
	Never	Occasionally	Often	Every Night/ Day	%	N
Low	18.8	24.4	18.0	38.8	100.0	818
Medium	32.1	37.4	14.5	16.0	100.0	131
High	62.8	17.6	3.9	15.7	100.0	51
Total	22.8	25.8	16.8	34.6	100.0	1000

Data source: Questionnaire Survey of GAMA, 1991.

5.2 Insecticide Usage and Other Preventive Measures

The people of Accra are very concerned about their pest problems. There is, however, relatively little environmental management designed to reduce the level of pest infestation through, for example, controlling man-made breeding sites. Instead, households take a number of protective measures, many of which involve the use of potentially hazardous chemicals. Despite the economic burden they impose, these protective measures have the attractions of being relatively simple to apply and of concentrating their protection on the users themselves. Controlling breeding sites requires a more sophisticated understanding of the behaviour of the pests, and, since the beneficiaries are more dispersed, it typically requires some form of public or collective action.

Mosquitoes are perceived to be a major health risk, and are the target of most of the protective measures households take. Similarly, most government efforts target mosquitoes. The following sections summarise the extent to which different methods are employed, and some health associations which, while far from definitive, do indicate that the potential dangers of using insecticides deserve more consideration.

5.2.1 Household Insect Control

About nine out of ten households take some measures to control mosquitoes. As indicated in Table 5.8, the most common measure is screening. Even in a well constructed house, screening does not provide full protection, and in many it is relatively ineffective. Indeed, households with full screening are more likely to use other methods of insect control than those without. The other three measures taken by more than 10% of the respondents are all chemical: mosquito coils, aerosol insecticides and pump-spray insecticides.

Table 5.8: Use of Insect Control Methods.

	Use of Method				Total Respondents
Method	No (%)	n	Yes (%)	n	n
Full Screening	47.4	474	52.6	526	1000
Mosquito coils	54.7	547	45.3	453	1000
Aerosol insecticides	59.5	594	40.5	405	999
Pump insecticides	89.2	889	10.8	108	997
Bed nets	92.2	922	7.8	78	1000
Traditional method	96.5	961	3.5	35	996
Private service	96.7	963	3.3	33	996
Govt. service	99.3	989	0.7	7	996
Other	97.9	973	2.1	21	994
At least one of above	10.2	101	89.8	893	994

Data source: Questionnaire Survey of GAMA, 1991.

Mosquito coils, the most common chemical means of insect control, are used more commonly among poor households, as illustrated in Table 5.9. Their use undoubtedly leads to increased exposure to air pollution. While the health hazards of such pollution are not well documented, among the households surveyed who

had children under six there was a higher share with one of these children having respiratory infection symptoms when mosquito coils were used. Indeed, about 15% (of 260) using mosquito coils had at least one child under six with such symptoms, compared to 9% (of 284) among those not using mosquito coils. The association between mosquito coils and health is explored further in Chapter 8.

Table 5.9: Use of Mosquito Coils by Household Wealth (%).

Wealth Index of Household	Use of Coil No.	Yes	Total %	N
Low	50.5	49.5	100.0	818
Medium	69.5	30.5	100.0	131
High	84.3	15.7	100.0	51
Total	54.7	45.3	100.0	1000

Data source: Questionnaire Survey of GAMA, 1991.

Aerosol insecticides, on the other hand, are used more often among wealthy households, as illustrated in Table 5.10. Aerosols also increase personal exposure to airborne pollution, especially for the person applying the insecticide. No significant association between children's health and the use of aerosol pesticides was found. Respiratory problem symptoms were actually less prevalent among personal homemakers using aerosol insecticides. However, aerosols and pump spray pesticides are relatively close substitutes, and this could be confounding the results. In Chapter 8, a brief attempt is made to examine this association more closely, controlling for factors such as smoking, gender of the principal homemaker, and other potentially significant variables.

Table 5.10: Use of Aerosol Insecticides by Household Wealth (%).

Wealth Index of Household	Use of Aerosol No	Yes	Total %	N
Low	65.2	34.8	100.0	817
Medium	38.8	61.2	100.0	129
High	20.8	79.2	100.0	53
Total	61.0	38.9	100.0	999

Like aerosols, pump insecticides are more often used by wealthy households (see Table 5.11). Generally, it is more difficult to control the chemicals used in insecticide pumps, and pump users are likely to use larger quantities of insecticide. As in the case of aerosols, no statistically significant association could be found between the use of pump sprays and children's health. However, about 40% of the (108) principal homemakers using pump insecticides had respiratory problem symptoms, as compared to 17% of the (889) principal homemakers not using pump pesticides.

Table 5.11: Use of Pump Insecticides by Household Wealth (%).

Wealth Index ofHousehold	Use of Pump Pesticide		Total	
	No	Yes	%	N
Low	90.2	9.8	100.0	815
Medium	84.5	15.5	100.0	129
High	84.9	15.1	100.0	53
Total	89.2	10.8	100.0	997

Data source: Questionnaire Survey of GAMA, 1991.

Box 5.1: Flies, Mosquitoes and Wealth

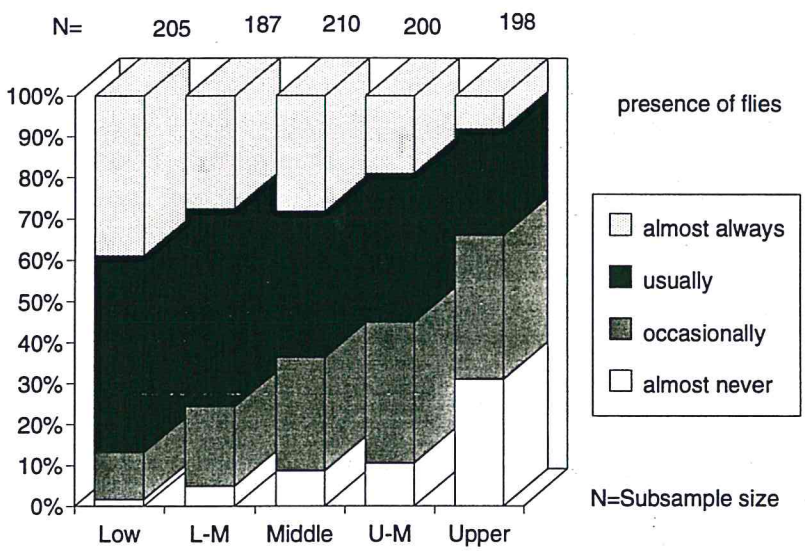


Figure 5.1: Presence of flies in cooking area by wealth group

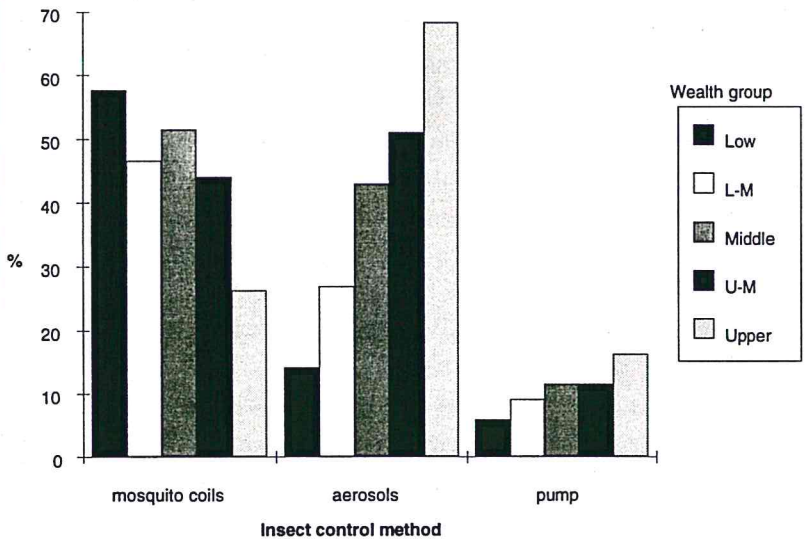


Figure 5.2: Use of insect control methods by wealth group

Data source: Questionnaire survey of Accra, 1991.

Flies are both filth feeders and filth breeders, and their presence in the cooking area is particularly hazardous when sanitation is generally poor, and they are likely to transfer faecal material to the food. As illustrated in Figure 5.1, the presence of flies follows much the same pattern as most other household environmental hazards - they are more prevalent among poorer households.

Mosquitoes were common both indoors and out in almost all neighbourhoods. However, as illustrated in Figure 5.2, the measures households take to protect themselves are very much wealth dependent. Mosquito coils are more common among poor households, aerosol sprays among wealthier households, and pump sprays somewhat more common among wealthier households. Malaria is a major health hazard in GAMA, but using insecticides can also be harmful, especially if care is not taken in their choice and application. As described in Chapter Eight, the use of mosquito coils was associated with respiratory problems in children, while the use of pump spray insecticides was associated with respiratory problems in the principal women of the household.

Note: The wealth groups employed in these diagrams are based on the same wealth index employed in the rest of the report. However, rather than three unequal groups (the poor majority, a small wealthy elite, and a somewhat larger medium-wealth group), five groups of roughly equal size have been created for the graphical presentation.

CHAPTER SIX

6 FOOD CONTAMINATION

6.1 Introduction

This chapter is concerned with microbial food contamination, and especially the role of food in the transmission of faecal-oral disease. Bacterial agents can multiply in food, while for viruses, protozoa and helminths, food can be a carrier. Food contamination can occur at any number of points between production and consumption, while cooking food can reduce contamination. The following sections examine, in turn, the potential sources of contamination: 1) prior to preparation; 2) during preparation; and 3) during storage in the home.

6.2 Food Supplies

Most households in the study area obtain their food from open markets. Very often the food is displayed openly on tables and on the bare ground in very poor sanitary environments. The prevalence of disease vectors such as houseflies at these markets, as well as the presence of pests such as cockroaches and rodents in the storage locations, suggests a potentially high level of contamination. Such contamination poses particular risks for meat, fish and for fruit and vegetables eaten raw.

A significant share of the vegetables sold are produced in small market gardens in the study area. Vegetables such as lettuce, carrots, green pepper, cucumber and Indian spinach are cultivated along some major drains in the study area, and microbiological examination has uncovered high levels of faecal contamination both in the water and in lettuce and cabbage leaves taken from such sites (Environmental Management Associates Ltd., 1989, p.154).

Fruits are available in almost all the local markets and a few wayside groceries in the study area, having arrived from hinterland areas a few kilometres away. Almost all fruits are eaten raw. The risk of contamination is thus high, especially when the fruits are not washed properly before being eaten. Such fruits may include mangoes, sugar-cane and berries of all sorts. The manner in which these are handled and displayed for sale exposes them to dust and houseflies. Sugar-cane is unloaded from trucks and packed on the bare ground prior to cutting it up in bits for sale. Fortunately, fruits such as coconut, groundnut (in shell), avocado pears and bananas are not so easily contaminated, due to their protective outer coat.

Meat is mostly sold raw in the study area. However, in a few cases, particularly with game (popularly referred to as bush meat), it may be smoked and displayed on tables on the open market for sale. In spite of the Slaughter House and Sale of Meat Bye Law of 1962, which states that no animal should be slaughtered for consumption outside the slaughter house, the slaughter and transport of raw meat from the existing slaughter houses in the study area to the marketing points is such that the risk of contamination is very high. The slaughter houses are in poor condition and at times poorly located. The James Town slaughter house, for example, is located about 20 metres from a public toilet. Carcasses are transported in open trucks and then head-loaded bare to the selling points which are themselves overwhelmed by scores of buzzing houseflies. All these are possible sources of contamination.

Both raw and smoked fish are displayed bare on wooden trays in the open market, exposing them to contamination by houseflies. The smoking is not always

properly done, and the fish is often in very poor condition by the time it is bought and consumed. Furthermore, viruses are present in the shellfish, which are popular protein foods in most indigenous Ga communities, where poor households predominate.

6.3 Food Preparation

All but a few (8) households surveyed regularly prepared at least one meal a day. In the majority of cases, two or three meals a day are prepared. However, as illustrated in Table 6.1, a higher proportion of the low income households than high income households prepare only one meal a day.

Table 6.1: Number of Meals Prepared Per Day by Household Wealth (%).

Wealth Index of Household	Number of Meals One	Two	Three	Total %	N
Low	16.8	42.8	40.3	100.0	808
Medium	3.1	39.1	57.8	100.0	128
High	2.0	31.4	66.7	100.0	51
Total	14.2	41.7	43.9	100.0	982

Source: Questionnaire Survey of GAMA, 1991.

While poor households consume less food, the tendency to prepare fewer meals at home also reflects their greater reliance on vendors selling prepared food, illustrated in Table 6.2. Most operators in the prepared food and ready-to-eat food business in the study area operate under rather unhygienic conditions. Prepared foods such as cooked rice, kenkey, and gari and beans are dished out to buyers in leaves, cement papers and old newspapers. Besides, some of these may be uncovered and so are exposed to dust and houseflies. Ready-to-eat foods such as doughnuts, bread, roasted plantain and groundnuts, and pastry are also in many cases similarly packaged or exposed. In the chop bars the presence of buzzing houseflies is not the only source of food contamination; the mass use of facilities such as eating plates and bowls (which may not always be properly washed before the next buyer is served), drinking cups and napkins/towels for cleaning the hands, as well as the poor personal hygiene of many operators and staff of these chop bars, may well be possible sources of food contamination too.

Table 6.2: Patronage of Prepared Food From Vendors by Households (%).

Wealth Index of Household	Patronage No	Patronage Yes	Total of Household %	Total of Household N
Low	22.9	77.1	100.0	818
Medium	46.6	53.4	100.0	131
High	47.1	52.9	100.0	51
Total	27.2	72.8	100.0	1000

Data source: Questionnaire Survey of GAMA, 1991.

Prepared food purchased by poor households is also somewhat more likely to fall into the high risk groups. Thus, for example, about 30% of poor households purchasing prepared food from vendors included purchases of open street food, as compared to 14% and 11% for medium-wealth and wealthy households respectively.

Food eaten out, which includes food purchased from vendors, is clearly perceived as a health risk by the households themselves, and especially by the poor. Indeed, 28 of the 72 households whose children had recently had diarrhoea identified food eaten out as a probable (or definite) cause, and all but one of these households was poor. By way of contrast, only seven identified home prepared food.

It is unlikely that prepared vendor foods, or more generally food eaten outside the home, is to blame for a major share of diarrhoea morbidity. There is, however, a significant association between eating such food and diarrhoeal morbidity. In 16% of the (400) households with children under six who regularly purchase prepared food from vendors, one of the children had had diarrhoea within the last two weeks, as opposed to 6% among those (137) who did not regularly purchase such food. Purchasing prepared food from vendors is also statistically associated with other risk factors. However, even controlling for these other factors, the statistical association between diarrhoea and such food purchases is statistically significant (see Chapter 8).

Even if households are less inclined to blame food prepared at home, the potential for in-house contamination should not be neglected. Food contamination in the home is intimately linked to the household sanitation, hygiene and insect problems discussed in previous chapters. Both the presence of flies in kitchens and not washing hands prior to food preparation were shown to be closely associated with a high diarrhoea prevalence among children under six. Moreover, both of these factors remain significant, even controlling for other risks. This could reflect high levels of in-home food contamination in GAMA.

Generally, one would also expect freshly cooked food to be less prone to contamination than leftovers. Tables 6.3 and 6.4 show the extent to which fresh food, heated leftovers and cold leftovers were regularly included in different meals. Among all wealth groups, the evening meal typically included fresh food. The midday meal was the one least likely to include fresh food, especially among poor households where about 40% of the households did not include it. Poor households were also somewhat less likely to include freshly cooked food in the morning meal,

though even among the poor more than four households in five did include freshly cooked food.

Table 6.3: Regular Inclusion of Freshly Cooked Food in Home Prepared Meals by Household Wealth.

Wealth Index of Household	Morning Meal No (%)	Morning Meal Yes (%)	n	Midday Meal No (%)	Midday Meal Yes (%)	n	Evening Meal No (%)	Evening Meal Yes (%)	n
Low	17	83	707	40	60	530	3	97	785
Medium	5	95	121	11	89	89	2	98	126
High	0	100	48	13	87	45	4	96	53
Total	14.4	85.6	876	34.3	65.7	664	3.0	97.0	964

Data source: Questionnaire Survey of GAMA, 1991.

Serving reheated leftovers was also relatively common, especially for the midday meal. Except for the morning meal, when poor households more often included reheated leftovers, it was the wealthier households that were more inclined to serve reheated leftovers. This may reflect better storage facilities or that poor households were less likely to have food left over.

Table 6.4: Regular Inclusion of Reheated Leftovers in Home Prepared Meals by Household Wealth.

Wealth Index of Household	Morning Meal No (%)	Morning Meal Yes (%)	n	Midday Meal No (%)	Midday Meal Yes (%)	n	Evening Meal No (%)	Evening Meal Yes (%)	n
Low	57	43	703	60	40	528	71	29	778
Medium	64	36	118	51	49	88	62	38	125
High	78	22	50	42	58	45	62	38	53
Total	59.2	40.8	871	57.6	42.4	661	69.4	30.6	956

Data source: Questionnaire Survey of GAMA, 1991.

As illustrated in Table 6.5, cold leftovers were rarely served, and were included by less than 10% of the households in every category.

Table 6.5: Regular Inclusion of Cold Leftovers in Home Prepared Meals by Household Wealth.

Wealth Index of Household	Morning Meal No (%)	Morning Meal Yes (%)	Morning Meal n	Midday Meal No (%)	Midday Meal Yes (%)	Midday Meal n	Evening Meal No (%)	Evening Meal Yes (%)	Evening Meal n
Low	97	3	699	94	6	523	98	2	774
Medium	92	9	118	94	6	88	98	2	125
High	100	0	50	98	2	45	100	0	53
Total	97	3	837	94	6	656	98	2	952

Data source: Questionnaire Survey of GAMA, 1991.

6.4 Food Storage in the Home

During the survey the facilities for the household storage of raw vegetables, raw meat, and leftovers were investigated. The survey revealed that while the refrigerator was the most popular storage facility for the above-mentioned categories of food among the medium and high income households, far fewer households in the low income bracket used this facility. Many of the poor households either used cupboards or the covered dishes (both of which are ineffective storage facilities) for the storage of these categories of food (see Tables 6.6, 6.7 and 6.8). There were also quite a number of poor households who either did not use any of the storage facilities identified or do not have any of the food categories surveyed to store.

Table 6.6: Storage Facilities Normally Used for Raw Vegetables by Household Wealth.

Wealth Index of Household	Refri-gerator	Cup-board	Open Air	Covered Dish	Food Net	N/A	Total %	Total n
Low	30.1	15.6	10.5	27.6	2.1	14.1	100.0	818
Medium	81.7	5.3	3.8	5.3	0.8	3.1	100.0	131
High	96.1	-	-	3.9	-	-	100.0	51
Total	40.2	13.5	9.1	23.5	1.8	11.9	100.0	1000

Data source: Questionnaire Survey of GAMA, 1991.

Table 6.7: Facilities Used for Storing Raw Meat by Household Wealth (%).

Wealth Index of Household	Refri-gerator	Cup-board	Open Air	Covered Dish	Food Net	N/A	Total %	Total N
Low	32.9	7.9	2.0	28.5	1.0	27.9	100.0	818
Medium	87.8	1.5	0.8	4.6	-	5.3	100.0	131
High	98.0	-	-	2.0	-	-	100.0	51
Total	43.3	6.7	1.7	24.0	0.8	23.4	100.0	1000

Data source: Questionnaire Survey of GAMA, 1991.

Table 6.8: Facilities Used for Storing Leftovers by Household Wealth (%).

Wealth Index of Household	Refri-gerator	Cup-board	Open Air	Covered Dish	Food Net	N/A	Total %	Total N
Low	27.5	10.9	3.3	46.6	2.0	9.7	100.0	818
Medium	79.4	4.6	-	8.4	2.3	5.3	100.0	131
High	94.0	-	2.0	2.0	-	2.0	100.0	51
Total	37.7	9.5	2.8	39.3	1.9	8.8	100.0	1000

Data source: Questionnaire Survey of GAMA, 1991.

The general pattern that emerges from the above tables is that it is the poorer households that use the less effective storage facilities to store the three categories of food. They therefore stand the greatest risk of losing their fresh foods and leftovers through spoilage.

This problem is highlighted in the answers to questions regarding the time it takes for leftovers to spoil. There is a larger proportion of low income households for whom leftovers spoil rapidly (see Table 6.9). This is obviously due to the inefficient storage facilities used. The table also shows that there is a larger proportion of high income households for whom the question of spoilage of leftovers does not apply, most probably because of the use of refrigerators and deep freezing facilities.

Table 6.9: Time Taken by Leftovers to Spoil by Household Wealth (%).

Wealth Index of Household	Number of Hours 1 - 12	13 - 24	24 and Above	N/A	Total %	Total N
Low	33.0	31.5	8.1	27.4	100.0	818
Medium	22.1	18.3	10.7	48.9	100.0	131
High	15.7	17.6	11.8	54.9	100.0	51
Total	30.7	29.1	8.6	31.6	100.0	1000

Data source: Questionnaire Survey of GAMA, 1991.

Box 6.1: Food Vending and Wealth

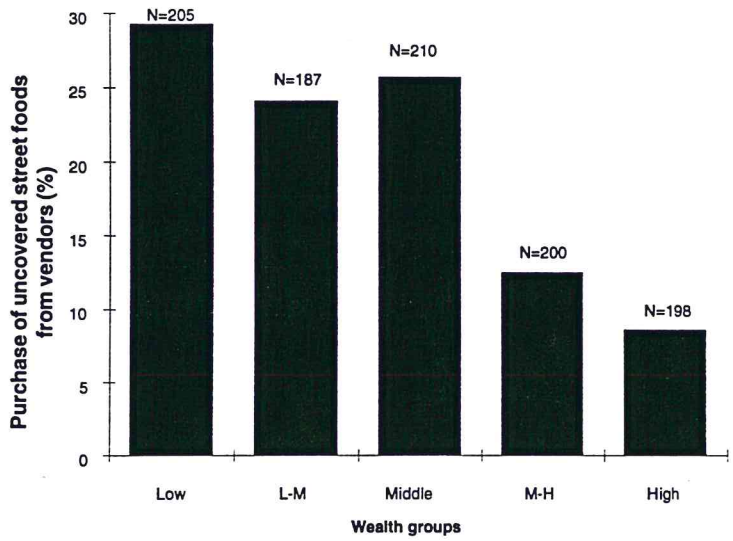


Figure 6.1: Purchase of uncovered street foods from vendors by wealth group

In GAMA, buying prepared food from vendors is not a luxury confined to the wealthy. Not only are poor households more likely to patronize vendors, but they are more likely to purchase uncovered street foods, as illustrated in Figure 6.1. Respondents with sick children often blamed food prepared away from home, and a statistical association between diarrhoea prevalence and frequenting food vendors was found. While these vendors provide an important service, improving hygiene practices among these vendors is one of the more important food-related issues.

Data source: Questionnaire survey of Accra, 1991.

Note: The wealth groups employed in these diagrams are based on the same wealth index employed in the rest of the report. However, rather than three unequal groups (the poor majority, a small wealthy elite, and a somewhat larger medium-wealth group), five groups of roughly equal size have been created for the graphical presentation.

CHAPTER SEVEN

7 AIR POLLUTION AND HOUSING

7.1 Household Air Pollution

Air pollution is among the most discussed urban environmental problems in international circles, and statistics on outdoor concentrations of particulates and SO_2 are available for a wide number of cities across the world (UNEP/WHO, 1988). However, concentrations in ambient air are poor indicators of the health burden of air pollutants. High levels of exposure can result from pollution which only accounts for a small share of the overall urban air pollution load. Pollution from cooking fires is a case in point: exposure can be hazardous due to high concentrations in the vicinity of the stove, even if the contribution to monitored ambient air concentrations is insignificant.

A listing of some of the major air pollutants and their potential health effects is provided in Table 7.1, along with WHO guidelines. Table 7.2 summarises the recommendations of the Environmental Protection Council of Ghana (see Chapter 10). Weekly air quality monitoring has been established at two sites in Tema (Amuzu and Leitmann, 1991). Past studies have found particulate concentrations in ambient air in residential areas to be below suggested limits. Similarly, results from a small number of samples indicate comparatively low sulphur dioxide concentrations. Generally, while outdoor air pollution may well come to be a critical issue in GAMA as industrialisation and motorization proceed, there is no evidence that it is currently a major health problem.

Table 7.1: Effects and guidelines for major air pollutants.

Pollutant	Known Danger	WHO Guidelines
Sulphur dioxide	respiratory problems	$\mu g/m^3$ annual mean: 40-60 98th %tile :100-150
Particulates	respiratory problems	TSP $\mu g/m^3$ annual mean: 40-60 98th %tile :150-230
Carbon Monoxide	reduced ability to absorb oxygen and attendant damage	mg/m^2 15 minutes: 100 30 minutes: 60 1 hour : 30 8 hours : 10
Lead	Problems of the circulatory and nervous systems	$\mu g/m^3$ annual mean: 0.5-1.0
Nitrogen dioxide	viral infections, "silo -fillers" disease and lung disorders	$\mu g/m^3$ 1 hour : 400 24 hours: 150
Polycyclic aromatic hydrocarbons	cancer	

Data source: UNEP-WHO, 1988; Wellburn, 1988.

Table 7.2: Recommended Ambient Air Quality Standards for Selected Pollutants - Ghana.

Pollutant	Effective Area	Max. Permissible Level	Averaging Time
1. Particulates Dust			
a) Total Suspended Particulates	Residential	260 μg/m^3	24 hours
	Industrial	290 μg/m^3	24 hours
b) Respirable non- toxic dust	Residential	150 μg/m^3	24 hours
	Industrial	260 μg/m^3	24 hours
c) Dust Fall	Residential	8 t/km^2/month	1 month
	Industrial	10 t/km^2/month	1 month
2. Toxic Particulates			
a) Asbestos	All Areas	1 fibre/m^3	24 hours
b) Fluorides(Total)	All Areas	10 μg/m^3	24 hours
c) Lead	All Areas	15 μg/m^3	24 hours
d) Arsenic	All Areas	10 μg/m^3	24 hours
3. Gases			
Sulphur dioxide	All Areas	200 μg/m^3	24 hours

Data source: Environmental Protection Council, 1977.

The potential dangers of exposure to smoke from cooking fires has only recently begun to receive widespread attention. Recent estimates suggest, however, that pollution concentrations encountered in the vicinity of cooking fires account for a far larger share of global human exposure to airborne particulates than does ambient air pollution (Smith, 1993). For an individual household, exposure depends on such factors as the cooking fuel, the stove, ventilation, cooking practices, and the location of both the people cooking and other household members. Even within GAMA there is sufficient variation in these factors to lead to very different health burdens among different groups.

7.1.1 Cooking Fuels

The results of the questionnaire survey indicate a fuel transition as one moves from poor to wealthy households. As illustrated in Table 7.3, charcoal was the principal cooking fuel of more than three-quarters of the poor households, followed by fuelwood (used principally in the rural fringe). Among medium wealth households, charcoal was also the most common principal fuel, but bottled gas (LPG) was almost as prevalent. For about two thirds of the wealthy households LPG was the principal fuel, followed by electricity. This shift from biofuels to LPG and electricity, often described as an "energy ladder", is common to many urban areas across the world (McGranahan and Kaijser, 1993).

Despite the variations among wealth groups, charcoal stands out as the dominant fuel, a finding consistent with the Ghana Living Standards Survey (Ghana Government, 1989), which estimated that 81% of households in Accra used charcoal as cooking fuel. Moreover, the results of our survey indicate relatively high stability in fuel use patterns: 85% of households had been using their principal cooking fuels for more than five years, with somewhat higher percentages among wood and charcoal users.

Table 7.3: Principal Cooking Fuel by Household Wealth (%).

Wealth Index of Household	Do not cook	Fuel-wood or similar	Char-coal	Kero-sene	Gas (LPG)	Elec-tricity	Total %	Total N
Low	1.0	8.8	75.6	6.1	6.1	2.4	100.0	818
Medium	1.5	3.1	43.5	6.9	41.2	3.8	100.0	131
High	-	2.0	9.8	-	68.6	19.6	100.0	51
Total	1.0	7.7	68.0	6.0	13.8	3.5	100.0	1000

Data source: Questionnaire Survey of GAMA, 1991.

Fuel choice is more complicated than these statistics might seem to suggest, however: Almost half of the households used more than one fuel (see Table 7.4), with multiple fuel use most common among wealthy households. Being able to use more than one fuel provides security, in case of supply interruptions. Also, some wealthy households have servants cooking with one fuel, while they themselves cook with another. Taking account of multiple use, a full 88% of households use charcoal at least intermittently, including 60% of the wealthy households.

Table 7.4: Second Cooking Fuels by Household Wealth (%).

Wealth Index of Household	No second fuel	Fuel-wood or similar	Char-coal	Kero-sene	Gas (LPG)	Elec-tricity	Total %	Total N
Low	54.4	9.6	16.1	15.9	1.6	2.3	100.0	818
Medium	37.2	3.9	35.7	13.2	5.4	4.7	100.0	131
High	19.6	7.8	47.1	2.0	9.8	13.7	100.0	51
Total	50.7	8.8	20.1	14.7	2.5	3.1	100.0	1000

Data source: Questionnaire Survey of GAMA, 1991.

7.1.2 Cooking Locations

The cooking locations employed were also very diverse, as indicated in Table 7.5. As with cooking fuels, cooking locations bear a close relation to wealth. Almost all wealthy households had separate kitchens, compared with two thirds of medium-wealth households, and only about one in four poor households. Every other cooking location, from multi-purpose rooms, to cooking huts, to open air, were more frequently used by poor households.

Table 7.5: Cooking Locations by Household Wealth (%).

Wealth Index of Household	Separate Kitchen Room	Other Private	Communal Room	Cooking Hut	Veranda	Open Air	Total N
Low	26.1	10.4	3.3	11.5	26.8	52.3	817
Medium	66.7	5.4	1.6	6.2	17.1	33.3	129
High	96.2	1.9	1.9	1.9	13.2	15.1	53
Total	35.0	9.3	3.0	10.3	24.8	47.8	999

Data source: Questionnaire Survey of GAMA, 1991.
Note: The figures in the table are percentages of households. Since some households used more than one location, the percentages sum to more than 100.

The locational patterns are displayed in a somewhat different form in Table 7.6 About one third of the households always cooked indoors, one quarter sometimes cooked indoors and sometimes outdoors, with the remaining 40% always cooking outdoors (outdoors is defined here to include verandas and other covered open-air locations). The shift towards indoor locations with increasing wealth is clear. Part of this shift is presumably due to the greater indoor space available to wealthier households. Indeed poor households living in the Rural Fringe are more likely to have an indoor cooking location than poor households in the more crowded sectors. Another part of the shift is an outcome of the fuels used: generally the more smoky fuels are more likely to be used outdoors.

Table 7.6: Outdoor and Indoor Cooking Location by Household Wealth (%).

Wealth Index of Household	Always Outdoors	Both Indoors and Outdoors	Always Indoors	Total %	Total N
Low	49.7	22.9	27.4	100.0	807
Medium	20.5	26.0	53.5	100.0	127
High	-	25.5	74.5	100.0	51
Total	43.4	23.5	33.2	100.0	985

Date Source: Questionnaire Survey of GAMA, 1991
Note: Households not cooking at home are excluded from this table.

About a quarter of the households using either fuelwood or charcoal always cooked indoors. If households with cooking huts are excluded, the percentage falls to 18. Outdoor cooking raises a variety of hygiene and sanitation problems, but one might expect reduced smoke exposure. However, smoke from open fires can be blown into the faces of those cooking. Moreover, all but a few poor and medium wealth households cooking indoors said that their cooking rooms were ventilated.

For children, exposure will of course depend on whether they are present while the cooking is going on. Table 7.7 indicates that children in poor households are considerably more likely to be present.

Table 7.7: Presence of Children Under Six During Cooking by Household Wealth (%).

Wealth Index of Household	Never Present	Sometimes Present	Usually Present	Total %	Total N
Low	32.8	40.4	26.9	100.0	458
Medium	39.7	41.4	18.9	100.0	58
High	60.9	26.1	13.0	100.0	23
Total	34.7	39.9	25.4	100.0	539

Data source: Questionnaire Survey of GAMA, 1991.
Note: This table only includes households with children under six.

7.1.3 Exposure to Respirable Particulates While Cooking

Exposure to respirable particulates (RSP) is generally taken to be the principle risk associated with high concentrations of air pollution from cooking fires. The particulates emitted contain a variety of carcinogens. But more important to GAMA dwellers, particulates can increase susceptibility to respiratory infection among children and chronic respiratory problems in adults. A number of studies undertaken in other countries, including some in Africa, suggest that exposure to wood-fuel smoke contributes to acute respiratory infections in children and chronic obstructive lung disease in women (see Chen et al., 1990 or Smith, 1993). However, since the evidence also indicates considerable variation in exposure across different locations, it is important to be able to assess exposures locally.

In order to determine more precisely the levels of exposure women in GAMA face while cooking, 199 women were monitored for both respirable particulates (RSP) and carbon monoxide (CO). In this section, the results of the RSP measurements are summarised. A description of the measurement procedures are provided in Appendix 3. Briefly, the women were requested to wear portable pumps with filters for about three hours, spanning the time spent cooking a meal. The particulates collected during this period were measured, and then employed to calculate the average concentration of respirable particulates in the vicinity of the woman's face during the period.

As illustrated in Table 7.8, the results conform to the anticipated fuel hierarchy. Wood users were subject to the highest average concentrations, followed by charcoal users and finally kerosene, LPG and electricity users (grouped together due to the small sample size). The differences in the estimated means are appreciable. At 587 $\mu g/m^3$, the estimated mean concentration faced by wood users is over twice the estimate of 195 $\mu g/m^3$ for kerosene, LPG and electricity users. While there was considerable variation in the average concentrations even within the fuel user groups, fuel choice is quite clearly an

important factor in determining exposure[1]. The frequency distribution in Figure 7.1-3 illustrates the extent to which wood users are exposed to larger quantities of respirable suspended particles compared to charcoal or kerosene, LPG and electricity users.

Table 7.8: Average concentrations of RSP ($\mu g/m^3$) in three groups of fuel users.

Wood			Charcoal			Kerosene, LPG, electr.		
Mean	SE	n	Mean	SE	n	Mean	SE	n
587.1	194.0	21	341.2	34.4	122	195.2	55.0	24

Data source: Personal monitoring undertaken in GAMA for this study.

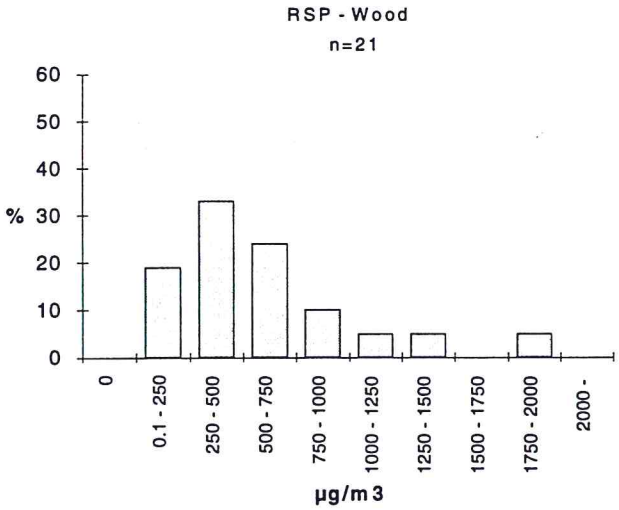


Figure 7.1: Frequency distribution of RSP concentrations among wood users.

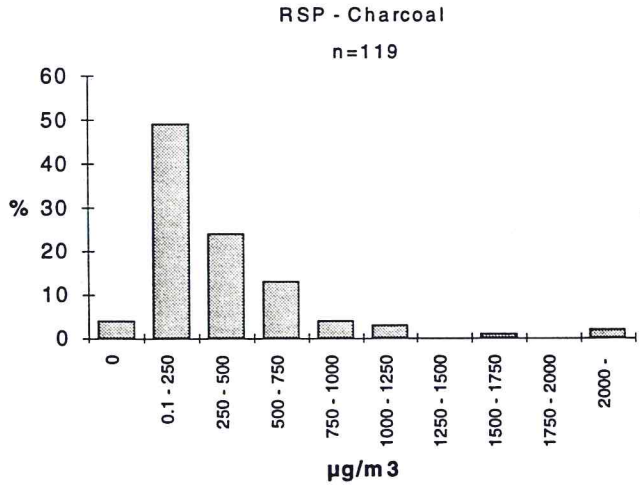


Figure 7.2: Frequency distribution of RSP concentrations among charcoal users.

[1]ANOVA analysis indicated statistically significant differences in exposure to RSP among the three fuel-user groups (p=0.002). Further analysis, applying t-tests, showed a statistically significant difference in RSP exposure between wood and charcoal users (p=0.022) and a marginally significant difference between charcoal users and kerosine, LPG and electricity users (p=0.075).

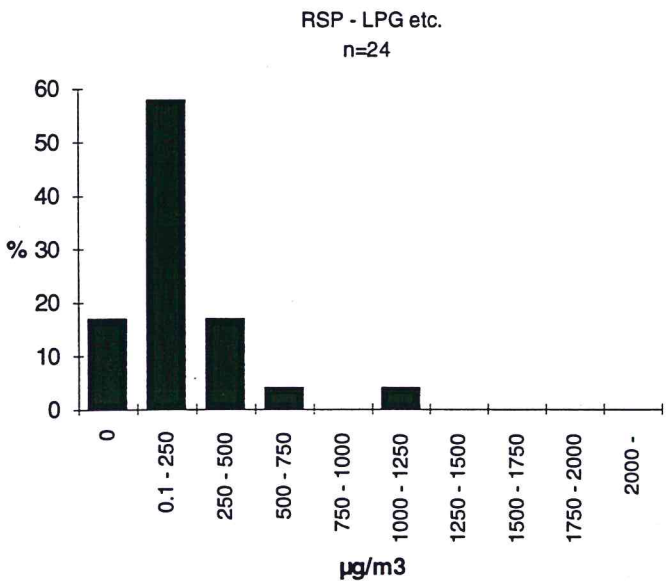


Figure 7.3: Frequency distribution of RSP concentrations among kerosene, LPG and electricity users.

There are no directly applicable international standards or guidelines with which to compare these concentration levels. However, for outdoor air, WHO recommends that the mean daily concentration of total suspended particulates (TSP) should not exceed 150-230 $\mu g/m^3$ more than seven days per year (see Table 7.1). The United States Government has set a 24-hour standard of 150$\mu g/m^3$ that should not be exceeded more than once a year. Also, as noted in Table 7.2 above, the maximum permissible level of TSP in residential areas in Ghana is 150$\mu g/m^3$ (averaged over 24 hours). In view of these figures the levels measured are disturbingly high.

In a comparable study from Zambia, wood users were exposed to a mean concentration of respirable particles of 890 $\mu g/m^3$, charcoal users to 380 $\mu g/m^3$ and electricity users to 240 $\mu g/m^3$ (Ellegård and Egnéus, 1992). These figures are not very different, and could easily be accounted for by somewhat different cooking locations and practices.

Within GAMA, no significant differences in exposure could be detected among the districts, or between high, medium and low class residential areas. However, as noted above, poor households are more likely to use wood or charcoal as their principal fuel, while households in the rural fringe are the most likely to use wood. It is safe to assume, therefore, that the poor, and particularly the more rural poor, face the highest exposure to respirable particulates.

7.1.4 Exposure to Carbon Monoxide While Cooking

Carbon monoxide (CO) is also emitted from cooking fires, and can be hazardous to the health. Factors that govern the toxicity of CO include the concentration of the gas in the inhaled air, the duration of exposure, the respiratory volume, the cardiac output, the oxygen demand of the tissues and the concentration of haemoglobin in the blood. Table 7.9 indicates the physiological effects different CO levels have in

humans. CO exposure is of particular concern for pregnant women, and their unborn children.

Table 7.9: Effects of carbon monoxide and their likely accompanying carboxyhaemoglobin blood (COHb) content in humans.

Exposure range* (ppm)	Effect and symptoms	COHb** blood conc. %
0-10	No discomfort or effect	0-2
10-50	General tiredness, impaired vigilance and reduction in manual dexterity	2-10
50-100	Slight headache, pronounced tiredness and irritability	10-20
100-200	Headache	20-30
200-400	Severe headache, visual impairment, nausea, general weakness and vomiting	30-40
400-600	As above, but with greater possibility of collapse	40-50
600-800	Fainting, increased pulse rate and convulsions	50-60
800-1600	Coma, weak pulse and possibility of death	60-70
1600-	Death within a short period	70-

* 2 hours exposure

** Likely equilibrium carboxyhaemoglobin/oxyhaemoglobin ratios in the blood after some time whilst resting (although they may be achieved three times as fast during heavy work and generally by heat and humidity).

Data source: Wellburn, 1988. p 274.

WHO guidelines for CO exposure are as follows: maximum exposure of 100 mg/m^3 (87 ppm) for a time duration of not more than 15 minutes, and 30 mg/m^3 (approximately 25 ppm) for a time duration of not more than 1 hour (UNEP-WHO, 1988). EPC of Ghana has no recommended standards in regard of CO exposure levels. Hence the WHO guideline value of 25 ppm for 1 hour is used in the following discussion results.

The average exposures of the five fuel-user groups are presented in Table 7.10, along with the time-weighted average concentrations. The data shows that charcoal users were the group most exposed to CO, followed by wood users and, finally, kerosene, LPG and electricity users. The graphical presentation in Figure 7.4-6 of the frequency distribution of CO among the three fuel user groups in GAMA demonstrate that more charcoal users were exposed to higher concentrations than users of wood or kerosene, LPG and electricity. All CO concentrations for wood users fall under 20 ppm and under 10 ppm for kerosene, LPG and electricity users.

Table 7.10: Average concentration of CO measured as dose units (ppmh) and calculated Time-Weighted Averages in three fuel-user groups of fuel users.

	Wood			Charcoal			Kerosene,LPG,electr.		
	Mean	SE	n	Mean	SE	n	Mean	SE	n
Exposure (ppmh)	24.1	9.1	24	33.1	2.9	137	3.8	1.1	32
Concentration (ppm)	7.5	3.0	24	11.0	1.0	137	1.2	0.4	32

Data source: Personal monitoring undertaken in GAMA for this study.

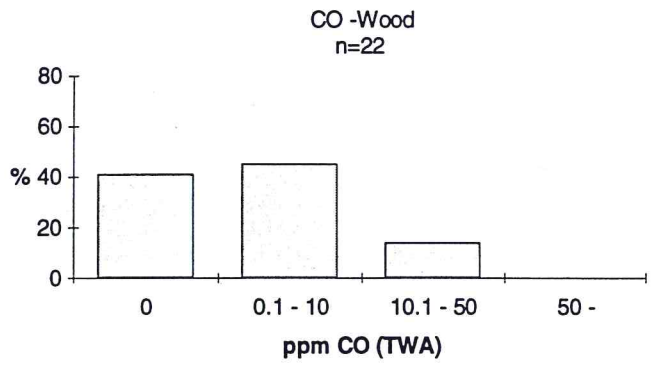


Figure 7.4: Frequency distribution of carbon monoxide concentrations among wood users.

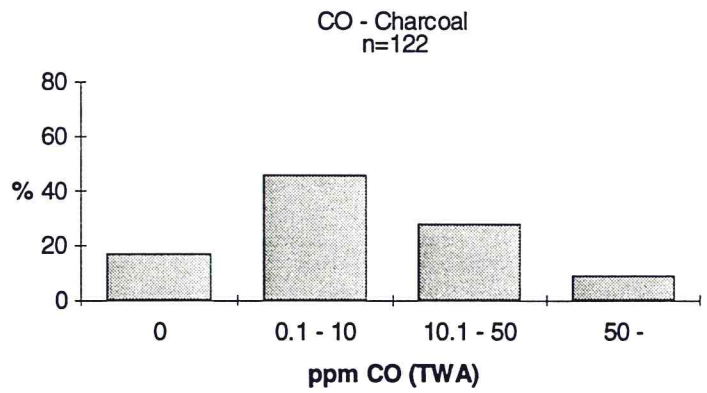


Figure 7.5: Frequency distribution of carbon monoxide concentrations among charcoal users.

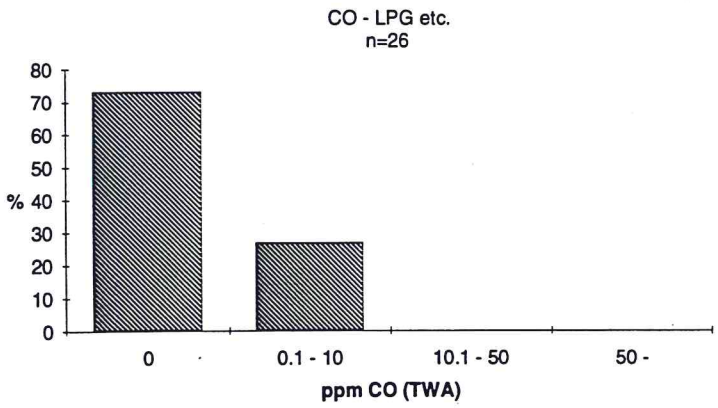


Figure 7.6: Frequency distribution of carbon monoxide concentrations among kerosene, LPG and electricity users.

About 6% of the charcoal users were exposed to an average CO concentration greater than 25ppm, the UNEP-WHO guideline for 1 hour of exposure. The measuring time ranged between 1.6 - 4.5 hours, with a mean measuring time of 3.0 hours, suggesting that 25ppm is very conservative. Also, table 7.9 indicates that even low exposure levels of 10-50 ppmv have a negative effect in humans, which is accentuated when exposure time is prolonged. It is best to assume that CO exposure, like exposure to particulates, is a health burden for a significant share of the women in GAMA.

In the Zambia study referred to above (Ellegård and Egnéus, 1992), the mean CO exposures were found to be 43 ppmh for fuelwood users and 65 ppmh for charcoal users, which are about double the doses measured in the present study and cover periods of similar duration. When compared to a recent study from Maputo which again used similar measurement techniques and durations, the CO dose measured in Accra for wood, 24ppmh, is also considerably lower than the Maputo dose of 49 ppmh, while charcoal levels are of the same magnitude, 33 ppmh in Accra versus 37 ppmh in Maputo (Ellegård, 1993.). In a table compiled by Smith (1987), two studies from Nepal reported 14 - 295 ppm CO during 1 - 2 hour cooking periods. One would expect exposures in Nepal to be considerably higher than Accra, however, as cooking is often performed indoors with very little ventilation.

7.1.5 Cooking Patterns and Respiratory Problems

The results described above suggest that exposure to pollution from cooking fires is indeed a health risk, even if the situation is likely to be worse in other parts of Ghana where wood use is more prevalent. This section looks briefly at the relationship between cooking patterns and symptoms of respiratory problems in female principal homemakers and children under six. A more comprehensive analysis of respiratory problems, which attempts to take into account factors other than air pollution, is presented in Chapter 8. Even in this section, however, the 41 principal homemakers who smoke have been excluded to avoid distorting the results. More than half of the smokers complained of respiratory problem symptoms (e.g. sore throat, cough, and difficulties breathing), as compared to 18% for non-smoking principal homemakers.

Table 7.11 presents the two-week prevalence of respiratory problem symptoms for principal homemakers grouped according to cooking practices. Only those categories found to be statistically significant are included. Perhaps surprisingly, the relationship between fuel choice and respiratory problem prevalence was not statistically significant. As described in Chapter 8, this may be due to other risk factors the women using clean fuels face. Also, multiple fuel use and the relatively small share of households using the cleaner fuel make it inherently more difficult to detect associations. A longer cooking time, cooking in a cooking hut, and not cooking in the open air, are all associated with higher prevalences, which could well reflect higher exposures to air pollution.

Table 7.11: Cooking Patterns and the Prevalence of Respiratory Problem Symptoms in Female Principal Homemakers.

Category	Households in Category	Two-week Prevalence (%)
a. Sometimes cook in open air		
Yes	434	13.8
No	476	22.1
b. Sometimes cook in cooking hut		
Yes	94	25.6
No	816	17.3
c. Hours stove is lit per day		
0-3 hours	506	15.4
3+ hours	403	21.3

Data source: Questionnaire survey of GAMA, 1991.
Note: Households without female principal homemakers and missing values are excluded.

The women monitored for exposure were also tested for peak expiratory flow (see Appendix 1.3). The peak expiratory flow (PEF) is proportional to the diameter of the upper and central airways and therefore low values can indicate the existence of a reduction in the airways due to inflammatory reactions or blockage by phlegm. Such reaction could be due to the effect of prolonged exposure to particulates and irritating gases (Ellegård and Egneus, 1992). However, neither the differences in PEF before and after cooking, nor the differences between fuels, are appreciable (see Table 7.12) .

Table 7.12: Peak Expiratory Flow l/min before and after cooking period by fuel-user group.

Cooking fuel	Wood			Charcoal			Kerosene,LPG,Electr.		
	mean	SE	n	mean	SE	n	mean	SE	n
Final PEF	344.4	20.8	24	361.6	7.2	139	377.0	20.5	32
Initial PEF	373.4	17.4	24	353.7	7.0	139	365.5	19.7	32
Difference	-29.0			7.9			11.6		

Data source: Personal monitoring undertaken in GAMA for this study.

As illustrated in Table 7.13, children under six were more likely to have had symptoms of acute respiratory infection in the last two weeks if they were generally present during cooking or if cooking was done in a cooking hut. Again, this could well reflect differences in air pollution exposure.

Table 7.13: Cooking Patterns and the Prevalence of Acute Respiratory Infection Symptoms in Children Under Six.

Category	Households in Category	Two-week Prevalence (%)
a. Sometimes cook in cooking hut		
Yes	63	20.6
No	481	10.6
b. Children present during cooking		
Usually	137	20.4
Rarely	402	9.0

Data Source: Questionnaire survey of GAMA, 1991.
Note: Households without children under six and missing values are excluded.

7.2 Housing

The size and quality of the dwelling are, of course, critical aspects of the household environment. Many previous sections of this report have dealt, either directly or indirectly, with housing problems. The recent Housing Needs Assessment Study (Housing and Urban Development Associates, 1990) examines GAMA's housing situation in some depth. This section provides a brief assessment of selected housing problems, drawing on the results of the questionnaire survey.

Excessive crowding clearly affects the well being of a household, and many studies indicate it can also affect health (Bradley et al., 1991). Neighbourhood crowding is at least partially captured in the strata upon which the questionnaire survey was based. Crowding within the home can be equally important. As indicated in Table 7.14, about a third of the households surveyed resided in one room, another third in two rooms, and the final third in three or more rooms. While about 41% of the poor households lived in one room, none of the wealthy households did so. Indeed, 94% lived in three or more rooms, indicating the extent to which overcrowding is associated with poverty.

Table 7.14: Number of Rooms Household Occupies by Household Wealth.

Wealth Index of Household	Number of Rooms Occupied: One Room	Two Rooms	Three+ Rooms	Total %	N
Low	40.9	35.4	23.7	100.0	816
Medium	11.5	29.2	59.2	100.0	130
High	-	5.9	94.1	100.0	51
Total	35.0	33.1	31.9	100.0	997

Data source: Questionnaire survey of GAMA, 1991.
Note: Missing values are excluded from table.

It is possible, however, for crowding to result even in homes with several rooms, especially if the use of most rooms is restricted to one or two households members. For this reason, the space available per person in the most crowded sleeping room can be a better indicator of crowding for most household members than the overall number of rooms or their floor space. As indicated in Table 7.15, in about 60% of households there is less than 4 square meters per person in the most crowded sleeping room, though among wealthy households the percentage falls to 16. While all but a few of these rooms are ventilated, this level of crowding is a cause for concern. Principal homemakers in households with less than 4 square meters per person have a somewhat higher prevalence of respiratory problems (21% instead of 18%), but there is a more obvious difference among households with small children: among the (388) households with less than 4 square meters, 14% had had a child with symptoms of acute respiratory infection in the past two weeks, as compared to 6% among the (139) households with more space.

Table 7.15: Space per Person in Most Crowded Sleeping Room.

Wealth Index of Household	Square Meters Per Person <2	2-4	4-8	8+	Total %	N
Low	11.4	53.3	28.6	6.7	100.0	796
Medium	7.9	38.6	43.3	10.2	100.0	127
High	2.0	14.3	57.1	26.5	100.0	49
Total	10.5	49.4	32.0	8.1	100.0	972

Data source: Questionnaire survey of GAMA, 1991.
Note: Missing values are excluded from table.

Damp conditions can also affect both well being and health. Overall, 40% of the households reported that their roofs leaked, 18% complained of damp conditions, and 14% reported mildew or mould problems. Again the problems were far more prevalent among poor households than among the wealthy. Thus, for example, 43% of poor households had leaky roofs, compared with 23% of the wealthy households, 20% of poor households complained of damp conditions, compared with 6% of wealthy households, and 15% of poor households reported mildew or mould problems while no wealthy households reported such problems.

Box 7.1: Cooking Fuels and Wealth

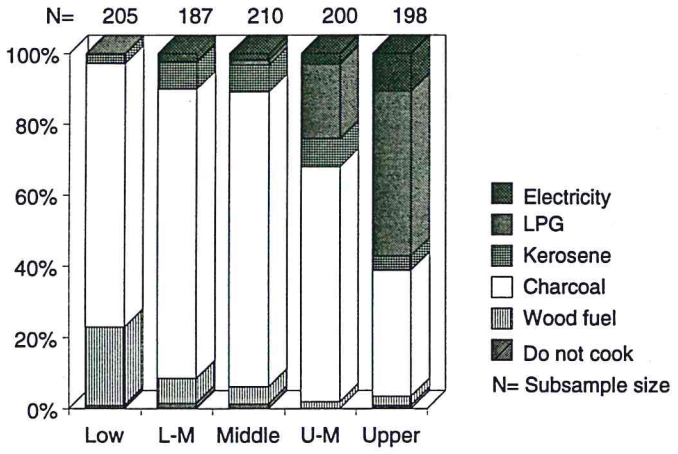


Figure 7.1: Distribution of households by type of principal cooking fuel in Accra by wealth group

Cooking fires are almost certainly the main source of personal exposure to air pollution for women in GAMA. Charcoal is the dominant cooking fuel, and is likely to remain so for many years to come. As illustrated in Figure 7.1, however, there is a fuel hierarchy, with a small but significant share of the poorest households using wood, and LPG and electricity becoming significant in the wealthiest groups. Exposure monitoring undertaken for this study indicated that wood users are the most exposed to particulates, followed by charcoal users and finally kerosene, LPG and electricity users.

Data source: Questionnaire survey of Accra, 1991.

Note: The wealth groups employed in these diagrams are based on the same wealth index employed in the rest of the report. However, rather than three unequal groups (the poor majority, a small wealthy elite, and a somewhat larger medium-wealth group), five groups of roughly equal size have been created for the graphical presentation.

CHAPTER EIGHT

8 HOUSEHOLD ENVIRONMENT AND HEALTH

8.1 Introduction

Many of the environmental problems described above pose health risks. In individual chapters, some of these health risks were discussed, and empirical associations between particular environmental hazards and ill health were presented. Two of the most important environment-related health problems are diarrhoea and respiratory illness. Neither of these health problems are simple effects of individual environmental factors. There are a number of interrelated environmental risk factors, which are related in turn to non-environmental factors such as age, malnutrition and so on. One of the reasons for bringing the health issues together in this chapter is to broach some of these complexities. More generally, by considering the health issues together, it is possible to demonstrate more forcefully the critical importance of household and neighbourhood environments to the well-being of the population.

Among the ten top "diseases" reported at outpatient facilities in the Greater Accra Region (Table 8.1), environment-related health problems feature very prominently. (GAMA accounts for over 90% of the population of the region.). For the period 1987 to 1990, the top three on the list were malaria, diarrhoea, and upper respiratory tract infection. Outpatient visits are a biased source of information on morbidity, and will tend to exaggerate the importance of the better known treatable conditions. On the one hand, people are more likely to become outpatients if they believe there is a treatment for their condition. On the other hand, the diagnostics are relatively superficial. Malaria, for example, is likely to be over-reported, since there is a treatment known to most potential patients, and a tendency to label ambiguous cases as malaria so as to justify treatment. Even accepting the data deficiencies, however, the high prevalence of environment related health problems is clear.

Table 8.1: Ten Most Frequently Reported Health Problems at Outpatient Facilities (Greater Accra Region - 1987-90).

1987	%	1988	%	1989	%	1990	%
malaria	53.0	malaria	45.7	malaria	44.3	malaria	41.0
diarrhoea	10.9	diarrhoea	7.0	respiratory inf.	10.9	respiratory inf.	9.1
respiratory inf.	8.0	respiratory inf.	10.3	diarrhoea	5.8	diarrhoea	5.9
skin diseases	7.3	skin diseases	4.9	skin diseases	4.5	skin diseases	5.3
accidents	5.3	accidents	3.2	pregnancy related	3.4	pregnancy related	4.1
acute eye inf.	4.3	acute eye inf.	2.1	accidents	3.2	accidents	3.9
intestinal worms	3.4	intestinal worms	2.6	intestinal worms	1.8	hypertension	2.4
pregnancy related	3.0	anaemia	2.1	rheumatism	2.8	intestinal worms	2.1
hypertension	2.3	hypertension	2.4	hypertension	2.0	anaemia	2.0
[2]fever	2.1	pregnancy related	1.9	anaemia	1.7	fever	2.0

Data source: Ghana Government, 1991.

[2] Pyrexia (fever) of unknown origin.

The following statement from the 1991 Health Annual Report for GAMA clearly emphasises the twin role of poor environmental conditions and poverty in causing disease in the metropolis:

"Malaria, skin conditions, respiratory conditions, measles, whooping cough, tuberculosis and gastro-intestinal infections-featured prominently in the list of diseases common in the Metropolis. Poor hygienic standards due to lack of health knowledge coupled with lowered resistance due to malnutrition have been some of the predisposing causes of a number of cases" (Ghana Government, 1991, p.2).

Over time, if economic conditions improve, the disease profile is likely to change. Already, there are some indications that diseases more typically associated with wealthy lifestyles, such as cancer and heart disease, may be becoming increasingly important causes of death in GAMA. Currently, however, the most evident health problems are not the result of lifestyle choices, but of the lack of choice.

In the course of the household survey, questions were asked regarding diarrhoea, respiratory illness and malaria among children under six, and respiratory problems among principal homemakers, most of whom are women. The principal sections of this chapter cover diarrhoea and respiratory problems in turn. Numerous other health problems are environment-related, but are not easily addressed using the approach adopted in this study.

Malaria is one of the most important diseases in Accra. The prevalence of *Anopheles* mosquitoes depends on a number of environmental factors, some of which have been discussed in Chapter 5. Often the links are complex. Inadequate water supplies, for example, lead to water storage in the home, creating a potential breeding site for malaria vectors (see page 48 above). The survey data do not allow for detailed analysis, however. While about 19% of the households with children under six said that at least one of the children had had malaria within the last two weeks, self reporting of malaria is inaccurate. Moreover, since *Anopheles* mosquitoes make up only a small share of the mosquito population, reports of mosquito biting are not a good indicator of risk (some of the more common mosquitoes can, however, be vectors of other diseases, such as dengue and yellow fever). Finally, factors such as proximity to natural breeding sites are likely to be critical, but were not identified during the survey. For these reasons, no attempt is made here to go beyond the discussion of Chapter 5.

Similarly, epidemics are not amenable to analysis using the household survey data. In many cases, however, the conditions which sustain endemic diseases are also those which give rise to epidemics. Evidence in GAMA of cholera morbidity in 1991 suggests that the urban poor living in degraded slum environments with poor water and sanitation facilities are more at risk from cholera attack. There were more than two thousand reported cases of cholera with 35 reported deaths in Accra District alone (AMA, 1991, Table 6). The residential areas where the diseases were prevalent were mainly found in the poor sectors. The poor neighbourhoods in which the epidemic occurred include Nima, Accra, New Town, Maamobi, Zongo, Sukura and Abeka. Others are Bukom, James Town, Korle Wokon, Korle Gonno, Chorkor, Labadi and Teshie. None of the remaining areas cited, including Asylum Down, Adabraka, Kaneshie and Teshie, were high class residential areas of the city.

Overall, the analysis which follows depicts a complex system, wherein poverty, related social risk factors, and environmental deprivation all combine to contribute to ill-health. It has been argued elsewhere that health outcomes in the urban milieu derive ultimately from the socio-economic context of a household's existence, with poverty as the most significant predictor of urban morbidity and mortality (Bradley et al., 1991, p.ii). The importance of poverty is indeed evident in the following results. However, this should not be taken to imply that direct action targeting environmental improvement is not warranted. Environmental factors make an appreciable difference to the health of the poor. Indeed, the importance of poverty would seem to be in large part a reflection of the difficulties poor households face achieving adequate environmental conditions. These difficulties cannot all be reduced to household financial capacities, but often involve non-economic disadvantages.

8.2 Diarrhoea

"Diarrheal diseases are widely recognized as a major cause of morbidity and mortality in Sub-Saharan Africa" (Kirkwood, 1991). The situation in GAMA is not exceptional in this regard. Children are especially at risk, and despite efforts to improve treatment, diarrhoeal diseases continue to inflict a heavy toll. Most diarrhoeal diseases are transmitted through faecal-oral routes which are particularly pervasive in conditions of poverty.

Table 8.3 displays the relationship between poverty and the prevalence of diarrhoea among children under six. The estimates are based on the principal homemakers' reports of cases of diarrhoea within the past two weeks among any children in the household under six. Households without children under six are excluded. The results clearly indicate that children living in poor households are significantly more at risk than those living in wealthier households. Given malnutrition and/or inadequate treatment, diarrhoea is more often lethal. Poor children are less likely to be well nourished or receive adequate treatment. As such, the differentials in diarrhoea morbidity across wealth groups are likely to be less than those for diarrhoea mortality.

Table 8.3: Relationship Between Wealth and Childhood Diarrhoea Prevalence.

Wealth Group	Number of Households with children under 6	Two Week Prevalence of Diarrhoea (%)
Low	457	14.7
Medium	59	8.5
High	21	0.0
Total	537	13.6

Data source: Questionnaire Survey of GAMA, 1991.

The relationship between area of the city and diarrhoea prevalence, displayed in Table 8.4, is equally clear. Poor areas of the city are also those with the greatest diarrhoeal prevalence, although there are significant variations within the group. The high density indigenous sector and the rural fringe had the worst scores. The high density low class sector ranks third even though the mean wealth index was

higher for the high density indigenous sector than the high density low class sector. By contrast, the diarrhoeal prevalence was quite low for the middle density indigenous sector, the middle to low density middle class sector and the low density high class sector (incorporating the newly developing low density areas).

Table 8.4: Relationship between Residential Sector and Childhood Diarrhoea Prevalence.

Area	Number of Households with children under 6	Two Week Prevalence of Diarrhoea (%)
RF	29	24.1
HDLCS	274	14.0
HDIS	81	26.0
MDIS	61	5.0
M-LDMCS	70	4.3
LDHCS	22	4.6
Total	537	13.6

Key: RF=Rural Fringe; HDLCS=High Density Low Class Sector; HDIS=High Density Indigenous Sector; MDIS=Middle Density Indigenous Sector; M-LDMCS=Middle to Low Density Middle Class Sector; LDHCS=Low Density High Class Sector (including Newly Developing Sector).
Data source: Questionnaire Survey of GAMA, 1991.

There are a number of additional social factors which could be expected to affect diarrhoea prevalence. As noted in Chapter One, a significant share of the households in Accra are headed by females. Such households tend to be poorer than male headed households. About 79% of all male headed households fell into the poor group with 15% and 7% in the medium income and wealthy groups respectively. By contrast, 89% of all female headed households were poor, with 7% and 4% lying in the medium income and wealth groups respectively. Nevertheless, the prevalence of diarrhoea in children under 6 was only marginally higher for female headed households than male headed ones. About 13% of all (415) male headed households with children under 6 had diarrhoea, as compared to 15% for all (122) female headed households with children under 6. This may be due to the fact that women tend to channel more of their income and time to their children than men. The importance of women is also highlighted by the fact that when the principal homemaker (generally a woman) spends more time at home, the children are less likely to have had diarrhoea. Thus, for example, in the (174) households where the principal homemaker typically spends almost all her time at home, diarrhoea prevalence fall to about 9%.

The environmental factors most often linked to diarrhoeal mortality and morbidity are water and sanitation. Studies indicate that "children from households using public standpipes and cesspools are several times more likely to die from diarrhoea than those with in-house piped water and sewerage" (Bradley et al., 1991, p.ii). There have been similar findings with respect to diarrhoeal morbidity: "Comparing the results of studies of diarrhoeal morbidity, Esrey, Feacham and Hughes (1985) found a median percentage reduction in diarrhoeal morbidity of 16% in the 9 cases involving improved water quality, 25% in the 17 cases involving improved water availability, 37% in the 8 cases involving improvements

in both water quality and availability, and 22% in the 10 cases involving improvements in excreta disposal" (McGranahan, 1991, p.14).

The results of our own analysis cited in the chapters on water and sanitation tend to conform to such observations. For example, the prevalence of childhood diarrhoea among households using communal standpipes was several times higher than among those with indoor piped water supply. Differences of a similar magnitude were observed between households using non-flush toilet technologies (i.e. pit, KVIP, and pan latrines) and those with flush systems. As Lindskog and Lundqvist have indicated, improvements in sanitation and hygiene may have a greater impact upon diarrhoeal diseases than improvements in water quality at source alone. "This may be so because improvements in water-quality at the water-source only influence the disease load in one way, while improvements in sanitation and personal hygiene influence the disease load in three different ways. Firstly, better personal hygiene reduces faecal-oral transmission via solid bodies. Secondly, better hygiene reduces faecal-oral transmission via water. Finally, better hygiene reduces faecal-oral transmission via food. Improvements in sanitation, i.e. properly constructed pit-latrines which are correctly used, prevent transmission via water, while lack of good personal hygiene may still result in transmission via the other routes" (Lindskog and Lundqvist, 1989, p.21).

It is therefore important to take account of hygiene practices of households to achieve a better understanding of the spread of diarrhoeal diseases. Other factors which were identified in previous chapters as potential causes of high diarrhoea prevalence include purchasing prepared food from vendors and the presence of flies in food preparation areas and toilets.

In a city like Accra, household hygiene is not independent of water and sanitation facilities, however. Without a reliable water source, good hygiene habits are difficult to maintain. As indicated in Chapter 3, hand washing would seem to be more closely associated with the type of water source a household has than the education level of the principal homemaker. Similarly, hygiene habits can be affected by inadequate sanitation. The results summarised in Chapter 3 clearly demonstrate that outdoor defecation is related to overcrowded sanitary facilities.

Under these circumstances, it can be unreasonable to isolate specific causes of high diarrhoeal morbidity, and target policies accordingly. Socio-economic conditions help determine access to environmental amenities which in turn help determine hygiene practices. Even in cases where hygiene practices are the proximate cause, it may be more appropriate to achieve better health through improved facilities or improved economic opportunities, rather than admonishing people to adopt better hygiene practices.

These complex interrelationships also make it difficult to analyse the associations between environment and diarrhoea morbidity statistically One of the more common techniques employed by epidemiologists is logistic regression (Armitage and Berry, 1987). This technique allows simultaneous analysis of diarrhoea prevalence and a number of possible explanatory factors. It is generally preferable to techniques which examine associations between diarrhoea morbidity and environmental conditions one by one, in that it avoids fully ascribing the same diarrhoea cases to a number of different factors. On the other hand, logistic regression cannot capture the hierarchy of interrelationships described above: it cannot model, for example, the way in which socio-economic conditions relate to diarrhoea morbidity through access to environmental amenities.

Table 8.5 displays the childhood diarrhoea prevalence among 8 high risk groups identified through logistic regression. Only households with children under six, and having information on all of the relevant variables, are included in the table. As indicated, the difference between the diarrhoea prevalence in any one of these groups and the diarrhoea prevalence for the rest of the sub-sample is highly significant statistically ($p < .01$).

Table 8.5: Children's Diarrhoea Prevalence in High Risk Household Groups Identified for Logistic Regression -Accra.

Environmental Feature	Households in Subsample	Two Week Diarrhoea Prevalence (%)
Share toilet with >5 households	303	18.8
Use Pot for Storing Water	34	32.4
Open Water Storage Container	90	27.8
Outdoor Defecation - Neighb. Children	132	28.0
Many Flies in Kitchen	151	25.2
Do not Wash Hands - before Food Prep.	125	23.2
Water Supply Interruptions (time of day)	329	17.9
Buy Prepared Food from Vendors	374	16.6
Total	**500**	**13.8**

Difference between high risk group and rest of sample is statistically significant ($p < .01$) in all cases.
Data Source: Questionnaire Survey of GAMA - 1991

In Table 8.6 the diarrhoea prevalence is presented for households grouped according to the number of high risk conditions the households face. The association very close. None of the households facing less than two of the risks identified had children (under six) with diarrhoea, while most of the households facing more than five risks had at least one child with diarrhoea. One would not expect all the risk factors to be equally closely associated with higher diarrhoea morbidity, however.

Table 8.6: Childhood Diarrhoea Prevalence by Number of High Risk Conditions Household Faces.

Number of High Risk Conditions	Size of Subsample	Two-Week Diarrhoea Prevalence (%)
None	19	0.0
One	50	0.0
Two	133	3.0
Three	119	14.3
Four	77	14.3
Five	68	23.5
Six	21	57.1
Seven	13	69.2

Data Source: Questionnaire Survey of GAMA, 1991.

The results of the logistic regression are summarised in Table 8.7. Even entered simultaneously (and along with variables for wealth quintile, education of the principal homemaker and the number of children under six) all of the risk factors display statistically significant associations with diarrhoea morbidity ($p<.05$). The odds ratio, also sometimes referred to as the *approximate relative risk*, is an estimate of the odds of having had a child (under six) with diarrhoea if the factor is present over the odds of having had a child with diarrhoea if the factor is absent. For all of the risk factors, it is estimated that the odds of having had a child with diarrhoea are at least twice as high if the factor is present than if it is absent.

Table 8.7: Summary Results of Logistic Regression Relating Children's Diarrhoea Prevalence with Environmental Factors in Households with Children Under Six.

Variable	Coefficient	Standard Error	Significance	Odds Ratio
Use pot for storing water	1.47	.48	.002	4.34
Water supply interruptions	1.12	.39	.004	3.06
Share toilet with >5 households	.98	.40	.015	2.66
Purchase vendor prepared food	0.95	.45	.034	2.58
Open water storage container	0.79	.34	.022	2.19
Outdoor defecation	0.73	.31	.020	2.08
Many flies in kitchen	0.72	.32	.025	2.05
Don't always wash hands before preparing food	0.71	.31	.023	2.03

Note: Other variables included in logistic regression were education level of principal homemaker, wealth quintile,and number of children under six. None of these variables were statistically significant at the 95% confidence level, however. Environmental variables which were not included due to a lack of statistical significance were: water source, type of toilet facility, location of water source, dirty toilet floor, open storage of leftover food observed, many flies in the toilet, and crowding.
Data Source: Questionnaire Survey of GAMA, 1991.

These results clearly indicate that household environmental factors play a major role in diarrhoea prevalence, and thereby overall child morbidity in Accra. All of the factors identified through the statistical analysis are suspected contributors to the spread of faecal-oral disease. They reflect a number of different possible routes, including food contamination and insects. Individual coefficients should not be given undue attention, however. For example, the high odds ratio associated with the use of a pot for storing water is based on a very small subsample of pot users, and in any case need not reflect problems with pot storage *per se*.

Water and sanitary conditions are heavily implicated, but the most common indicators of access to water and sanitation (type of water source and sanitary facility) did not emerge as statistically significant in the multi-factor analysis. The results conform to the view that access to water, rather than the quality of the water at source, is critical to health. With easy access to a good water supply, there would be no water interruptions, no need to store water, and as noted above many of the hygiene practices identified would be facilitated. Similarly, the results would seem to corroborate the view that it is the quantity rather than quality of sanitation facilities which is critical. Both the level of sharing of toilet facilities and the prevalence of outdoor defecation by children are closely linked to a lack of toilet facilities.

Three of the factors identified may reflect food contamination: washing hands before preparing food, purchasing prepared food from vendors, and the presence of many flies in the kitchen or food preparation area.

8.3 Respiratory Illness

Globally, the level of morbidity and mortality caused by respiratory infections rivals that from diarrhoeal diseases. Acute respiratory infection (ARI) is particularly hazardous for children, especially infants, and the elderly (Graham, 1990). Viral agents account for the majority of ARI cases, but bacterial agents tend to cause more severe infections, and account for a greater share of fatalities (Berman, 1991). Alternatively, infections affecting the lower respiratory tract tend to be more severe than upper respiratory tract infections. Like diarrhoeal diseases, ARI is believed to be aggravated by malnutrition and spread more easily under conditions typically associated with poverty, such as poor hygiene and crowding (Kirkwood, 1991). The incidence of respiratory diseases has also been linked to air pollution.

The survey undertaken for this study collected information from the principal homemaker on respiratory problems among children under six and for the respondent herself. For the children, the questions were designed to identify ARI, though the interviewers were not trained by medical personnel. For the principal homemakers, a series of tracer symptoms were employed, which would be expected to identify a broader range of respiratory problems, including chronic conditions. As with diarrhoea, a two week period was employed, and the results for childhood prevalence refer to the share of **households** with children under six wherein at least one case was identified.

8.3.1 Acute Respiratory Infection among Children Under Six Years Old

Overall, the estimated prevalence of childhood ARI was 11.8%, roughly comparable with the diarrhoea prevalence. Indeed, there was considerable overlap: in about one third of the households reporting diarrhoea or ARI, both were reported. Children in poor households or poor areas again seem to be more at risk, as indicated in Tables 8.8 and 8.9. The differences are less striking than in the case of diarrhoea, and verge on being statistically insignificant. On the other hand, mortality differences are likely to be more appreciable than morbidity differences.

Table 8.8: Relationship Between Wealth and Childhood ARI Prevalence.

Wealth Group	Number of Households with children under 6	Two Week Prevalence of ARI (%)
Low	460	13.0
Medium	60	5.0
High	23	4.4
Total	543	11.8

Data source: Questionnaire Survey of GAMA, 1991.

Table 8.9: Relationship between Residential Sector and Childhood ARI Prevalence.

Area	Number of Households with children under 6	Two Week Prevalence of ARI (%)
RF	29	13.8
HDLCS	279	12.5
HDIS	82	12.2
MDIS	62	12.9
M-LDMCS	70	8.6
LDHCS	22	4.5

Key: RF=Rural Fringe; HDLCS=High Density Low Class Sector; HDIS=High Density Indigenous Sector; MDIS=Middle Density Indigenous Sector; M-LDMCS=Middle to Low Density Middle Class Sector; LDHCS=Low Density High Class Sector (including Newly Developing Sector).
Data source: Questionnaire Survey of GAMA, 1991.

Several associations between childhood ARI prevalence and environmental factors were described briefly in previous chapters. Table 8.10 summarises the ARI prevalence in high risk groups identified through logistic regression. Most of the variables previously mentioned are included. Fuel choice is not, however, although as indicated in Chapter 7, fuel choice is significantly associated with ARI prevalence when one-way analysis is performed (i.e. no variables other than fuel choice are included). Once the other explanatory variables are included, fuel choice does not add significantly to the explanatory power of the equation. However, most of the households use more than one fuel, and a large majority use charcoal, making it inherently difficult to discern the influence of fuel choice. Moreover, two of the variables which are included may reflect the effects of air pollution: whether a child is usually present during cooking, and whether cooking always takes place indoors.

Table 8.10: Childhood ARI Symptom Prevalence in High Risk Household Groups Identified through Logistic Regression.

Environmental Feature	Households in Subsample	Two Week ARI Prevalence (%)
Child often present during cooking	137	20.4***
Many flies in kitchen	161	18.6***
Less than 4 m^2/ person in sleeping room	388	13.9**
Water supply interruptions (time of day)	348	14.9***
Use mosquito coils	253	15.4**
Never cook outdoors	258	13.6
Roof leaks during rains	224	15.2**
Total	**527**	**11.8**

Note: Statistical significance of difference between high risk group and rest of sample:
(* for p < .1) (** for p<.05) (*** for p<.01).
Data Source: Questionnaire Survey of GAMA - 1991

Table 8.11 summarises the childhood ARI prevalence according to the number of risk factors households face. Again, the relationship is fairly clear. Overall, the prevalence among the 274 households facing three or fewer high risk conditions was 4.4%, while that among the 253 households facing four or more was 19.8%.

Table 8.11: Childhood ARI Symptom Prevalence by Number of High Risk Conditions Household Faces

Number of High Risk Conditions	Number of Households with Children Under 6	Two-Week Prevalance of ARI
One or fewer	51	2.0
Two	106	6.6
Three	117	3.4
Four	146	14.4
Five	74	20.3
Six or more	33	42.4

Data source: Questionnaire Survey of GAMA, 1991.

The results of the logistic regression are summarised in Table 8.12. By and large, the results corroborate prevailing wisdom regarding respiratory infection. While there is considerable uncertainty in the odds-ratios associated with particular variables, overall the results indicate that environmental factors are associated with appreciable differences in ARI morbidity.

The strong association between ARI and children being present during cooking should be interpreted with care. Children present during cooking may be exposed to hazards other than smoke. Also, women who are more often with their children are more likely to be aware of their health problems. The prevalence of diarrhoea (without respiratory problem symptoms) is also higher among households where children are present during cooking, though this is unlikely to be related to smoke exposure. Thus, the relationship between ARI and the presence of children during cooking should not be taken as a definitive indication of the hazards of smoke. On the other hand, outdoor cooking is also statistically significant, and the results do suggest that the risks of smoke exposure should be taken seriously.

Flies in the kitchen and water interruptions are both likely to indicate poor hygiene. While more typically associated with diarrhoeal diseases, poor hygiene is also implicated in respiratory infection. In this context, it is worth noting that both of these variables remain significant even if cases where diarrhoea was also reported are excluded.

Crowding, another often cited risk factor in respiratory infection, is also represented. Having a leaky roof may reflect damp conditions, which can facilitate the spread of respiratory infections, but could also be taken to indicate generally low quality housing. The use of mosquito coils is not a well known risk factor in ARI, but does of course contribute to air pollution.

Table 8.12: Summary Results of Logistic Regression Relating Children's ARI Prevalence with Environmental Factors in Household with Children Under Six.

Variable	Coefficient	Standard Error	Significance	Odds Ratio
Child often present during cooking	0.96	0.29	.001	2.62
Many flies in kitchen	0.87	0.33	.008	2.39
Less than 4 m^2/ person in sleeping room	0.83	0.42	.049	2.29
Water supply interruptions	0.77	0.38	.040	2.16
Use mosquito coils	0.60	0.30	.048	1.83
Never cook outdoors	0.60	0.30	.044	1.82
Roof leaks during rains	0.53	0.30	.079	1.69

Note: Other variables included in logistic regression were education level of principal homemaker, wealth quintile,and number of children under six. Only the number of children under six was statistically significant at the 90% confidence level. Environmental variables which were not included due to a lack of statistical significance were: use of cooking hut, use of pump-spray insecticide, principal cooking fuel, observed evidence of dampness and selected water and sanitation variables.
Data Source: Questionnaire Survey of GAMA, 1991.

8.3.2 Respiratory Problem Symptoms among Principal Homemakers

A full 19.5% of the (956) female principal homemakers reported at least one respiratory problem symptom, the most common being dry coughs (9.3%) and sore throats (8.8%). As indicated in Tables 8.13 and 8.14, the prevalence of respiratory problem symptoms (RPS) and wealth or zone of the city are somewhat ambiguous. The highest prevalences are in the medium wealth group and the middle class zone. This is largely the result of a very high prevalence in one neighbourhood within the middle class zone, where 13 of the 15 principal homemakers interviewed reported at least one respiratory symptom. Such an extreme result is almost certainly the result of a single cause, and should not be taken as representative. The neighbourhood has been excluded in the analysis which follows. Also, however, the risk factors for respiratory problem symptoms in principal homemakers are not as wealth-dependent as those for childhood diarrhoea and ARI.

Table 8.13: Relationship Between Wealth and Principal Homemaker RPS Prevalence.

Wealth Group	Number of Households with female PH	Two Week Prevalence of RPS (%)
Low	781	18.2
Medium	125	28.8
High	50	16.0
Total	956	19.5

Data source: Questionnaire Survey of GAMA, 1991.

Table 8.14: Relationship between Residential Sector and Principal Homemaker RPS Prevalence.

Area	Number of Households with Female PH	Two Week Prevalence of RPS (%)
RF	49	14.3
HDLCS	437	18.5
HDIS	162	14.8
MDIS	108	16.7
M-LDMCS	155	31.6
LDHCS	45	15.6

Key: RF=Rural Fringe; HDLCS=High Density Low Class Sector; HDIS=High Density Indigenous Sector; MDIS=Middle Density Indigenous Sector; M-LDMCS=Middle to Low Density Middle Class Sector; LDHCS=Low Density High Class Sector (including Newly Developing Sector)
Data source: Questionnaire Survey of GAMA, 1991.

The RPS prevalence among principal homemakers in high risk groups identified through logistic regression is presented in Table 8.15. Again, several of the variables have already been mentioned in previous sections, including the use of pump spray insecticides, which is associated with a surprisingly high prevalence. Smoking is included for obvious reasons. It is treated here as a dichotomous variable (either one smokes or one does not), although in the regression the number of cigarettes smoked was employed. Generally, smoking among females is not only relatively rare, but the numbers of cigarettes smoked is low: about half the smokers consume five or less cigarettes a day. The overall prevalence noted in Table 8.15 is somewhat lower than the 19.5% cited above due to the exclusion of the excessively high prevalence neighbourhood.

Table 8.15: Female Principal Homemakers' Respiratory Problem Symptom Prevalence in High Risk Household Groups Identified through Logistic Regression.

Environmental Feature	Households in Subsample	Two Week RPS Prevalence (%)
Smokes cigarettes	35	34.3**
Uses pump-spray insecticide	101	39.6***
Water Supply Interruptions (time of day)	617	19.8
Never Cook Outdoors	482	21.2**
Roof Leaks During Rains	374	21.7**
Total	**939**	**18.3**

Note: Statistical significance of difference between high risk group and rest of sample: (* for p < .1) (** for p<.05) (*** for p<.01).
Note: Households with missing values for any variable, or without female principal homemakers, are excluded.
Data Source: Questionnaire Survey of GAMA, 1991.

As indicated in Table 8.16, the prevalence in those (79) households not in any of the risk categories identified is only 7.6%, rising to 31.5% in the (178) households in three or more risk categories (only 16 households were in more than three categories).

Table 8.16: Female RPS Prevalence by Number of High Risk Conditions Household Faces.

Number of High Risk Conditions	Size of Subsample	Two-Week RPS Prevalence (%)
None	79	7.6
One	307	11.7
Two	375	19.7
Three or more	178	31.5

Data source: Questionnaire Survey of GAMA, 1991

Table 8.17 summarises the results of the logistic regression. The only highly significant variable ($p < .01$) relates to the use of pump-spray insecticides (aerosol insecticides are not included in this category). This finding clearly deserves further investigation. Breathing in the insecticide could be the cause of respiratory problem symptoms, and the use of pump-spray insecticides would not appear to be restricted to any particular part of the city, or associated with other known risk factors not included in the regression. It would be premature to assume that the use of spray pesticides is a major health risk. But a careful assessment of the insecticides being used, the methods of application, and the health problems users face is clearly warranted. Should pump-spray insecticides be a problem, there are a number of measures which could be taken.

Table 8.17: Summary Results of Logistic Regression Relating PH RPS Prevalence with Environmental Factors.

Variable	Coefficient	Standard Error	Significance	Odds Ratio
Use pump-spray insecticide	1.25	0.24	<.001	3.49
Water Interruptions common at certain times of day	0.46	0.20	.019	1.58
Roof leaks during rains	0.42	0.18	.023	1.52
Never cook in open air	0.36	0.18	.050	1.43
Cigarettes smoked per day	0.10	0.05	.025	1.11

Note: Other variables included in logistic regression were age of principal homemaker and wealth quintile, though neither were statistically significant. Environmental variables which were not included due to a lack of statistical significance were: crowding, use of cooking hut, principal cooking fuel, observed evidence of dampness and selected water and sanitation variables.

Water interruptions, leaky roofs and never cooking out-of-doors are all variables which arose in the analysis of children's ARI. Roughly, they can be taken to reflect poor sanitation, damp conditions, and smoke exposure respectively. In interpreting the results for cigarette smoking, it is important to bear in mind that, given the small number of relatively moderate smokers, one would not expect a high statistical significance. Furthermore the odds ratio applies to smoking one additional cigarette: the equivalent odds ratio for smoking ten cigarettes would be close to three.

Box 8.1: Household Environmental Conditions and Health

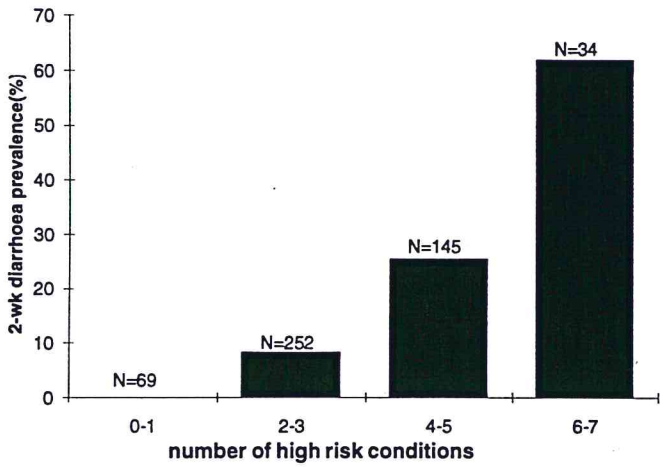


Figure 8.1: Childhood diarrhoea prevalence by number of high risk conditions

N = subsample size

List of high risk conditions
- sharing toilet with >5 other households
- using pot for storing water
- storing water in an open container
- outdoor defecation by neighbourhood children
- presence of many files in kitchen at time of interview
- not washing hands before preparing meals
- experiencing water interruptions at certain times of day
- buying prepared foods from vendors

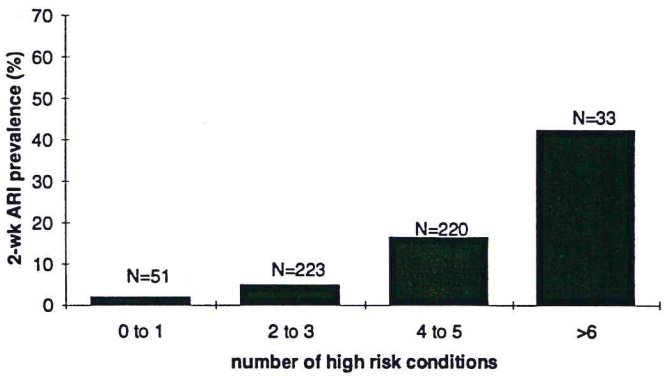


Figure 8.2: Childhood accute respiratory infection prevalence by number of high risk conditions

N = subsample size

List of high risk conditions
- child often present during cooking
- presence of many flies in kitchen at time of interview
- less than 4 m²/person in sleeping room
- experiencing water interruptions at certain times of day
- use of mosquito coils
- never cooking outdoors
- leaking roof during rains

Data source: Questionnaire survey of Accra, 1991.

The figures in this box graphically illustrate the importance of environmental risk factors to GAMA dwellers. Diarrhoea and respiratory infection are two of the major health problems in GAMA, and are especially critical among young children and infants.

Figures 8.1 and 8.2 are based on those households with children under six, and illustrate the close association between the prevalence of these health problems in the past two weeks among children under six, and the number of environmental risk factors households face.

For diarrhoea, the conditions identified (through statistical analysis) are dominated by water, sanitation and hygiene problems, which are suspected risk factors, and are clearly associated with poverty. However, while the factors identified are not surprising, the differences in diarrhoea prevalence are striking.

The conditions associated with symptoms of acute respiratory infection among small children are also all suspected risk factors. Along with crowding, and indicators of poor hygiene, there are several factors related to exposure to air pollution, including smoke from mosquito coils. Again, most of these conditions are poverty related.

Respiratory problem symptoms in women are shown to be related with a less wealth-dependent set of risk factors, see Figure 8.3. Smoking cigarettes and using pump spray insecticides, two of the most significant factors, are actually more common among wealthier households.

Box 8.1 cont'd

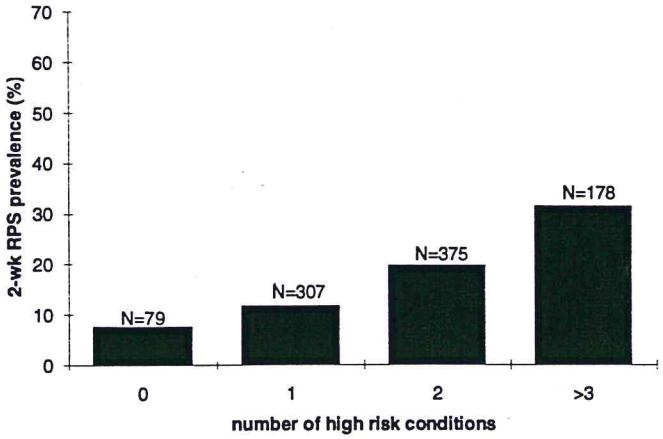


Figure 8.3: Female respiratory problem symtoms prevalence by number of high risk conditions

N = subsample size

List of high risk conditions
- smokes cigarettes
- uses pump-spray insecticide
- experiencing water interruptions at certain times of day
- never cooking outdoors
- leaking roof during rains

CHAPTER NINE

9 THE ECONOMICS OF HOUSEHOLD ENVIRONMENTAL MANAGEMENT

9.1 Introduction

The way environment assets are managed has important consequences for the economy, and more generally human welfare. Equally important, economic constraints and incentives help determine how the environment is managed. This holds for both the large scale problems like outdoor air pollution and the more localised problems affecting urban dwellers in or near their homes, with which this study is primarily concerned. It has been demonstrated that not only are many of the environmental conditions very poor, but the health risks are substantial. This chapter focuses on the concerns of the principal homemakers, and in particular the value they place on environmental improvement. Ideally, such concerns should provide a driving force for environmental improvement. Unfortunately, deficient information, structural obstacles and inadequate policies often prevent such concerns from being formulated appropriately or acted upon, either by the households or their government.

Environmental risks and processes can be difficult to understand. As demonstrated in the preceding chapter, the health implications of environmental degradation are extremely complex. Households may practice poor hygiene or governments may take inappropriate actions because they are poorly informed. It is hoped that some of the information gathered in the course of this study will provide for better decisions. However, households have an intimate knowledge of their surroundings which no study can hope to capture. Moreover, their opinions and preferences matter, even if they are not always well informed. Even in areas where households do not participate directly in decision-making, it is important not to rely on "expert" judgement alone, but to consider the priorities and valuations of those most affected.

For some economic goods, people's preferences are relatively easy to ascertain. If someone buys food for 400 cedis, it seems reasonable to assume that they are placing a value of at least 400 cedis on that food. One may question whether 400 cedis is worth the same to different people, but by and large people can be said to be revealing their own preferences through their purchases.

For environmental amenities, the situation is typically more complicated. Most environmental amenities have public benefits, and hence can be difficult to sell even when the benefits outweigh costs. It is not possible, for example, to provide individuals with cleaner streets in proportion to their voluntary payments. Once the street is clean, it is clean for everyone who uses it. If street sweeping were put up for sale, there would be a strong incentive to free-ride, and hope others pay the costs. Much the same applies to safe waste disposal, drainage, clean outdoor air and environmental insect control. One result is that many environmental amenities are not sold in the private sector: their provision is often, at least in part, the government's responsibility. Even environmental services which are sold, such as piped water, sanitation and household waste collection, have public benefits. For these quasi-public goods, market prices may exist, but are unlikely to reflect the public benefits of better sanitation, waste disposal and health.

As part of the household survey undertaken, a series of question were asked in order to provide an indication of how much people value environmental amenities.

There are several possible approaches which can be employed for such purposes. One can attempt to impute values from the expenses people incur protecting themselves. Rents may be higher in areas with better environmental quality, and in some circumstances it may be possible to use rent differentials to estimate the value people place on environmental amenities. People may boil their water before drinking, and cost incurred could be taken to reflect, roughly, the value they place on cleaner water. Unfortunately, the scope for such estimates is very limited, and would not provide comparable results for different environmental amenities.

The approach employed for this study is more direct: the principal homemakers were asked directly what they would be willing to pay for particular environmental improvements if they were for sale. This technique is called *contingent valuation*, as people are asked to provide values contingent on their being a market for the benefits in question. The technique has been applied extensively in recent years, and there is a growing body of literature on its strengths and weaknesses (see Mitchell and Carson, 1989). A number of studies have undertaken contingent valuation of water and sanitation technologies in developing countries (e.g. Whittington et al., 1990; Altaf et al., 1992). The purpose here, however, is not to evaluate any particular technologies, but to ascertain how much value people attach to environmental improvements. The improvements evaluated cover: water quality, water availability, solid waste, outdoor air, indoor air, and insects.

In order to provide a basis for comparison, the improvements were taken to be relatively comprehensive, and included the elimination of health risks when relevant. Sanitation improvement was not included due to difficulties formulating appropriate questions (i.e. not because sanitation was considered less important). Rather than asking respondents open-ended questions, estimates were elicited through bidding games. A monthly payment of 400 cedis was proposed. If the respondents were "willing to pay", the bid was increased. If not, it was reduced. This process was repeated up to five times, after which the respondent was asked to estimate the maximum they were willing to pay. Respondents not interested in the improvement in question, or unwilling to pay anything, were asked why.

The estimates arising from the contingent valuation are only intended as a rough guide to household priorities. They are too uncertain to provide a sound basis for cost-benefit analysis or the pricing of environmental services. Households cannot be expected to have a precise idea of what an environmental improvement would be worth to them, or to be overly concerned with the accuracy of their responses. Some may even be inclined to overestimate in the hope of promoting the improvement, while others may underestimate in the hope of avoiding fees. Moreover, different members of the household may have opposing priorities. The respondents were the principal homemakers (96% women), who are likely to be relatively knowledgeable about household conditions, but may not have commensurate influence over the household budget. In short, the estimates provide a first approximation of how the principal homemakers value environmental improvement, rather than an accurate prediction of how much households would actually be willing to allocate to the improvements in question.

Economics, as well as common sense, suggests that wealthier households are likely to place a higher monetary value on environmental amenities. To the extent that environmental amenities can already be purchased, this is already reflected in the superior environmental conditions in wealthy homes. For public benefits, averaging valuations across households will tend to place more weight on the

priorities of the wealthy. This mirrors the reality of goods provided through competitive markets. It does not necessarily reflect the priorities the government would like to respond to, however. For this and other reasons, in most of the following analysis households are stratified into low, medium and high wealth groups.

In addition to having opinions about the value of improvement, people have opinions about who, if anyone, needs to act. Crudely, one can think of three levels: household action, neighbourhood action and government action. Economic theory suggests that the appropriate level of action is related to the extent to which the improvements provide public benefits. Reducing indoor air pollution benefits principally the polluting household, and does not raise the problem of free-riding. Many of the benefits of better solid waste collection accrue to the whole neighbourhood. Reducing outdoor air pollution simultaneously benefits a wide range of households living in different parts of the city. From a public-goods perspective, this suggests, again very crudely, that while household action may be adequate for indoor air improvements, neighbourhood action and city-wide action are more likely to be appropriate for solid waste and outdoor air. There are other relevant considerations, however, many of which are beyond the purview of economics, narrowly defined (e.g. moral responsibilities and the competencies of the institutions involved). As in the case of valuing environmental improvement, household perceptions matter, not only because they influence the outcome, but also because they reflect opinions which should be taken seriously.

The following sections address the following issues in turn:

1. In which areas did respondents feel action was needed and by whom?;
2. In which areas were respondents willing to pay for improvements, and if not, why not?;
3. How much were respondents willing to pay for these improvements?

9.2 Where is action needed by whom?

In all of the problem areas covered, more than three out of four households perceived a need for action. As indicated in Table 9.1, however, there were differences among the problem areas, not only regarding whether action was necessary, but even more as to **who** needs to act.

Table: 9.1: Opinions on Who Needs to Act by Environmental Problem Area - All Households.

Problem Area	No Action	Individual	Neighbourhood	Gov't	No Opinion	Number of Households
	(%)	(%)	(%)	(%)	(%)	#
Water	13	4	3	78	2	1000
Outdoor Air	20	2	16	56	6	1000
Indoor Air	24	56	2	15	3	1000
Insects	7	27	21	44	1	1000
Garbage	11	6	21	61	1	1000
Sanitation	9	13	34	42	2	1000

Data source: Questionnaire Survey of GAMA, 1991.

In the two areas where the largest share of respondents felt action was necessary, insects and sanitation, there was also the most disagreement over who should take action. In both cases, the largest share favoured government action, but more than half of the respondents identified either individuals or neighbourhoods for insect control, and more than a third felt that neighbourhoods should take action to improve sanitation.

The responsibility for providing and maintaining sanitation facilities does vary considerably, with neighbourhood groups often playing an important role in managing communal toilets. One might expect that households using communal toilets open to the neighbourhood would be the most inclined to identify the neighbourhood as the appropriate locus for action. Actually, almost half (49%) of these (389) households referred to government action; the share referring to neighbourhood action (36%) was little different from other households. Within this group, however, there was a significant divergence of opinion between those with communal KVIP latrines and those still using unimproved pit latrines. The (70) households with KVIP latrines referred to neighbourhood action about twice as often as government action, while the reverse was true of the (243) households with unimproved pit latrines. It would seem that those households with unimproved pit latrines believe it is up to the government to provide better sanitation facilities, and quite possibly feel they have missed out on recent improvement programmes.

Indoor and outdoor air pollution attracted the largest shares of respondents feeling no action was necessary, reflecting a relatively low level of concern. Those who did want some action were likely to refer to the government with respect to outdoor air and individuals with respect to indoor air. For indoor air, there were no appreciable differences between households using different cooking fuels or cooking in different locations. For outdoor air, residents of Tema were substantially more likely to perceive a need for action (only 6% felt there was no need for action), presumably because of concern about industrial emissions. In Ga, on the other hand, where solid waste burning is common, a larger share of respondents (36%) favoured neighbourhood action.

Water and garbage problems had the largest shares of respondents referring to government action, though about one in five households identified the neighbourhood as the most important level for dealing with garbage problems. Among vendor users, a full 97% wanted action on water problems, though unlike other groups a significant share of vendor users (10%) referred to neighbourhood action, perhaps with a view towards curbing vendor profits.

Tables 9.2 to 9.4 summarise the responses for households in different wealth groups. Generally, the differences are not very substantial. However, in all problem areas, the ratio of households favouring government action to households favouring neighbourhood action is highest among wealthy households. This resumably reflects the fact that neighbourhood action is considered inappropriate in wealthy areas, and expected to remain so. More generally, most of the difficulties can be explained in terms of the conditions households at the different wealth levels face.

Table: 9.2: Opinions on Who Needs to Act by Environmental Problem Area - Low-Wealth Households.

Problem Area	No Action	Individual	Neighbourhood	Gov't	No Opinion	Number of Households
	(%)	(%)	(%)	(%)	(%)	#
Water	14	4	3	77	2	818
Outdoor Air	20	2	17	55	6	818
Indoor Air	23	58	3	13	3	818
Insects	7	27	20	44	2	818
Garbage	10	5	20	64	1	818
Sanitation	7	12	35	44	2	818

Data source: Questionnaire Survey of GAMA, 1991.

Table: 9.3: Opinions on Who Needs to Act by Environmental Problem Area - Medium Wealth Households.

Problem Area	No Action	Individual	Neighbourhood	Gov't	No Opinion	Number of Households
	(%)	(%)	(%)	(%)	(%)	#
Outdoor Air	23	1	15	56	5	131
Indoor Air	30	51	0	18	1	131
Insects	5	29	26	39	1	131
Garbage	16	10	26	47	1	131
Water	11	5	2	81	1	131
Sanitation	15	24	26	34	1	131

Data source: Questionnaire Survey of GAMA, 1991.

Table: 9.4: Opinions on Who Needs to Act by Environmental Problem Area - High-Wealth Households.

Problem Area	No Action	Individual	Neighbourhood	Gov't	No Opinion	Number of Households
	(%)	(%)	(%)	(%)	(%)	#
Water	15	2	0	77	6	51
Outdoor Air	19	6	6	65	4	51
Indoor Air	28	43	0	29	0	51
Insects	10	25	20	45	0	51
Garbage	23	8	12	57	0	51
Sanitation	28	10	25	37	0	51

Data source: Questionnaire Survey of GAMA, 1991.

9.3 Willingness and Ability To Pay

The improvements respondents were asked to evaluate included, briefly: water of a quality perfectly safe to drink (same source as at present); water available in the home without interruption; outdoor air clean enough to pose no health risk; similarly clean indoor air, elimination of insect borne disease; comprehensive solid waste collection with safe disposal. In some cases, distinctions were also made in

the scale of the improvement (e.g. just for the household, for the whole neighbourhood, or for the whole city). By and large, however, the responses were similar regardless of scale, so only the results for the more extensive improvements are presented here.

Despite the comprehensive nature of the improvements, some respondents said they were uninterested in the improvements cited. Among those interested, some were unwilling to pay anything. Table 9.5 provides a breakdown of households in each wealth group, according to whether they were willing to pay anything for the improvements and if not why not. Overall, fewer households were willing to pay than advocated action. Indeed, some households who advocated action claimed that the situation was already adequate when asked in the context of making payments. On the other hand, the differences across the problem areas are similar. Insects stand out as the problem the largest share was willing to pay to improve upon, while both indoor and outdoor air attracted only slightly more than half of the respondents. Also, insects was the only problem area where almost half of those unwilling to pay said that they could not afford any payment. In all other areas, by far the most common reason for being unwilling to pay was that quality was already sufficient. Only for outdoor air did a significant share (13%) of the respondents claim that they would be unwilling to pay because it was not their responsibility.

Table 9.5: Reasons for Un-Willingness to Pay for Improvements by Improvement Category.

	Water Quality	Water Quantity	Outdoor Air	Indoor Air	Insects	Garbage
Willing to Pay for Improvement(%)	72	73	51	57	87	75
Quality already sufficient(%)	15	14	23	31	5	14
Any payment is too costly(%)	8	9	12	10	6	5
Not household's Responsibility(%)	3	3	13	1	2	3
Unwilling for Other Reason(%)	1	2	2	1	1	2
TOTAL %	100	100	100	100	100	100
(N)	1000	1000	1000	1000	1000	1000

Data source: Questionnaire Survey of GAMA, 1991.

The share of households willing to pay for improvements does not show a clear association with wealth. As indicated in Table 9.6, the share willing to pay declines with increasing wealth for indoor air and, though less significantly, for garbage collection. For all the other areas the lowest share is in the middle wealth

group, with the highest share in most cases being in the highest wealth group. This is perhaps not all that surprising. It is quite possible that with fewer aspirations than the wealthy, and better conditions than the poor, middle wealth households are the most likely to be satisfied with, for example, the existing water supply. What is more striking than the wealth-related differences is that among all the groups the highest share was willing to pay to alleviate insect problems and the lowest shares were willing to pay to improve air quality.

Table 9.6: Shares of Households Willing to Pay for Improvements by Wealth Group and Improvements by Category.

	Water Quality	Water Quantity	Outdoor Air	Indoor Air	Insects	Garbage
Low Wealth (% Willing to Pay)	72	74	52	59	88	76
Middle Wealth (% Willing to Pay)	68	64	45	50	81	73
High Wealth (% Willing to Pay)	85	79	49	40	89	72
All Households (% Willing to Pay)	72	73	51	57	87	75

Data source: Questionnaire Survey of GAMA, 1991.

Before examining the additional payments households were willing to pay for improvements, it is worth reconsidering how much they were already paying for some of the existing services. As indicated in Chapter 2, water prices were regressive, with poor households generally paying more per gallon than the wealthy. Moreover, prices were inversely related to the quality of the service. For a household using 1,000 gallons per month, the costs ranged from roughly 1,000 cedis per month if purchased by the bucket to about 250 cedis if a private connection were shared between three households. For garbage collection, while 82% of the sample said they dumped their waste at community collection points or dumps, only 31% of these claimed to pay a levy. The official charge for the use of community refuse dumps is 2500 cedis a year, or roughly 200 cedis per month, in Accra and 500 cedis a month in Tema. Only about 10% of households were served by a home collection service. The charges for home collection ranged from 1000 cedis a month for a 100 litre container to 3500 cedis a month for a 240 litre container. However, more than half of the households with home collection said they paid less than 1000 cedis a month.

Table 9.7 shows the averages of the maximum monthly willingness to pay for improved services for each wealth group (households unwilling to pay anything have been ascribed zero). For all households combined the means range from 240 cedis per month for indoor air to 446 cedis per month for insect control. These figures are of comparable magnitude to monthly payments for water and solid waste services. Individually they may seem small, but they would represent significant sacrifices on the part of the households, and summed across the more

than 200,000 households in GAMA, the totals are appreciable (summing across improvement categories would yield still larger figures, but would probably overestimate the combined willingness to pay). The 446 cedis per month per household for insect control, for example, would translate into more than one billion cedis per annum (roughly 2.5 million dollars). In short, the results suggest a considerable demand for improvements, and a willingness to make real sacrifices to achieve them.

In most cases, the average willingness to pay for improvement increases substantially with wealth. For every improvement except indoor air, the rich are, on average, willing to pay the most and the poor the least. Indeed, in every case except indoor air the wealthy are willing to pay more than twice what the poor are willing to pay, despite the fact that in several categories they are already far closer to the improved situation. Thus, for example, the wealthy are willing to pay on average an additional 954 cedis per month to obtain a reliable indoor piped water supply, despite the fact that virtually all of them already have indoor piped water. The low-wealth households are only willing to pay an additional 361 cedis per month, despite the fact that most now have to fetch water by hand. On the other hand, given the prevailing income distribution in GAMA, as a share of income, the mean willingness to pay for the low-wealth households is almost certainly higher than for wealthy households.

Table 9.7: Willingness to Pay for Environmental Improvements by Wealth Group in Cedis/Month.

	Low	Medium	High	All
Water Quality	332	418	746	365
	(619)	(670)	(1123)	(668)
Water Availability	361	441	954	404
	(594)	(825)	(1357)	(701)
Outdoor Air	228	298	466	250
	(638)	(695)	(764)	(654)
Indoor Air	235	270	245	240
	(571)	(573)	(554)	(570)
Insect	417	462	849	446
	(597)	(414)	(941)	(608)
Solid Waste	343	450	809	382
	(607)	(518)	(1018)	(634)
# Households	796	124	53	973

Note: numbers in brackets are standard deviations.
Data source: Questionnaire Survey of GAMA, 1991.

In contrast to the different overall levels of payment, the relative value attached to different improvements remains similar across the wealth groups. For all households combined, the highest willingness to pay is for insects, followed by water availability, solid waste disposal, water quality, outdoor air quality and

indoor air quality, with both of the air quality figures considerably lower than any of the other categories. With the exception of a few minor reversals, this same order applies to every wealth group. Poor households place more concern on indoor than outdoor air pollution, presumably because they are the households using the more polluting fuels. Wealthy households' willingness to pay for water availability is marginally higher than for insect control, possibly because of water supply interruptions.

9.4 Summary

The previous chapter demonstrated the close association between environmental inadequacies and health problems. The valuations of environmental improvement presented in this chapter are, by and large, consistent with existing knowledge of the health burdens imposed. Malaria is the most evident health problem, and insect control was the most valued improvement. Diarrhoea is also a major health problem, and water improvements were also highly valued. (Sanitation improvements were not included in the survey, but there is every indication that they too would have been highly valued.) Air quality improvements were less highly valued, despite the importance of respiratory infection. However, the link between air pollution and respiratory problems is probably less significant than that between water and diarrhoea. Solid waste collection was quite highly valued, despite having a very uncertain link to health. In this case, it is probably best to assume that health was not the principal motivation.

In the final analysis major environmental improvements at the household level require poverty alleviation. The results support the notion that people place considerable value on environmental improvements, and are willing to make significant economic concessions in order to achieve them. The economic burden of paying for existing environmental services is considerable. In several cases (e.g. water) poor households are already paying high prices for an inadequate amenity. Under such circumstances, it is an indication of the importance people attach to the household environment that they are willing to pay still more for improvements. However, it is unrealistic to expect to achieve adequate home and neighbourhood environments without significant improvements in the economic status of the majority of households.

On the other hand, as noted at the start of this chapter, even if households value environmental benefits, individually they often have relatively little control over the environment they face. Indeed, the immediate economic incentive may be to degrade the environment, despite the costs this incurs on others. Such problems arise in poor as well as wealthy areas. Outdoor defecation in an urban setting, for example, is in part a symptom of severe poverty. But it is also an indication that individual and collective interests are not in harmony. Similarly, inadequate water access may be symptomatic of poverty, but poverty does not dictate that water prices should be especially high. Economics suggests that some form of collective action may be required when public benefits are involved.

Just as households seemed to place a higher priority on improvements which would have a major health impact, so also households tended to identify a need for more collective action the more public the benefits. .Indoor air improvement, which benefits principally the household making the improvement, was seen principally as a household affair. For other problems, the respondents most often identified a need for government action, though neighbourhood action received considerable support for garbage, insect and especially sanitation problems.

CHAPTER TEN

10 THE INSTITUTIONAL ASPECTS OF URBAN ENVIRONMENTAL MANAGEMENT

10.1 Introduction

As indicated in the previous chapter, good environmental management can only be achieved through appropriate institutions. It is not enough to identify problems and priorities. Society responds to problems through institutions ranging from markets to central governments, from private enterprise to non-governmental organisations, from kinship networks to political parties, and so on. All such institutions can be part of the problem or part of the solution. Hence, the role of existing social institutions in environmental management needs careful examination. The present chapter will examine whether and to what extent identifiable governmental, political, non-governmental and neighbourhood organisations can make significant contributions to the crucially important enterprise of improving environmental management at the household and community levels.

10.2 The Government's Institutional Structure

Within the metropolis, a complex set of institutions is involved in the decision-making and policy-execution processes which help determine how the environment is managed. Each has an important role to play in promoting a healthy city. But it is through the functional interaction of these agencies and organisations that household environmental problems can be effectively managed. Environmental problems rarely emerge within the confines of any one institution: their very nature typically precludes a simple assignment of institutional responsibilities.

10.2.1 Central Government Institutions

Clearly the larger, more formal, state institutions have an important role to play. As indicated in the preceding chapter, most households see the state as the most important actor for achieving environmental improvement. Already, state institutions provide the core structure for environmental services, to which other institutions, including households, must adapt. The role of the state in protecting the environment is expected to increase relative to many of its other, more traditional roles. However, environmental responsibilities within the state remain divided among a large number of ministries. There may be advantages to this division of responsibilities, but it creates a number of co-ordination problems.

At the governmental level, at least eight of the fifteen ministries are involved in one way or an other in environmental management. At this macro-institutional level, relevant policies are adopted and decisions taken concerning the implementation of environment related policies. The critical actors in the environmental arena include the ministries discussed below.

The Ministry of Finance and Economic Planning has the overall task of resource allocation for research into environment-related issues and for the execution of environmental action plans. Financing, personnel recruitment and, indeed, all material and human resources have ultimately to be addressed by this ministry. The effectiveness of environmental management agencies and practitioners is, therefore, largely dependent on this ministry.

The Ministry of Works and Housing not only engages in construction and maintenance, but also has a supervisory role in almost all public construction

activities. The Ghana Water and Sewerage Corporation, a service agency within this ministry, will be discussed in greater detail in 10.2.2.

The Ministry of Local Government performs basic co-ordinating and harmonising roles. Its task is to ensure that what is happening on the ground is in line with regional and national policies and guidelines on environmental as well as other issues. Two key departments within this ministry are the Town and Country Planning Department and the Environmental Protection Council. The former is responsible for ensuring the planned development of the metropolis, and the latter for ensuring that development projects take proper measures to safeguard the quality of the environment (Amuzu and Leitmann, 1991, p. 41). Indeed a new Ministry of the Environment has been created with the inauguration of the Fourth Republic on the 7th of January, 1993.

The Ministry of Industries, Science and Technology has an organising and controlling role. This ministry, besides its concerns for scientific research, oversees and controls the siting of new industries to ensure environmental safety. Among the institutes directly involved in environmental matters are the Institute of Aquatic Biology, the Water Resources Research Institute, the Food Research Institute, and the Building and Roads Research Institute (Amuzu and Leitmann, 1991, p.38).

The Ministry of Mineral and Natural Resources is responsible for ensuring that the use of natural resources does not lead to undue environmental degradation. While not centrally concerned with household environment issues, it is a critical actor in the environmental arena.

The Ministry of Agriculture is not only concerned with agricultural production but also with the health of citizens and safety of the environment. The Irrigation Development Authority within this ministry, for example, has as an objective ensuring the health of people living in target areas.

The Ministry of Transport and Communication has specific responsibility for controlling and containing air pollution. Policies on emissions from vehicles are formulated and executed.

The Ministry of Trade and Tourism, besides regulating trade, is concerned with the development of the tourism industry. Development of tourist sites has to take into active consideration the possible noxious environmental consequences.

Given the wide range of ministries with different, and in some cases overlapping, responsibilities for environmental management, problems of inter institutional co-operation and co-ordination can easily emerge. Success depends as much on the harmonious interaction of these different ministries as on the quality of any one ministry's actions.

At a lower level of this organisational structure are the regional and district administrations. The regional administration is a replica, at the Greater Accra Regional level, of the institutional structure outlined above. Similarly, the district administration replicates the regional administrative structure. These interconnected institutional structures are intended to ensure an efficient flow of information and influence, and the effective formulation and execution of environmental policies.

10.2.2 Health Education

The institutional arrangements that are in place in the study area for health education and management are discussed here with respect to the three health-related issues: food contamination, air pollution and insect vector incidence. Three distinct groups of actors are associated with the health education endeavour: the Ministry of Health (MOH) and its various preventive health delivery units, the district assemblies of the three districts in the study area, and private organisations, including NGOs and other voluntary associations. In the study area, health care delivery is under the auspices of the Ministry of Health.

The Ministry of Health has established a Health Education Division which is charged with the dissemination of information on health and health-related issues to the general public. Its functions are carried out through seminars, workshops, talks, public campaigns and the like.

The Ministry's Primary Health Care Programme is directed at delivering preventive health care, and promotes, among other things, good personal hygiene and the implementation of the Expanded Programme of Immunisation (EPI) against the six childhood killer diseases (i.e. measles, tuberculosis, poliomyelitis, tetanus, diphtheria, and yellow fever). Public education to help people understand and respond to the potential dangers of food contamination and the use of dangerous chemicals and soaps is part of this preventive health delivery system. In the Accra District, for instance, primary health care and outreach services from a number of health institutions have been established, to ensure that health promoting, preventive and curative measures, including health education, reach residents in almost all neighbourhoods.

10.2.3 The District Assemblies

The three district assemblies in the Study area are the Accra Metropolitan Assembly (AMA) for the Accra District, the Tema District Assembly for the Tema District, and the Amasaman Assembly for the Ga District.

General Management of waste and sanitation is the responsibility of District and Municipal Councils, according to Section 7, Sub-section I of the Local Administration Act. Consequently, in the reformed local government system, the Accra Metropolitan Authority in the Accra District, the Tema Development Corporation and District Authority in Tema District, and Amasaman Assembly in Ga District are responsible for waste management in their respective areas of jurisdiction. In the case of Accra District, the then Accra City Council set up the Waste Management Department in 1985 to address the acute problem of waste management caused by run-down facilities and equipment. This was supported with equipment and funding from Germany (formerly FRG). This institutional strengthening has gone a long way to stabilise the deteriorating sanitation situation in the country, although a lot remains to be done (Songsore, 1992, p.11).

The Accra Metropolitan Assembly, however, encounters a number of difficulties in its health education management efforts. Despite all of the measures mentioned above, lack of supervision and enforcement of bye-laws often results in very poor food hygiene practices by the numerous chop-bars and restaurants, as well as food and water vendors. Bye-laws regulating meat hygiene are also not always enforced.

10.2.4 The Environmental Protection Council (EPC)

The only regulatory standards for air pollution are those set by the EPC for ambient air quality in residential, commercial and industrial areas. These standards, summarised in Chapter 7, cover both indoor and outdoor air pollution. To ensure the successful achievement of such standards, there must be adequate information on present emissions and concentrations, as well as future trends. The high risk sources and locations must be identified. The general public, as well as the government, must know when high levels of air pollution occur and where. Public education is all the more critical given the relative importance of exposure to smoke from cooking fires, which affects mainly women and children, and is particularly severe when wood and charcoal are used with poor ventilation. It is difficult to control such pollution without the active involvement of well informed users.

Unfortunately: "since its establishment in 1974, the EPC has not created any formal mechanism for involving the public in environmental management, except for the annual observance of the World Environmental Day. On this day, institutions, politicians and other senior officials are invited to participate in lectures and discussions on selected themes. Formal participation is limited largely to those who have professional and other interests in environmental matters. The media is heavily involved in these events but this is not usually sustained" (Amuzu and Leitmann, 1991, p.44). However, Amuzu and Leitmann also note that "... the EPC's past ad-hoc approach to environmental education is being changed to one of positive action through the formulation of the Environmental Action Plan".

10.2.5 Environmental Sub-Committees

There are moves to establish environmental sub-committees within the District Assemblies, to function under the technical guidance of the EPC. It is anticipated that these sub-committees will translate the objectives of broad public health education programmes on environmental pollution and quality into practical activities at the grassroots level.

10.3 Delivery Agencies

It is the responsibility of the Ghana Water and Sewerage Corporation (GWSC) to make potable water available to the citizenry. As indicated in the chapter on water supply, actual production of potable water is lower than estimated demand, resulting in widespread water supply problems in large areas of the metropolis. An effort to rehabilitate water supply infrastructure and expand production is anticipated. GWSC faces a major problem, however, generating revenue. Quite apart from the problems of cost recovery through user fees, there is the added problem of diversion of revenue generated in GAMA to the Head Office of GWSC, which re-allocates a share of the funds elsewhere. This creates further problems of maintaining supply systems and expanding coverage.

The GWSC is also involved in human waste disposal. In Accra, the level of sewerage service provided ranges from house connections to water-borne systems, septic tanks, KVIPs, pit latrines and irregular night soil collection. Other parastatal organisations provide sewer systems and treatment plants in various parts of Accra, e.g. State Housing Corporation, Ministry of Health, the Military establishment, hospitals, etc. As described in previous chapters, however, the sanitation system remains inadequate, especially in low income areas within GAMA. Again, however, revenue problems make it difficult to respond effectively.

10.4 Political Organisations: The Committees for the Defence of the Revolution (CDRs)

The Committees for the Defence of the Revolution (CDRs) were formed in the early 80s, with the advent of the Provisional National Defence Council (PNDC). They are overtly political organisations. Their official objective is to involve the people at the grassroots level in political decision-making, and to bring government to the doorsteps of the ordinary citizen. But, like any organisation, the CDRs have adapted to their physical and social context. Apart from their more overtly political activities, CDRs also serve other functions. Typically, they are environmentally conscious, and instrumental both in environmental education and in planning collective local responses to existing environmental conditions. The Mateheko CDR is a case in point.

Box 10.1: Environmental Management and a Neighbourhood Political Institution: the Mateheko CDR.

Although the Mateheko CDR is not officially involved in protecting or improving the environment, it occasionally takes responsibility in ensuring a safe environment for the community. It organises a monthly clean-up to unblock choked gutters and drains. The surroundings are cleared of weeds and all filth is removed to prevent outbreak of epidemics. It ensures that food sellers cover their food properly and adopt good hygienic practices, which has reportedly brought the incidence of food poisoning to very low levels. It is in charge of the only public toilet within the community, and ensures a very high level of cleanliness. It also ensures that the inhabitants dispose of solid waste in the collection can provided.

Data source: Focus Group Discussion, 1992.

While this is typical of a number of the CDRs encountered (e.g. those in Jamestown, Madina and Mamprobi), the CDR in Darkuman would seem to have gone further. The Darkuman CDR has been visibly committed to a healthy environment, a key concern of the group. To realise this objective, the group has established a projects committee, whose primary task is to mobilise financial resources to meet operational costs. A sanitation committee has been set up with the responsibility of organising community members to become actively involved in the management of their environment. Regular clean-up campaigns have been organised, along with public education initiatives to create awareness of environmental sanitation. The net result of all these efforts has been positive. Residents have not only come to value keeping their surroundings clean, but they have also organised themselves into small work groups. Regular activities include sweeping the streets and cleaning choked gutters. The CDR has also embarked on campaigns educating vendors on the dangers of food contamination and the importance of keeping their surroundings clean and safe. Stubborn food sellers are made to pay fines. The effects are encouraging.

In Darkuman, environmental consciousness is now high, at least in part as a result of the CDR public education efforts. The unit CDR is in close contact with the Environmental Protection Council (EPC) and assists the Council by, for example, putting up posters to make people become more vigilant about the

environment. (One of the posters reads: Keep your surroundings clean for good health.) activities of the CDR reinforce the message. As in some other areas visited, the Darkuman CDR interacts positively with other neighbourhood organisations. Such interaction yields good dividends in terms of environmental management.

Overall, the case of Darkuman would appear to be somewhat exceptional. In no other community have the activities of the CDRs been so effective in creating a sustained commitment to a clean environment. Indeed, the unsanitary conditions in most neighbourhoods suggest that clean-up campaigns are not bearing the desired results. Furthermore, there were indications of serious internal difficulties and conflicts within some CDRs, no doubt limiting their effectiveness. As far as environmental management is concerned, it appears that most of the CDRs have run out of steam in recent years. Also, their future is uncertain in the light of the ongoing democratisation process. Alternative social arrangements to promote a clean environment are therefore required. Fortunately, some such social mechanisms already exist within the study area, either as spontaneous neighbourhood organisations or official neighbourhood social structures.

10.5 Official Neighbourhood Groups

A characteristic feature of the Ghanaian social structure is the emergence of groups responding to specific community needs. Some of these groups have evolved with support and encouragement of the state. Such organisations are referred to as official neighbourhood groups. They are small scale government agencies. Some of these groups have environmental management as their primary objective. For instance, the Ashaiman Waste Management Committee was inaugurated in March, 1991, and has been primarily concerned with environmental sanitation. Specifically, the main objectives are to administer the sanitary facilities: maintain them, desludge them when they are full, and generally make them accessible to the community. This group has been effective in terms of its main objectives. The achievements of the committee during the first seven months of its operation include the effective management of public toilets, the organisation of clean-up campaigns, and active involvement in the government sponsored face-lift project for Ashaiman. Phase 1 of this project has already been completed. The projects under this phase include drainage, rehabilitation of existing toilets and the construction of new ones, as well as the extension of piped water supply to some hitherto deprived areas.

Similarly, the Bogyia Services Limited of Accra New Town is a good example of inter-organisational interaction. Established in December, 1987, through the co-ordinated efforts of the Ministry of Health, AMA, and the German Government, the group has been actively involved in the planned disposal of liquid and solid waste within the neighbourhood. Such technical and material support is a positive stimulant for groups on the ground. The Old Ashale Botwe Development Committee is another case in point. With the necessary assistance from the Department of Rural Development, the community, through the leadership of the Town Development Committee, has been able to build four KVIPs. This has improved sanitary conditions considerably. Dynamic groups of this nature constitute critical social structural variables for effective environmental management.

10.6 Spontaneous Neighbourhood Organisations

During the course of the field work, a number of spontaneous neighbourhood groups or clubs were identified within the study area. These include: Jerusalem Fun Club, Tema New Town; Kungiyar Nasara (Nasara Club), Sabon Zongo; Maamobi Islamic Youth Association, Nima 441 Muslim Youth Association, the La Mansaamo Kpee of La Town (Labadi), and the Nima 441 Welfare Association. These clubs emerged spontaneously in response to certain perceived needs within the communities. They are formal but voluntary organisations. They have specific goals embodied in their constitutions, but membership is optional.

The goals pursued by these clubs vary. However, they typically incorporate community-wide concerns. The Jerusalem Fun Club, though a manifestly socialising neighbourhood group, fosters environmental awareness within the Tema New Town area. Furthermore, in co-operation with other clubs in the area, it actively promotes environmental sanitation. The Nima 441 Muslim Association, the Maamobi Islamic Youth Association and the Kungiyar Nasara (Nasara Club) transcend their immediate religious concerns to tackle environmental issues. Indeed, concern for the environment is one of the few commonalities extending across all of these clubs. Unfortunately, their differences can mask this common concern, making co-operation and co-ordination problematic.

Two relatively successful neighbourhood organisations, the Nima 441 Welfare Association and La Mansaamo Kpee of Labadi (La), are described in more detail below.

10.6.1 Nima 441 Welfare Association

The Nima 441 Welfare Association was established in July, 1980. Nima is a high density, low income residential neighbourhood. Sanitation has been an endemic problem. The objectives of the Welfare Association include the promotion and improvement of sanitation and the training of unskilled and unemployed persons so as to enable them to become gainfully employed. The association has achieved considerable success in both regards.

The association has been able to train the unskilled and unemployed in various skills like carpentry, dressmaking, and welding. Group members have built a clinic to cater for the sick in and around the neighbourhood; they have been dealing with environmental issues such as solid waste disposal, desilting of gutters and sweeping of surroundings, and organising public education on sanitation and environmental issues. A 24-seater KVIP has been built with the help of a Canadian benevolent organisation (St. John).

The association derives its finances from monthly dues, special contributions, revenue from the operation of the association's corn-mill, and donations from the Netherlands Embassy. Given the proper environment and the commitment of organisational members, there is no reason that the effectiveness of the group should not be sustained, or even enhanced, to the benefit of social and human development in the target area.

10.6.2 La Mansaamo Kpee, La Town (Labadi)

The La Mansaamo Kpee (LMK) was established in 1979 by eminent citizens of the community. The objectives of LMK include the provision of a forum for free discussion of all the matters that will promote an orderly yet vigorous development of the La traditional area, raising the standard of living and quality of life of the inhabitants of La by improving public health, sanitation, education, and recreation

through self-help and voluntary service and undertaking and sponsoring development projects in the La Traditional Area.

Box 10.2: Environmental Management and a Spontaneous Neighbourhood Association: La Mansaamo Kpee (LMK).

The efforts of LMK to help in developing the La town by way of improving public sanitation has yielded four public water closet toilets (WCs), one public bathroom, and three KVIP toilets for some schools in the neighbourhood. Also the group has been able to set up a community bank, which is operating successfully. A grant from the African Development Foundation based in the U.S.A., enabled LMK to establish a revolving fund through which individual households are assisted in building KVIPs or WCs in their own compounds. LMK bears the full constructional cost while the landlord or owner of the house is expected to repay the loan within 30 months at an interest of 11%. Credit advanced to each household is limited to 300,000.00 cedis per project. At the moment 25 households have benefited from the fund and are providing themselves with electricity, water and toilet facilities.

Data Source: Focus Group Discussions and Reports, 1992.

The association derives funds from many sources. These include monthly dues, clan house levies, grants and donations from organisations abroad, proceeds from the hiring out of a cesspit emptier, a tractor and a tipper truck, and profits from the community bank which are invested into other ventures.

The La Masaamo Kpee is certainly a success story. This success can be attributed to several factors. These include the ability to generate funds from members and resource support from other sources, the interaction of the organisation with other local and even international groups, and, of course, the members' active participation.

Spontaneous neighbourhood groups, given material resources and effective leadership, can clearly be very effective. Environmental management is a natural focus for such groups. As such, there already exist within the Accra metropolis social mechanisms or arrangements that can help promote effective environmental management. This is an opportunity which environmental management agencies and practitioners should capitalise on in the pursuit of their key objective: a healthy city.

10.7 Households' Environmental Role

The household is a basic social institution, and critical to environmental management. On the one hand, households themselves manage a shared space, and often people's most critical decisions regarding water, sanitation, cooking and so on, are very much influenced by the household context. On the other hand, households are by no means always harmonious decision-making units.

Households are the terminal focus of many of the policies and government interventions, and many environmental services take households to be their natural customers. Needless to say, household perceptions of, and attitudes towards environmental problems are vital to the success of environmental programmes.

In the Accra context, it is important to distinguish between single household units and multiple household units. Single household units are typical of middle and high class areas such as Airport Residential Area, Cantonments, East Legon, etc. Ironically, in these single family homes, the household plays a relatively minor role in environment management. State and private organisations play major roles in this regard. The role of families consists in depositing solid waste in the appropriate containers for eventual disposal by other agencies and, of course, ensuring the cleanliness of the immediate surroundings - a task frequently executed by house maids.

The situation within the low income, high density residential areas is drastically different. Such areas are characterised by several households living within the same residential unit, frequently a compound house. Residents within these areas typically experience the more acute environmental problems. As a result the household plays a key role in the maintenance of the environment. Keeping the surroundings clean is a daily task of the household. In multiple household residential arrangements a gender based division of labour obtains with regard to environmental management. Each household unit assumes responsibility for its immediate surroundings - rooms, verandas. Beyond this, there is shared responsibility for the larger compound with each family taking turns at regular periods of time to ensure clean surroundings. Characteristically, female household members of various ages perform this vitally important role. The more conscious households are of environmental issues, the greater is the commitment to, and participation in, environmental management at this basically micro-institutional level.

10.8 Summary and Conclusions

Almost every institutional level has its strengths and weaknesses. Moreover none can operate effectively alone. Success depends not only on the efficiency of individual institutions, but on how well adapted they are to the institutions which surround them. This applies to governmental as well as non-governmental institutions.

The government clearly has a critical role to play. It is already central to a wide range of environmental services, and most respondents felt that the government needs to act to address a range of environmental problems. Within the government itself, co-ordination problems arise, given the wide range of ministries responsible for different aspects of environmental management. An efficient system of co-ordination and co-operation would certainly enhance the effectiveness of environmental management efforts at the level of government ministries, district administration, and the community. There are, however, other problems which make it difficult for the government to respond.

Given the current financial circumstances, and the imperatives of structural adjustment, financing environmental improvement is difficult. As the wealthiest area in Ghana, it is important that GAMA does not drain the national economy to solve its local environmental problems. Unfortunately, local taxes are unlikely to provide significant amounts of additional resources in the near term. On the other hand, given the public nature of most environmental amenities, and the economic status of the households themselves, there is limited scope for cost recovery through user fees. These circumstances make it difficult for the government to take anything near full responsibility for providing environmental services to households, and more generally ensuring that environmental conditions are

adequate. Devising new and equitable means of financing improved environmental management is important. Equally critical, government agencies must be able to work effectively with non-governmental institutions, who will also continue to play a major role.

There is a tendency to portray households as direct "consumers" of environmental services, such as water, garbage collection, sanitation provision, and so on. In GAMA, this is not the case, particularly in poor areas. Household water connections, home waste collection, and individual toilets are the exception, not the rule. Various institutions, ranging from informal household groupings to C.D.R.s mediate between the households and the service utilities. Improving the technical efficiency of service delivery and extending their coverage, are clearly important. Providing a more flexible service, adapted to the particular needs and institutional context of low-income neighbourhoods could be equally important.

Non-governmental institutions are also important in other aspects of environmental management. The focus group discussions indicated that neighbourhood organisations are dynamic social structures, taking a wide variety of changing forms. Environmental management agencies and practitioners will have to take active account of these groups. They are already involved in environmental management, and, given the right support, could do even more. Local participation in environmental management is time consuming and can be a burden. But it can also increase commitment and appropriate social norms, as well as helping ensure that the priorities of local residents are taken into account.

Fortunately, the Wastes Management Department of the Accra Metropolitan Assembly recognises the importance of the complex of factors in environmental management. The objectives of the department include the following:

- To involve the community in various aspects of waste management, particularly in the area of participation, clean-up campaigns/health day activities, maintenance of residential drains and payment of fees.
- Involvement of the private sector and Non-Governmental Agencies in the waste management delivery sector.
- Public education of the community so as to improve user habits of the facilities, that is, containers, public drains and toilets (AMA Document).

The realisation of these stated objectives would certainly promote the effectiveness of environmental management and create the requisite conditions for a healthy Accra City. The challenge will be to turn them from goals into operating principles.

With regard to environmental education there also appears to be ground at least for qualified optimism about the future. Pupils at the Junior Secondary School level are exposed to courses on environmental studies. These seminal programmes have the potential of drawing out the pupils' concern for the environment, and making it more effective. Together with other new educational initiatives, such efforts can be significant in furthering the cause of environmental management.

CHAPTER ELEVEN

11 SUMMARY OF POLICY IMPLICATIONS

11.1 Introduction

The principal purpose of this report is to present action-relevant findings, not to make specific policy recommendations. Effective policies emerge from political processes, and cannot be deduced from the results of a study. In any case, identifying and evaluating the range of options available, and examining a coherent strategy, is beyond the scope of this study. Even at this early stage, however, it is possible to draw some conclusions about the form an appropriate strategy would probably take, and the priority problems which need to be addressed.

Household environmental improvement is not simply another concern to be added to the long wish-list of any urban centre such as GAMA. It is central to improving the well-being of the population. Previous chapters have described in some detail:

1. The serious deficiencies in households' environmental conditions.
2. The close association between a number of these deficiencies and ill- health.
3. The disproportionate share of the environmental health burden borne by the poor.
4. The high value people place on improvements, despite severe economic constraints.
5. The common perception that the government should take the lead in introducing improvements in a number of areas. Taken together, the results demonstrate the importance of developing an environmental-health strategy for Accra. But perhaps more important, they indicate where the most pressing concerns lie, and can help identify opportunities and obstacles which an effective strategy must confront.

The following subsections review some of the policy implications in each problem area. The Chapter then concludes with a brief discussion of the need to develop an integrated strategy to household environmental improvement, and some of the ways in which research could complement such developments.

11.2 Water

The deficiencies in the water supply system serving households in GAMA are serious, but probably less serious than in most of the country. Only a minority of households have indoor piping, but most live within a relatively short distance of a water tap. The quality of the water at the tap would generally seem to be adequate, except perhaps in poor neighbourhoods. GAMA households are dependent on the piped water system, and can suffer considerably when that system fails. However, such failures are less of a burden for GAMA residents than the chronic water quality and quantity problems almost certainly experienced more severely in other parts of Ghana.

Within GAMA, access to water is currently a more serious problem than water quality at the tap. The results indicate a significant improvement in health when the taps are located within the house compounds, probably due to the better hygiene practices easy access to water allows. Alternatively, water supply interruptions were very strongly associated with health problems. However, extending the water

system and increasing throughput is costly. Given prevailing economic conditions, providing all households with in-house piping must remain a long term goal. In the medium term, providing standpipes to compound housing units may bring almost equivalent health benefits at considerably lower cost. Even in the short term, efforts to increase the water supply to low-income areas are warranted: in addition to health improvements, a greater water supply should lead to lower vendor prices.

The results clearly demonstrate that the existing system places the greatest health burden on poor households, who also often rely on water vendors and end up paying the highest prices for their water. This is very much counter to the government's intentions, and deserves special attention. While many vendors charge high prices for water, efforts to control vendors directly are likely to be counter-productive. If sanctions decrease vendor sales, for example, supply problems will be exacerbated and unofficial water prices may actually rise. It should be possible, however, to use vendor prices as an indicator of which low-income areas deserve special efforts to increase water supply. Alternatively, the existing water tariff, while intending to be progressive, discriminates against households which share water connections. High prices are charged to large consumers, both in order to prevent profligate water use, and because large consumers are considered wealthy. When several households share a meter, however, they can easily have high meter readings despite a low per-household consumption. There are a number of possible means of redressing this problem, ranging from area-based pricing to formal recognition of shared meters.

A large share of the water samples taken from water storage containers showed evidence of faecal contamination. This reflects both the water supply problems which necessitate considerable in-house storage, and hygiene problems (see sub-section on hygiene below). Households using pots to store their water had a significantly higher level of childhood diarrhoea. While it should not be assumed that storage in pots is the cause of this ill-health, further investigation is clearly warranted. Should pots prove to be leading to water contamination, there are a number of relatively low-cost policy measures which could be taken.

11.3 Sanitation and Hygiene

Alleviating the household sanitation problems of GAMA is clearly a priority. The technology profile may look relatively favourable, with a comparatively high share of households (36%) using flush toilets and few (3%) without access to any toilet facilities at all. However, for a large segment of the population, the extreme level of crowding negates any technological advantage over less urbanised settings. Almost half of the households shared toilet facilities with at least ten other households. Many complained that the queues for their toilets were sometimes so long as to render them unusable. In addition to causing unhygenic conditions in the toilets themselves, over-crowding of existing facilities leads to open defecation, which is itself an important public health hazard in GAMA. Indeed both the sharing of toilets and open defecation by neighbourhood children were found to be closely associated with higher diarrhoeal prevalence among children.

Given these conditions, increasing the quantity of toilet facilities available is probably more critical to public health than introducing improved technologies. Owing to the communal character of a large share of the facilities, the government and community groups are already involved in determining the quantity of facilities available. Most households interviewed felt that the government needs to take the lead in sanitation improvements, though a significant share felt action at the

neighbourhood level was more critical. Ultimately, the successful provision and operation of communal toilets depends on effective collaboration of government (e.g. the Waste Management Department) and local groups.

Identifying additional sources of funds for expanding sanitation provision is itself a priority. The pricing of community toilets is relatively high, given the low incomes of most users. In some communities charges on using the toilets are employed to help finance other environmental clean-up activities. There is little evidence that these high charges are an important factor in dissuading people from using toilets (people were more likely to cite the length of the queues or toilets being out of order or closed). However, given the insufficient supply of sanitary facilities, the diversion of funds which could be used to expand supplies is a matter of concern. It amounts to a tax on a service which provides public benefits, and economics suggests should be partially financed through other taxes or public revenues. More generally, the difficulties encountered at the local level in funding sanitation improvement reflect an underlying obstacle to community environmental management. User charges alone cannot provide an efficient means of financing all environmental services, let alone environmental improvements not linked to service delivery. Yet few communities have the capacity to raise substantial funds through other means.

The results also indicate that good hygiene behaviour is associated with appreciably better health. However, while the government is directly involved in providing water and sanitation facilities, it cannot prescribe hygiene behaviour. Moreover, the results suggest that hygiene behaviour is closely linked to the provision of water and sanitation facilities, and more generally economic constraints. The most obvious difference between the situation in poor and wealthy households is not that wealthy households are more aware of good hygiene practices, but that they have facilities which make good hygiene practice comparatively simple. It is often noted that water and sanitation improvements can fail when hygiene practices remain the same. The reverse is equally true: education and awareness programmes are far more likely to be effective if accompanied by improved environmental services.

11.4 Solid Waste

Accumulations of solid waste create problems at the final disposal sites, at neighbourhood dumping sites, and even within people's homes. Financially precarious cities typically have difficulties maintaining an efficient waste disposal system, and Accra is no exception. With Ghana's economic difficulties in the late 70s and early 80s, the waste management system fell into crisis. More recently, some of the deficiencies have been redressed, but the Waste Management Department can still only collect about two thirds of the waste generated, and existing disposal sites are already overused. Only about 10% of households have home-collection, and incomplete collection typically leads to local accumulations of waste, especially in relatively poor neighbourhoods. Problems with waste storage within peoples homes are relatively independent of the waste collection system, but can affect the indoor environment. The survey results indicate, for example, that open storage of waste within the homes is associated with a higher prevalence of insects and rodents.

While solid waste problems are not a priority health concern, the respondents clearly felt improvements were needed, and were inclined to identify the government as the key actor. Also, there were indications that while people may

not want to pay for a poor service, they are willing to pay significant sums for good service.

As with sanitation, many local groups are already somewhat involved in solid waste management, and probably deserve more support. Successful local management can easily be inhibited by institutional obstacles. Unlike communal toilets, it is difficult to charge for communal solid waste management. Yet local groups must have a reliable means of raising funds if they are to play an important role over the long term. Equally important is a reliable municipal waste collection service, and a good interface between the collection service and the local management system. It is difficult to envisage major improvements in the solid waste situation without increasing the collection and disposal (and/or recycling) capacity.

11.5 Pests and Pesticides

Insects, and especially malarial mosquitoes, are undoubtedly a major health risk for GAMA residents. Malaria is the principal health problem reported by out-patient clinics. Flies are a known health risk, especially when sanitary conditions are poor, and strong associations were found between the presence of flies in the kitchen and health problems among children. Furthermore , the results indicate that improved insect control is a priority among the households themselves.

Urban areas generally have a comparative advantage in malaria control, as malarial species are relatively poorly suited to urban conditions. However, while households spend considerable sums on chemical mosquito control, relatively little has been done to exploit GAMA's urban advantage through environmental management. From a household perspective, an emphasis on chemical control is understandable. It is difficult for individual households to identify, let alone eliminate, breeding sites. Furthermore, insecticides and insect repellents clearly target the mosquitoes threatening the household itself, while environmental management does not. As a result, effective environmental management for mosquito control almost inevitably requires public sector support.

Chemical insect control can itself create environmental problems and health risks. Associations were found between the use of mosquito coils and the prevalence of respiratory illness among children, and between the use of pump-spray insecticides and the prevalence of respiratory problem symptoms among female principal homemakers. While these findings should be interpreted with care, the possibility that current methods of insect control are contributing to respiratory problems does indicate another advantage of environmental management. While mosquito control through improved environmental management often has benefits over and above a decline in malaria prevalence, chemical control is likely to have damaging side-effects. This is not to say, however, that chemical control should be universally condemned. Indeed, it is critical to distinguish between different types of chemical control, and differentiate between those which yield an acceptable risk and those which do not.

An effective programme of mosquito control through environmental management will require far more information than could be collected or reviewed in the course of this study. The new insights that can be derived from this study are limited by inherent inaccuracies in self-reported malaria prevalence, and the lack of information on different mosquito species. Past studies indicate that some malarial species are becoming better adapted to breeding in, for example, Accra's household water storage containers. The results of this study indicated a somewhat higher

level of mosquito biting in households storing their water indoors. These results indicate the potential importance of collecting information on mosquito breeding and biting in Accra, but only begin to answer a number of critical questions relevant to environmental management.

Flies may not pose a health hazard comparable to malaria, but are important disease vectors nonetheless. Flies are both filth-feeders and filth-breeders. They are mechanical carriers of disease, and pose a particular risk when regularly in contact with both human faecal material and food. The presence of many flies in the kitchen was found to be associated with a higher prevalence of childhood diarrhoea. However, the most obvious means to decrease the risk of food contamination from flies are improvements in sanitation, solid waste disposal and food handling. People should be made aware of the dangers flies pose, but there is little point in designing policies targeting flies in particular.

11.6 Food Contamination

The contribution of microbial food contamination to ill-health is difficult to discern, but could be considerable. Three of the variables found to be associated with a higher diarrhoea prevalence may reflect food contamination problems: the presence of flies in kitchens; not always washing hands prior to food preparation; frequenting prepared-food vendors. Popular perceptions clearly link food to illness, and almost half of the questionnaire respondents whose children had had diarrhoea identified bad food as a probable cause. (Food eaten out, rather than food prepared at home, was typically blamed, however). While it is unlikely that anything like half of the diarrhoea cases are the result of eating contaminated food, the results are consistent with the notion that food is one of the more common routes through which "water diseases" are contracted.

Unfortunately, it is difficult to design policies to improve food handling practices. Better water, sanitation and solid waste disposal are likely to help.Improved hygiene education is possible. Government regulation of small food vendors, however, is likely to be ineffective and possibly counterproductive. On the other hand, some local groups are already acting to improve the hygiene of food vendors in their neighbourhoods. Providing support for these local activities could well be one of the most effective means of improving food quality directly.

11.7 Household Air Pollution

Cooking with charcoal or firewood, and especially the latter, gives rise to potentially damaging levels of pollution exposure. However, conditions are probably worse in other parts of the country, where wood is the predominant cooking fuel. Within GAMA most of the households relying primarily on wood live in the rural fringe, and it is there that exposure to particulates from cooking fires is likely to be highest. In some circumstances, however, urban crowding may lead to cooking indoors in small poorly ventilated rooms. In households where cooking was always done indoors, both women's and children's respiratory problems were more common, and children's respiratory problems were also more common when they were often present during cooking.

Promoting the increased use of LPG or electricity for cooking would reduce exposure among households which switched to these fuels. However, subsidies large enough to influence fuel choice are likely to be very costly. Moreover, the health benefits will almost inevitably accrue primarily to the relatively well-off. Even if the share of households using LPG or electricity as their principal fuel

could be trebled through subsidies most poor households would still be using wood and charcoal.

At least in the short term, improved cooking practices, possibly in conjunction with improved stoves, are of more relevance to the poor majority. However, the results suggest than many women are not concerned about exposure to smoke from cooking fires. There is little point in advocating measures to reduce smoke exposure to people who do not perceive smoke to be a significant problem. More than with the household environmental problems examined, education should be central to any serious efforts to curb smoke exposure. Such information could be integrated into campaigns against smoking cigarettes.

11.8 An Integrated Environmental Strategy

A successful environmental strategy for GAMA must come to terms with both the very severe environmental problems people face in their homes and neighbourhoods and also city-wide environmental degradation and the regional impact of developments in GAMA. It would be economically inappropriate and financially infeasible to implement a traditional infrastructure program for GAMA on the scale needed to address all household-level problems, even disregarding the broader environmental implications of such an approach. On the other hand, partial measures, slowly extending the coverage of good quality environmental services, risk favouring the relatively well-off. It is therefore critical to identify means to assist the poor majority, who will not have indoor piping, individual toilets, or household waste collection in the near future.

Economic austerity makes it all the more important that policy action respond to local priorities and be based on the best information available. Under existing conditions, it is not enough for policy analysts to identify serious problems and recommend actions. The government cannot afford to take on all serious problems. Difficult choices have to be made. The perceptions and priorities of local residents can help guide policy development. Information on existing conditions and health risks can also help ensure that improvement efforts are well targeted.

With tight constraints on government expenditures, it is also important that environmental strategies take full account of non-governmental institutions, and their potential role in environmental management. As indicated in Chapter 10, there are a wide range of local institutions working with varying degrees of success in GAMA. The more successful examples received at least some degree of external support. Assisting these intermediate institutions, both institutionally and financially, is often likely to be more cost-effective than simply expending resources on infrastructure development.

It should also be kept in mind, however, that especially in relatively poor areas, integrated improvement efforts are more likely to be effective than a series of independent interventions. Physically, the problems are closely interrelated. Sanitation, water, hygiene and food contamination problems are so intertwined that their borders are difficult to define, and most problem areas have at least some interconnections. Refuse can be a breeding ground for flies, which then lead to food contamination. Water, including household water storage containers, can be a breeding site for malarial mosquitoes. Changes in cooking habits may not only affect food contamination, but also smoke exposure. Given these close interrelations, it is critical that improvements be complementary.

Taken together, all of these considerations point to the need for an integrated strategy for environmental management in GAMA. The problems are too severe to

be ignored. Economic and financial conditions preclude administratively simple, high-cost solutions. The institutional context provides a range of opportunities, but a number of co-ordination and co-operation problems. The physical interrelations pose a different set of co-ordination problems and opportunities. Only a coherent strategy can hold out the hope of weaving together the threads in this web.

This report has only begun to tap the policy relevant information which has been collected in the course of this study. There are important policy-related issues regarding environmental service provision, house tenure, settlement planning, gender and epidemiology, many of which could be explored with the help of the data base employed here. In a few areas, the statistical associations presented need to be followed up with more detailed physical evaluations. The association between pump-spray pesticides and respiratory problems is a case in point: there is not enough evidence to condemn these insecticides outright, though there is more than enough to justify a careful investigation of the chemicals and practices involved.

Perhaps more important than these extensions, however, the results could be employed in the policy development process itself. It would be possible to develop a set of environmental health indicators which could be used to help monitor endemic environmental health hazards, and support targeted policies designed to improve conditions in critical areas. Alternatively, the results could provide critical input to evaluations of particular options, such as investments in improved sanitation facilities or environmental control of malarial mosquitoes. In short, this report need not be seen as the end-product of a research project - it could also be the starting point for renewed efforts to improve the environmental conditions for the people of GAMA.

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APPENDIX 1

Sampling Procedure for Questionnaire Survey

The first order stratification is described in the introductory chapter of this report. The selection of neighbourhoods to be sampled from each strata was a modification of the list employed in the *Housing Needs Assessment Study* (Housing and Urban Development Associates, 1990). The additions are starred in Table 1.6, and are intended to reflect the recent extension of the boundary of GAMA, and the addition of the rural periphery category. For Accra, 25 of the 52 neighbourhoods are represented, for Tema 8 of the 22 neighbourhoods are represented, and for Ga 7 of the 20 neighbourhoods are represented.

The sample was apportioned among Accra, Tema, and Ga districts so as to reflect the approximate relative population shares of these districts, as estimated for 1992 (Benneh et al, 1990). Within the strata of each district, the sample was apportioned among neighbourhoods in the same proportions as in the *Housing Needs Assessment Study*, except for the newly added neighbourhoods (i.e. those starred in Table 1.6). The sample size in the newly added neighbourhoods reflects the relative share of GAMA's population in Ga and Tema districts, and the estimated 5% of GAMA's population living in the Rural Periphery. The resulting sample size in each neighbourhood is given in Table 1.6.

Within the neighbourhoods, clusters averaging five households were selected. To create these clusters, blocks of an estimated one hundred households for high density areas and fifty households for low density areas were selected within the neighbourhoods, the number of blocks in each neighbourhood being indicated in Table 1.6. The selection of blocks was based on a reconnaissance of the supervisors. (Ideally, the blocks would be based on a random or stratified sample of enumeration areas from the Ghana Statistical Office. Such a procedure would pose serious logistical problems, however). During their reconnaissance the supervisors identified the principal types of residential areas in the neighbourhood, estimated roughly the share of households living in the different residential types, and apportioned the blocks to reflect these shares, and also to ensure that areas off the main roads and of high density are adequately represented.

Having been shown the blocks, the interviewers selected households to interview by systematically walking through the block and interviewing every twentieth (or tenth) household. The interviews were done at times when people were not generally working, so as to avoid a bias against households wherein the principal woman works. If the principal homemaker was not home, the surveyor continued with the next household, returning later to attempt an interview again. Only after the rest of the household interviews in the block have been completed did the interviewer look for a replacement household (a neighbouring household). Households which refused to be interviewed were replaced immediately. A code was included in the survey to ensure that replacement households can be identified.

Table 1: Listing of Neighbourhoods Surveyed.

	Neighbourhood	Sample Size	No. of Blocks
11	Osu (A)	70	14
12	James Town (A)	70	14
13	Labadi (A)	30	6
Sub-total HDIS		**170**	**34**
21	Airport Residential (A)	5	1
22	Roman Ridge (A)	5	1
23	Ringway Estate (A)	5	1
24	N. Labone Estate(A)	5	1
Sub-total LDHCS		**20**	**4**
31	Achimota (A)	15	3
32	Tesano (A)	15	3
33	Asylum Down (A)	10	2
34	Cantonments (A)	10	2
Sub-total MDMCS		**50**	**10**
41	Dansoman Estate (A)	25	5
42	Kaneshie Estate (A)	15	3
43	S. Odorkor (A)	20	4
44	N. Teshie Estate (A)	25	5
45	Tema C. 4 & 9 (T)	25	5
Sub-total LDMCS		**110**	**22**
51	Sports C. Area (A)	15	3
52	E. Legon Extension (A)	5	1
53	Adenta (T)	5	1
54	Haatcho (G)	5	1
Sub-total LDNDS		**30**	**6**
61	Mataheko (A)	20	4
62	Mamprobi (A)	20	4
63	Darkuman (A)	35	7
64	Abeka (A)	20	4
65	*Amasaman (G)	10	2
66	*Kpone (T)	10	2
Sub-total MDIS		**115**	**23**
71	Sabon Zongo (A)	80	16
72	Accra New Town (A)	65	13
73	Nima (A)	50	10
74	Maamobi (A)	80	16
75	Madina (G)	80	16
76	Tema New Town (T)	35	7
77	Ashiaman (T)	35	7
78	*Tema C. 2 (T)	30	6
Sub-total HDLCS		**455**	**91**
81	*Old Ashalebotwe (T)	10	2
82	*Danfa (G)	10	2
83	*Oyarifa (G)	10	2
84	*Afienya (T)	10	2
85	*Old Ofankor (G)	10	2
Sub-total RF		**50**	**10**
TOTAL		**1000**	**200**

NB: A = Accra District; T = Tema District; G = Ga District.

APPENDIX 2

Methodology for Assessment of Water Quality

1 Material and methods

Household location and water sampling usually started in the morning at about 0900hrs and sometimes ended at about 1800hrs. An average of about 7-10 samples were collected a day.

In the various households, the drinking water source was first identified and the questionnaire was later run. Paired samples of water source and stored water were taken. However, if no running water source was available, then single stored water samples were taken. Some households did not have stored water and were therefore not covered.

All the samples were transported in an ice-box at a temperature range of 0 - 4°C to minimise changes in bacterial counts between sampling and testing.

2 Water Sampling Procedure

Sampling of the piped supplies and overhead tanks was carried out using aseptic methods (APHA, 1985). For the collection of water from household storage containers, an aluminium cup was used for sampling. 'Ice-water' dispensed from a cup was poured directly into a sterilised bottle and stored in an ice-box at 0-4°C. The cellophane- packaged "ice-water" was placed directly in the ice box.

2.1 Bacteriological Examination

F. coli and faecal streptococci were quantified using the membrane filtration method. The Slanetz and Bartley agar method was used for the examination of faecal streptococci.

The sample was first filtered through a membrane filter, after adding 3.0 - 3.5ml of sterile distilled water to the petri-dish containing the nutrient pad. The membrane filter was then placed on the nutrient pad without entrapping air bubbles and incubated.

For the detection of F.coli, the MFC (Membrane Faecal Coliform) medium was used with the incubation temperatures ranging between 44 to 44.5^{o}C for 22 to 24 hours. Blue colonies with diameters of 1- 2mm were counted.

The Azide medium was used for the detection of faecal streptococci, with incubation conditions at 37°C for 24 to 48 hours. Faecal streptococci form small (approximately 1 mm in diameter) red to reddish brown colonies which have smooth peripheries.

APPENDIX 3

Methodology for Air Test

1 Field Operations

The field operation began after the field assistants were carefully introduced to the background and the purpose of the air pollution survey. They were also introduced to the practical aspects of the survey with a series of initial test- runs with the equipment and trial-test with the questionnaire before moving into the field.

There were 12 field and 2 laboratory assistants. The field equipment was packed in nylon shopping bags. Each bag contained:

* a Gil-Air S-C Air pump charged with filter cassette containing filter with a cyclone,
* carbon monoxide tubes with clips,
* screw-driver,
* tape measure,
* belt for mounting the air pump,
* Peak Expiratory Flow meter,
* Peak Expiratory Flow cylinders and
* a questionnaire.

1.1 Field Exposure Measurements Methods

The method of collecting physical information during this investigation was by exposure measurement using the person-carried equipment. The person-carried equipment has the advantage of ensuring that the sampling of particulates and carbon monoxide reflect the actual exposure situations. It also does not hinder the respondents in their normal work during the monitoring period due to its light weight and portability.

The equipment used for the investigation samples the ambient air wherever the respondent is. It gives information about the quantity of a pollutant a person has been exposed to during the monitoring times, and hence average concentrations encountered, but no information about the peak concentrations.

The exposure was monitored for a 3 hour period, covering the time during which the respondent cooked the principal meal.

a) Particulate Matter

The Gil-Air S-C Air pumps were fitted with a cyclone which contained a filter to collect respirable dust and particulates. Since it has been established that most emissions from biomass fires are 0-5μm in size (Klaassen, C.D. 1985), ambient settling particles of other origin, for example road dust, which are often larger, were excluded. These battery powered Gil-Air pumps used with built-in timers drew air at a fixed rate of 1.9 litres/minute. The built-in timers were used to monitor the exact time the pumps were in operation.

All pumps were charged during the night and the air flow was adjusted with a rotameter before use. Before the pumps were sent to the field, the filters (the filter type is a 37 mm Cellulose acetate filter with a porosity of 8 μm, Millipore SWCP 03700) were conditioned at room temperature and humidity 24 hours prior to field use and for 24 hours after field use. After conditioning, they were weighed on an electronic digital balance. To account for the possible variation of the humidity in the laboratory, blank filters were weighed together with the sample filters. The

monitoring of humidity in the laboratory was carried out using a mechanic thermohydrograph (Fischer). No monitoring of humidity in the field was carried out.

After instructing the recipient as to the use and operation of the pump, the equipment was attached to the waist and the filter contraption was fitted to the dress of the recipient as close to the breathing zone as possble. After monitoring the timers of the pumps were rechecked and the information noted in the questionnaire in the field. The pump air flow was re-checked as soon as the pumps were returned from the field in order to obtain the average air flow during the monitoring period.

b) Carbon Monoxide

The monitoring of carbon monoxide was carried out with diffusion tubes. After the tip was broken, the diffusion tube (Drager 6733191) was placed close to the breathing zone of the recipient. The colour change of a reactive salt in the tube was compared with a printed scale on the tube to determine the extent of the recipient's exposure to carbon monoxide gas. The scale reading on the tube is in ppmh. Readings were done in the field and cross-checked in the laboratory, 30 minutes after the completion of the monitoring.

c) Peak Expiratory Flow

When a person is exposed for a long time to particulate and irritable gases, obstruction of the airways can occur and may cause inflammation and phlegm production. In this study the impairment of airways of the respiratory system was measured by the use of the portable Wright's Mini Peak Flow Meter to measure the Peak Expiratory Flow (PEF). The Peak Expiratory Flow is proportional to the diameter of the upper and central airways of the respiratory system and therefore indicates the presence of a reduction in the airways due to inflammation or blockage by phlegm (Klaassen, C.D. 1985).

The Wright's mini Peak Flow Meter has a direct reading of the maximum flow in litres per minutes. A new paper cylinder for blowing was fitted to the flow meter for every respondent. The respondent was then taught how to exhale into the meter and allowed one or two training exhalations. After this, three exhalations were performed sequentially by the respondent while catching enough breath between the exhalations. The highest value of the three exhalations was then taken as the PEF value.

d) Other Measurements

The height of the respondent was also measured.

1.2 The Questionnaire

An additional questionnaire was applied along with the air tests, designed to give information on:

*Residential area and conditions
*fuel type used and cooking habits
*the health status of the respondent

All respondents interviewed using the questionnaire were also monitored.

APPENDIX 4

Opening address
Thursday December 9, 1993

by

Hon. Dr. Christine Amoako-Nuamah
Minister for the Environment

At the opening cermony of the seminar on "Environmental Problems and the Urban Household in the Greater Accra Metropolitan Area" (GAMA)

held at

The Auditorium, School of Administration
University of Ghana

Mr. Chairman,
Your Excellencies,
Distinguished Ladies and Gentlemen,

It is a great pleasure for me to address this gathering of academics from Ghana and the Stockholm Environment Institute, representatives of international organizations in Ghana, planners, government officials, environmental NGO's and community groups as you prepare to deliberate on the results of a major study on "Environmental Problems and the Urban Household" in the Greater Accra Metropolitan Area (GAMA).

The slums and shantytowns of cities in the developing world are growing at twice the rate of cities in other parts of the world. The World Bank estimates that the bottom quarter of urban populations in most African and low-income Asian cities cannot afford a minimal level of permanent housing.

Large sections of major cities in developing countries are without adequate treated water, municipal sewerage or solid waste disposal systems. According to the World Commission on Environment and Development, between 1985 and 2000 developing countries will require a 65 percent increase in their capacity to build and manage urban infrastructure, including transportation and sanitation systems, utilities, schools and hospitals.

It is therefore imperative that development strategies be developed to deal with the combination of population growth, health of the fragile ecosystems,

appropriate technologies and access to adequate human and material resources. The primary goal of any development strategy in this regard should include poverty alleviation, food security and education as well as good health and quality of life. These issues are of major concern to the urban household.

Consequently, at the recent Rio Earth Summit (UNCED), there was a broad agreement that a "brown agenda", which focuses on environmental issues and poverty, would be vital for urban populations if cities are to develop in a sustainable manner.

It is this concern for the sustainable management of our human settlements, that led the Government of Ghana to support the design of the Strategic Plan for the Greater Accra Metropolitan Area (GAMA) which was the subject of a seminar held a few weeks ago. GAMA has also been selected for participation in both the sub-regional and global networks of sustainable or healthy cities. To emphasize the importance of this concern, another seminar held last week on "Planning and Management of the Urban Environment", highlighted some general problems associated with urbanization and also proposed some strategies and operational arrangements for their solution.

It is hoped that results of this study, empasizing intra-urban differentials in access to environmental amenities, the links between environmental risk factors and health outcomes, the economics of household environmental management and finally institutional issues will be thoroughly discussed at that seminar. It is further hoped that out of the discussions concrete proposals for innovative policies for improving urban management shall be sent to the Ministry for consideration.

Mr. Chairman, ladies and gentlemen, as you may all be fully aware, the commitment of the Government of Ghana to sustainable development is unquestionable. The establishment of the Environmental Protection Council in 1974 after the Stockholm Conference on the Human Environment and the creation of the Ministry for the Environment in the Fourth Republic underscores this commitment.

On the part of the Ministry it might please you to know that improvement to the urban management is a major priority. It is for this reason that the Ministry is supporting two new projects aimed at alleviating living conditions in urban centres. These are the Sustainable Cities Project (SCP) and the Community Based Environmental Management Information System (CEMIS).

Many more of such projects are going to be sought by the Ministry in as much as the Ministry foresees that urban centres in Ghana would otherwise be overwhelmed by sanitation problems by the turn of the century.

As a measure of assuring sustainability of the improvement aimed at urban management, the Ministry is considering policies that will lead to protection and development of the rural environment through vastly improved planning and management of over-all human settlements and other land use in pursuit of sustainable national development.

On behalf of the Government and people of Ghana, as well as on my own behalf, I formally welcome you all to this Seminar. I extend a special welcome to Dr. Gordon McGranahan of the Urban Environmental Management Programme of the Stockholm Environment Institute.

Mr. Chairman, Your Excellencies, Distinguished Guests, Ladies and Gentlemen, I now have the pleasure to declare the Seminar open.

Stockholm Environment Institute
Address: Järntorget 84, Box 2142
S-103 14 Stockholm,
Sweden
Telephone: Int +46 8 723 02 60
Telex: 19580 SEI S
Telefax: Int +46 8 723 03 48

SEI at York
Address: University of York,
Heslington
York YO1 5DD, **UK**
Telephone: Int +44 904 43 2897
Telex: 57933 YORKUL G
Telefax: Int +44 904 43 2898

SEI-Boston
Address: 11 Arlington Street
Boston, MA 02116-3411
USA
Telephone: Int +1 617 266 8090
Telex: 279926 ESRG BSN UR
Telefax: Int +1 617 266 8303

SEI-Tallinn
Address: Box 160
EE-0090 Tallinn
Estonia
Telephone: Int + 372 2 601 844
Telefax: Int + 372 2 440 982

Stockholm Environment Institute

The Stockholm Environment Institute (SEI) was established by the Swedish Parliament in 1989 as an independent foundation for the purpose of carrying out global environment and development research. The Institute is governed by an international Board whose members are drawn from developing and industrialized countries worldwide.

Central to the Institute's work have been activities surrounding the Rio UNCED conference, and previous to this, the Brandt and Palme Commissions and the work of the World Commission for Environment and Development. Apart from its working linkages with the relevant specialized agencies of the UN system, a particular feature of SEI's work programme is the role it has played in the development and application of Agenda 21, the action plan for the next century.

A major aim of SEI's work is to bring together scientific research and policy development. The Institute applies scientific and technical analyses in environmental and development issues of regional and global importance. The impacts of different policies are assessed, providing insights into strategy options for socially responsible environmental management and economic and social development.

The results of the research are made available through publications, the organization of and participation in conferences, seminars and university courses, and also through the development of software packages for use in the exploration of scientific problems. SEI has also developed a specialized library which functions as a central catalyst in the short-term and long-term work of the institute.

Research Programme

A multidisciplinary rolling programme of research activities has been designed around the following main themes, which are being executed via internationally collaborative activities with similar institutions and agencies worldwide:

- *Environmental Resources*, including energy efficiency and global trends, energy, environment and development, and world water resources;
- *Environmental Technology*, including clean production and low waste, energy technology, environmental technology transfer, and agricultural biotechnology;
- *Environmental Impacts*, including environmentally sound management of low-grade fuels, climate change and sustainable development, and coordinated abatement strategies for acid depositions;
- *Environmental Policy and Management*, including urban environmental problems, sustainable environments and common property management; and
- *POLESTAR*, a comprehensive modelling and scenario-based activity, investigating the dynamics of a world with 10 billion people by the middle of the next century.

SEI's Network

SEI has chosen a global network approach rather than a more traditional institutional set-up. The work programme is carried out by a worldwide network of about 60 full- and part-time and affiliated staff and consultants, who are linked with the SEI Head Office in Stockholm or to the SEI Offices in Boston (USA), York (UK) and Tallinn (Estonia). SEI has developed a large mailing register to communicate to key members of society in government, industry, university, NGOs and the media around the world.

SEI STOCKHOLM ENVIRONMENT INSTITUTE

International Institute for Environmental Technology and Management

Postal address:	Box 2142, S-103 14 Stockholm, Sweden
Telephone:	+46-8-723 0260
Telex:	19580 sei s
Telefax:	+46-8-723 0348
E-mail:	cdp!gn!pns!seihq