Research Report

SOCIO-CULTURAL ASPECTS OF WATER SUPPLY AND SANITION IN KOREA*

Han Sang-Bok
Kwon Tai-Hwan
Chun Kyung-Soo
Moon Chang-Kyu

This research is intended to establish the relationships among water sourse, water use and various aspects of environmental as well as personal sanitation in Korean villages, and to identify the major socio-cultural factors, ecological elements and life styles of the residents which influence the observed relationships based on the information collected in five ecologically distinctive communities dispersed throughout the country. These include a metropolitan shanty town, a typical agricultural village and a fishing-cash crop farming island community. Anthropological fieldwork was adopted as the major method of data collection. To obtain quantitative data, a base-line survey was conducted by using structured questionnaires at the early of the research. As a way to determine the safety of drinking water, a series of microbiological examinations of water samples were conducted over a one year period. Water samples were drown from various sources such as the original water sources, portable water in storages, and water from the tap. The research has examined diverse problems of water sanitation and the related environmental problems in Korean communities at three levels, that is enviromental contamination by external forces, sanitary problems due to community factors, and problems in indiviaual perceptions and behavior. Finally, policy recommendation has been formulated based on the research findings to upgrade government policies toward environmental improvement and water sanitation on the community level.

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Chapter I

INTRODUCTION

A. Purpose of the Study

The general purpose of the present study is to identify the socio-cultural linkages between water supply systems, sanitation and health in Korean villages. More specifically, this study intends to achieve the following objectives :

1. To examine the level of contamination of various potable water sources,
2. To determine the sanitary status of each survey community,
3. To examine the morbidity patterns of each survey community,
4. To examine the major environmental problems in relation to water contamination, sanitation and health,
5. To describe the traditional ways and the emerging or newly introduced patterns of water use, sewage treatment and night-soil treatment.
6. To discern the social and cultural elements in water use, sanitation and disease treatment,
7. To examine the implications of urbanization and industrialization for environmental sanitation,
8. To examine the impact of environment improvement programmes upon sanitation,
9. To discuss the relationship between water use and health, and
10. To formulate policy recommendations on water supply systems, water use and management education, environmental control, diffusion of innovative technologies, and sanitary and health education.

B. Background

In the early 1970 s, the Korean government launched a vigorous effort, called Saemaul Undong (New Village Movement), to modernize the traditionally stagnant rural villages throughout the country. It was an integrated effort to effect the total life conditions of the people rather than to change any particular aspect of them. Under this scheme, various programmes were developed to up-grade the health of the community. These include the introduction of simple piped water supply systems, the control of water and sewage disposal, and the diffusion of newly designed sanitary toilets. But each of these innovations was not implemented with equal success. For instance, the installation programme of simple piped water supply systems has progressed well in advance of the toilet replacement programme. On the other hand, little progress has been made with the sanitary treatment of sewage and disposed water, while the amount of them has been greatly increased.

As a result, it is expected that the safety of potable water has been increased to the point that potable water is no longer the major medium for disseminating various epidemic diseases. It is, however, often suspected that the problem of water contamination is still serious in some villages even after the installation of a piped water supply system. Technical imperfection and negligence may partially account for this suspicion, but it is more soundly grounded on the observation that the adoption of technical innovations has not been accompanied by the neccesary changes in the pattern of water use behaviour of the people (MOHSA, Health Weekly, 9 Nov. 1984). <The theory of culture lag developed by

Ogburn (1964) sheds light on the nature of such problems.) Traditional toilets are still dominant in rural Korea and accordingly, their implications for community health have not changed much. Also, new sanitary toilets are known to frequently cause water and environmental contamination. These observations are a clear indicator of the fact that community sanitation and health are not simply problems of technology but are also closely related to the life style of its residents. In this regard, we can have a sound basis for assuming that the behavioural aspects of water use and sanitation on the community level constitutes an area of prime importance in the search for viable and effective community health programmes in this country.

Unfortunately, there have been very few studies conducted in Korea from this perspective. Not a single study can be found on the relationship between water use and sanitation on the community level. There have not even been any attempts so far to examine the effect of the simple piped water system installation programme on the general health conditions of the communities involved. Concerns of water contamination as well as air pollution have been raised almost exclusively in connection with urbanization and industrialization during the last ten or more years. It is well accepted, though systematic evidence is lacking, that health in rural Korea has deteriorated in the wake of the country's industrialization. Many rural villages were directly or indirectly affected by the development of nearby areas into havens of heavy pollution industries. The introduction of modern technology to traditional rural villages such as the use of chemical fertilizers, insecticides, electricity and farming machines is often considered a major cause of environmental deterioration. The linkage between modern technology and environmental health is complex. Modern technology could have broken down the traditional system of environmental control through causing social disorganization, cultural disintegration, ecological imbalance, or through causing changes in the geomorphological landscape.

In Korea, epidemiological studies have been confined to the search for the mechanical causes of diseases. Environmental as well as socio-cultural explanations of disease prevalence patterns have rarely been attempted. For example, there are several studies on the cholera eltor (Kim 1980). Investigators examined the channels of cholera (Vibrio El Tor biotype) introduction and found that no dinstinctive channel can be identified and the dissemination of V. El Tor has tended to be food borne rather than water borne. The findings provide no fundamental knowledge on how V. El Tor is disseminated and what kinds of measures need to be adopted to prevent it. In these cases, it is clear that the determination of whether a disease is water borne or food borne has little meaning without any comprehensive understanding of such socio-cultural behaviours as water use, food preparation, dining table habits, toilet use habits, water disposal and so forth. There are several studies on the prevalence of parasitic diseases (e.g., Feachem 1978 ; SPH, SNU, 1981) and water contamination (Zong, Lee and Lee, 1972 ; Kong and Zong, 1973 ; Suh and others, 1981). Similar observations can be made with these studies. Virtually all of them report only prevalence rates and have rarely tried to explain the findings in terms of the behavioural and cultural contexts. Further, there has been no effort to relate one aspect of community health to another or to study a particular subject of health from an integrated community health perspective.

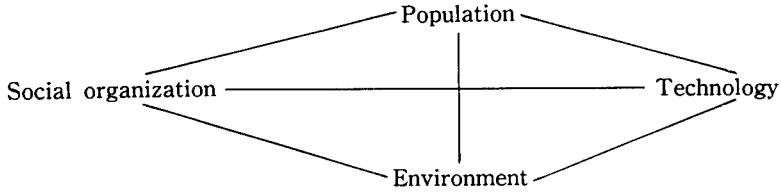
Another important limitation in past studies of health and disease prevalence on the community level in Korea is that the validity of the data is very questionable. This is particularly the case when a study adopts an interview method for data collection or uses clinic records. People usually develop the perception of health and disease through their

common as well as personal experience of everyday life in Korea. As such, minor discomforts or symptoms which do not affect their work seriously are generally not considered as illness, although this is dependent on the type of work one engages in. For example, diarrhoea and cold are considered normal in most agricultural villages while these are treated seriously among urban blue collar workers. Also, Koreans use diverse methods and institutions of health care including herb medicines, folk treatments and sharman rituals in addition to the western medical institutions, pharmacies and oriental medicines. These observations again confirm the importance of socio-cultural and behavioural approaches in health research in Korean communities.

C. Research Framework

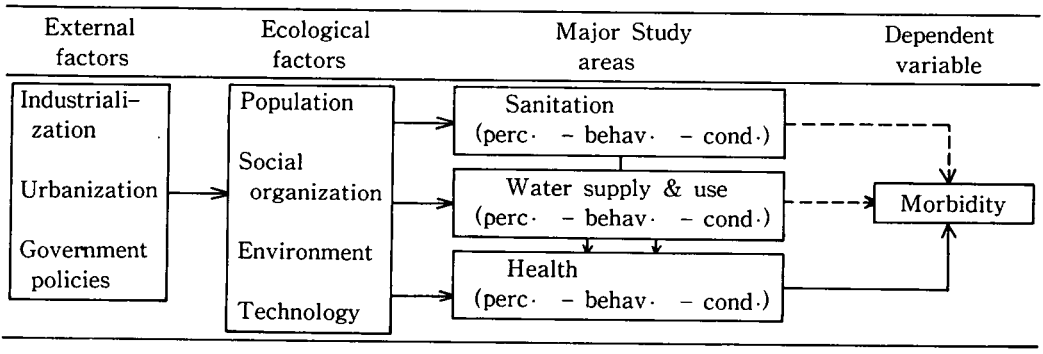
We have identified above our major areas of interest and our methodological positions adopted for this research. As well, we have also revealed our conceptualization of the relationships among the components of this study. To sum up, water supply and use, sanitation, and health are the primary foci of this study, and each of them is examined in three dimensions following our research interests, that is, perception, behaviour and resultant conditions. For analytical purposes, these dimensional aspects are assumed to be in partial causal relationships in the direction of "perception → behaviour → status condition". For instance, we have tried in this study to explain the sanitary conditions of a village in terms of the patterns of sanitary behaviour in the village, and in turn, we have attempted to explain the sanitary behaviour of the villagers by investigating their basic perceptions beliefs concerning sanitation. The meaning of each of these major research areas is to be determined by its relationships to the level and patterns of morbidity in each village.

Each survey community is primarily conceived of as an ecological system and thus ecological factors constitute the major explanatory variables in this study. By adopting Hawley's formulation (Hawley, 1950), the system is postulated to consist of four components (or factors), population, social organization, environment and technology as is illustrated by the diagram presented below.



An ecological analysis usually assumes that an ecological system is closed and all things in question can be explained by the system factors and their web of relationships. But the assumption of a closed system is no longer relevant in the contemporary Korean context. In other words, it is essential to examine the factors external to the system even in an *ecological* study of a Korean community. Considering this and the research objectives, we have formulated the following conceptual scheme for the present research.

Analytical conceptual schemata of the research



D. Methods and Data

Field observation techniques were adopted as the primary tool for data collection in view of the nature of the present study which can be summarized, from the above discussions, into a community level study, an ecological approach, a behavioural interpretation and an emphasis on holistic understading. This method was used mainly to find out government and community programmes adopted to change water supply system and sanitary conditions in each village, to determine the mechanisms and processes to implement these programmes, to reveal new health and sanitary problems arising from the programmes and to collect in-depth information on the patterns of water use, sanitary behaviour and morbidity history (particularly that of water borne or related diseases) of the residents.

To obtain the general and basic information on our various research topics, a questionnaire type base-line survey was conducted. It was administered to all households using head of the household as the prime respondent. In the later stages of fieldwork, data from the base-line survey were extensively used as a guide to in-depth interviews and observation. The survey intended to cover the following areas : a) socio-economic and demographic background of the resident population ; b) the patterns of water use, water handling, night-soil treatment, sewage disposal and health behaviour in each survey community ; and morbidity status of the survey households.

To determine the levels of water safety, a series of microbiological tests were conducted with potable water from various sources such as simple piped water supply sources, water taps and water containers. Since people suspect chemical or mineral contamination of water sources in some survey communities, an additional test was carried out to examine the level of such contamination. To take into account the seasonal variability of water quality, microbiological tests were repeated in monthly intervals during the one year period between April 1985 and March 1986. Detailed procedures of the tests are described in Chapter IV.

The base-line survey was conducted during one month from mid August through mid September 1984 with five male and five female interviewers. Male interviewers consisted of five field workers who were doctoral candidates in anthropology either at Seoul National University or Young-nam University. Female interviewers were recruited among college graduates with anthropology or sociology backgrounds. During the survey, all four researchers and two laboratory assistants made an itinerant trip to each of the five survey

communities to get acquainted with the village and to select water sample sites for microbiological testing.

Immediately following the base-line survey, participant observation in the survey communities started. One field worker, or research assistant, was assigned to each survey community for one year of resident fieldwork. It was found, however, that the information collected by the assistants who were males was biased and had an important limitation because of their limited opportunities to observe women's life due to the strongly prevailing traditional sex segregation in everyday life, as widely observed in other traditional cultures too (E.g., Elmendorf & Isely, 1983 : 196). Particularly, information on water use and handling was very limited because these constituted the domain of women's work. So, a special short fieldwork session was organized at the end of the regular fieldwork period by employing female anthropology students to observe women's behaviours and attitudes.

Although quantitative data were collected through the base-line survey, the use of statistical analysis is very limited in this study for the following three reasons. The first two reasons are related to the anthropological nature of the study. Due to a small number of households surveyed, it is considered not viable to adopt any vigorous and sophiscated statistical tests. The meaning of statistical inference is further limited since the research framework defines each of the five survey communities as a separate universe or an ecologically distinctive whole. Thirdly, the research findings diminish substantially the significance of statistical inference. In this research, the major area of concern is the relationships between water quality and health or sanitation. But the tests of potable water samples revealed that virtually all the samples were safe to drink, thus making water quality insignificant as a variable for statistical analysis. However, the anthropological fieldwork identified many problem areas to be clarified before accepting the results of the water sample tests. As a means for this, the base-line survey materials are used. Data from the base-line survey are mostly adopted to detect the basic patterns of water use and sanitation behaviour, and to link these to the health conditions of household members.

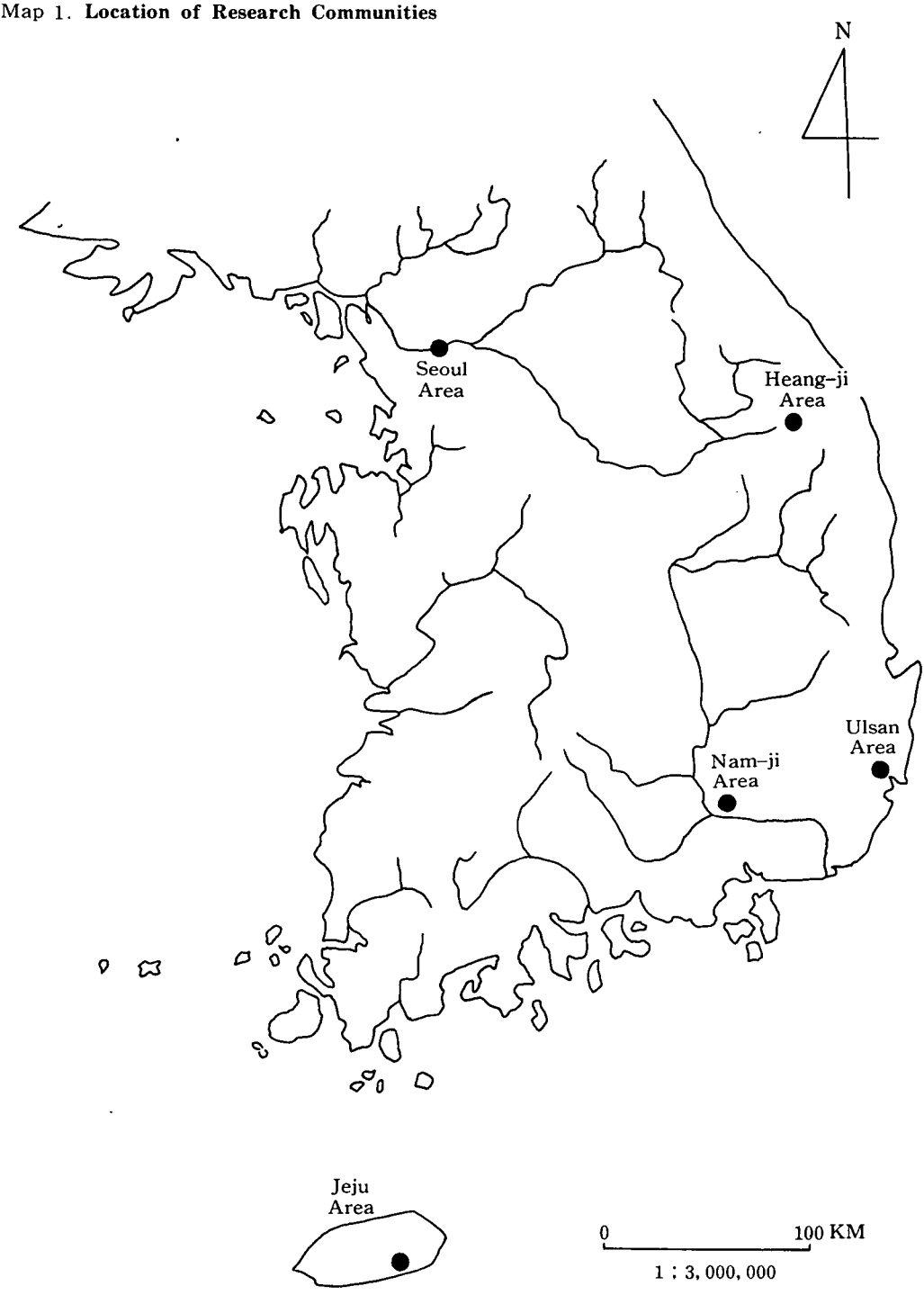
E. Selection of Research Sites

Five village type communities scattered over the country were selected as the research sites. Ecological distinctiveness of a community was the primary criterion for its selection. Reviewing various statistics and documents, five regions, each of which is ecologically distinctive from the others, were identified as the first step in determining the actual survey communities. They are :

Seoul : a metropolitan region which has shanty and squatter settlements,
Nam-ji : a green-house and rice farming area on the Nak-dong River,
Hwang-ji : a mountain mining and farming area,
Ulsan : a rice farming area off Onsan sea and near the Onsan non-ferrous metals industrial complex, and
Jeju : a large island which contains fishing and farming villages.

In each region, two or three communities with 100 to 200 households were chosen as possible research sites. Then the research team visited those communities to collect information on water sources, sanitation systems, geographical character and socio-economic activities in each village. Based on this information, five survey communities were finally selected. The list of survey communities together with brief descriptions of their ecological characteristics and water is presented below. The location of the survey

Map 1. **Location of Research Communities**



communities is illustrated in Map 1.

Profiles of study communities

Community	No. of households	Ecological characteristics	water source
Kuro (Seoul)	164	urban shanty town	city & simple piped water
Tong-jom (Hwang-ji)	132	mining & mixed cropping moutain village	simple piped, well, pump & brook water
Myung-ji (Nam-ji)	101	green-house & rice farming riverside village	simple piped, pump & tunnel water
Sam-pyung (Ulsan)	145	rice farming village near an industrial complex and off sea	simple piped, well & surface
Tosan (Jeju)	160	island, citrus farming, fishing & pig raising village	simple piped, spring & rain water

F. Composition of the Report

Results of the research are discussed in the subsequent chapters. After examining the general characteristics of the research communities and their populations utilizing materials from the fieldwork and the base-line survey, we have reviewed in Chapter III the development of the current water supply system in each study community. This information is the prime background material for this research. The outcomes of the laboratory tests of water samples are presented in Chapter IV. Then, our discussion proceeds to data on the patterns of water use and management, sanitary conditions and behaviour, and health conditions and behaviour in the respective study communities which was collected mostly through field observations. An additional argument is given in Chapter VIII on the relationships between water source and morbidity with the base-line survey data. Finally, we have tried to summarize the major findings and to formulate, based on the findings, recommendations for government water sanitation policy in the concluding chapter erns of water use and management, sanitary conditions.

Chapter II

THE RESEARCH SITES : GENERAL CHARACTERISTICS

As background information to facilitate the understanding of the research results, it is necessary to examine the overall ecological features of each study community before the introduction of the major research findings. In this chapter, we will first describe the living environment of each village, and then we will proceed to a comparative discussion of each village's socio-economic characteristics based on the base-line survey results.

A. Living Environment

1. *Kuro : A Metropolitan Shanty Town*

Kuro is located at the south-west end of Seoul and is known as an area composed of a big industrial zone developed in the early 1960 s and surrounding residential communities occupied mostly by blue collar workers employed in the nearby industrial complex and outcasts of Seoul. Kuro-3 rd-dong is a settlement which is typical of the Kuro area.

The residential area of Kuro-3 rd-dong was established in the early 1960 s in connection with the squatter clearance plan of central Seoul. The city government constructed so -called *relief* housing quaters in the area to accomodate those forced to leave the central squatter areas. The construction of relief and other low class housing units on a massive scale was in fact attempted without any proper thought and preparation. The urban service system was totally inadequate during its early years of development. The first bus route to this newly developing shanty town was opened in 1964 and the pavement of roads in the residential area with cement blocks was delayed until 1971, about ten years after the development of the area started. Electricity was provided from the beginning and the drainage system was built immediately after the construction of housing units. The traditional ditch type public toilets were provided originally and these public toilets were partially replaced by new sanitary type of public toilets in 1981.

The structure and conditions of relief houses were extremely coarse. They were built to accomodate four households in one unit space of 10 *pyung* (33 square metres), so they divided the space into four compartments with cement blocks. Only one room space was allocated to each household, and accordingly every household had to build its own kitchen by invading the road. As a result, roads in the residential area became so narrow that a small car could not get in. These already very narrow roads were further invaded by the residents. They put pots, garbage bins, bicycles, kitchen equipment and other nonvaluable items on the road in front of their living quarters.

The development of the Kuro area as a major industrial zone in the mid-1960 s contributed greatly to a rapid population increase and thus created a big demand for cheap rental rooms in the area including the survey community. This prompted a rush of construction with many residents buildinng a second story on top of the existing housing structure, although it was illegal and dangerous. In addition to such high densities of population and housing quarters, the area has been filled with poisonous carbon monoxide gas coming from *yontan* (a kind of coal briquet) fire, the almost exclusive fuel for heating and cooking in the area.

2. *Tong-jom : A Village of Upland Farming and Mining*

Tong-jom is located outside Tae-back City, the centre of coal mining areas along the Tae-back mountain range at the north east of South Korea. Tong-jom is a village set in a mountain valley divided into two parts : up-village and down-village. The up-village (or the upper part of the village) is the area where most indigenous people are living, while there are many new houses for mining workers in the down-village. The traditional housing structure and ways of life are more dominant in the up-village. A drift of young people has been observed in the up-village since the 1960 s, while an inflow of young working age population, or a labour inmigration, is a characteristic phenomenon in the down-village.

Because of the cold winter climate, a distinctive housing strcture was developed in this region including Tong-jom. Unlike what is observed in other parts of the country, the kitchen is located in the centre of the housing structure, thus making all rooms and the main floor easily accessible from the kitchen. In other words, all living spaces in the house are connected to or through kitchen. Also, there is usually a cattle stable at one corner of the kitchen or just outside the kitchen. This pattern of housing structure seems to have been developed to minimize the exposure to cold weather enabling residents to do everyday household work inside the walls during the winter. But toilets are separated from the living quarters and located at a corner of the front yard as in other areas.

At the bottom of the down-village, there is a three-way cross of local highways which lead to Hwang-ji, Jang-sung and Young-ju City respectively. (Tae-back City consists of two separate towns, Hwang-ji and Jang-sung with the former as its centre.) Below the highway line between Hwang-ji and Yong-ju, there runs the Hwang-ji River, an up-stream of the Nak-dong River, which is contaminated with coal dust as readily evidenced by its black colour. Among the three towns, the nearest to the study village is Jang-sung and the next is Hwang-ji. It takes about 15 minutes on bus to get to Jang-sung and 30 minutes to Hwang-ji.

The environment of Tong-jom was affected greatly by the construction of a lead muck treatment dam in a valley located just outside the upper part of the village in 1975 and the introduction of a city night-soil treatment plant and a slaughter house in the middle of the village in 1983 and 1985 respectively. The up-village is under the immediate threat of pollution created by the dam, whereas the night-soil treatment plant and the slaughter house affect the environment of the down-village most extensively. These incidences have greatly affected everyday life and life styles of the people. The major source of portable water was altered and the pattern of water use changed drastically. Contacts with outsiders increased profoundly because many merchants visit the slaughter house to purchase meat and people working for the lead muck treatment dam and the night-soil treatment plant frequently come to the village. The introduction of the slaughter house has apparently contributed to an increasing intake of animal protein and oil among villagers and provided unskilled village women with more work opportunities.

3. *Myung-ji : A Green-house and Rice Farming Village*

Myung-ji is located near the Nak-dong River which runs along the south eastern area of the Korean peninsula. The village is composed of two parts, In-village (the inner part of the village) and Out-village (the outer part) and has a small hill at its back. Being developed in a low land, the village had often been flooded by overflows of the river until a river bank was constructed in the early 1940 s. After the bank construction, the village

was flooded only once in the mid 1960 s.

The village was a typical rice cultivating community until the late 1950 s when green-house farming was introduced by a dozen relatively wealthy households. Their endeavour was a big success and copied by most villagers around 1970. The introduction of green-house farming has resulted in a sweeping change in the socio-economic structure of the village. With a prospering economy, many people, mostly consisting of farm labourers, moved into the village through a kinship mechanism. Green-house farming is also labour intensive and demands devoted and somewhat skilled care. As a result, the traditional social values and networks developed through the need for mutual cooperation in traditional agriculture, mostly rice cultivation, has weakened substantially. The role of women has changed, as well. They came to assume an important economic role and began to ride bi-cycles, which was unimagined in the traditional culture, to shorten the travel time between home and work. On the other hand, men are riding motor bikes, partially as a status symbol.

Despite the rising standard of living and the government push for environmental upgrading, there has been little improvement in the living environment. It is observed that economic prosperity and the adoption of various government recommended innovative measures have rather contributed to the deterioration of the sanitary environment of the village. Most Saemaul Undong (New Village Movement) projects are so standardized that there is little room to take village specific problems into account. For example, most houses in the village replaced the traditional straw roofs with slate roofs, as a Saemaul Undong project, without any substantive change in the building structure. The houses were originally of very poor quality because they were rebuilt in a rush after the complete destruction during the Korean War years, 1950–53. It may be expected in such a condition that the roof change will produce an adverse effect on the entire building structure.

4. *Sam-pyung : A Traditional Rice Farming Village near a Newly Established Industrial Complex*

Sam-pyung is a typical agricultural village located in a remote area of the south eastern part of the Korean peninsula. Access to the village is rather difficult even by national standards. It takes at least 30 to 40 minutes to enter the village from the nearest bus stop. People often walk to Nam-chang, the nearest township, for about two hours due to frequent cancelling of bus services. The villagers visit regularly the Nam-chang periodic market which opens every five days. The market working hours are very short lasting only until mid-day, but it functions as a meeting place of people from all the surrounding areas. People exchange various kinds of information there including information on the marriage of their children. In other words, the Nam-chang periodic market plays more of a social role than an economic one. Most economic roles of the Nam-chang market have been relegated to the regular markets in Ulsan and Pusan because of the development of both railway and road transportation between Nam-chang and these cities.

Sam-pyung is composed of four sub-villages, Nae-hoe, Chong-kok, Chong-dong and Sang-hoe. Each part has its own distinctiveness. The main industry of the entire village is rice farming, but pig farming is on the rise in Sang-hoe. In Jong-dong, many households have been engaged in fruit growing (mostly, peach), but the young generation is more inclined to raise pigs and cattle. This change is partly accounted for by the ever increasing difficulty of insuring enough labour supply for fruit growing which is in turn related to the countinuous outmigration of young working age people to urban areas. It is also said that

smelly toxic (sulphur acid) fumes discharged from factories in the Onsan non-ferrous metals industrial complex dry up peach trees in the village, and thus cause the fruit growers great anxiety.

The impact of industrial pollution on the living conditions of the village is felt in yet another way. People believe that the Hoe-ya River running down the village which is a partial source of agricultural water supply is also contaminated by a detergent factory located at the upper part of the river. Fish caught in the nearby Onsan Sea were a major food item in the village, but the villagers are very reluctant to eat fish caught in the sea because the sea is notorious for industrial, particularly cadmium, pollution. In short, people in the village feel that they are totally trapped by deadly pollution and accordingly the majority are thinking of moving out if an opportunity is given.

5. *Tosan : An Island Fishing and Farming Village*

Tosan is located at the south eastern tip of Jeju Island, 130 kilometres south of the Korean peninsula. The climate is warm and humid throughout the year. Jeju Island has developed its own regional culture distinguished greatly from the main Korean culture. In Jeju, women were the major bread winners : They worked on upland farms and caught shell fish to support the houshold, while men were often doing household jobs instead. Nuclear family ideology prevailed and a couple began living separately immediately after the wedding, or separate cooking at least if they had to stay with the groom's family.

Tosan is a village traditionally known for a snake cult and for this reason the village is more or less isolated from others. Girls from the village often have difficulty in getting married because they are known to bring a snake in a pot when they get married and put it in a corner of their newly arranged (bed) room. The villagers deny the existance of such a cult any more, but it is evident that the cult is still practiced behind the scenes. The cult appears to have influenced greatly the personality of the villagers. They are very suspicious of, and very unkind to, outsiders.

Entering the 1970 s, the national government launched a vigorous programme to develop Jeju as a national tourist attraction. Citrus farming was also introduced as one of the major promising future industries. Under these programmes the outlook of Tosan began to change rapidly along with its socio-economic charcteristics. A simple piped water supply system was installed in 1974 and this has resulted in an expansion of the village territory which was confined to a very limited area where spring wells were available. The new water source together with technical innovations also made citrus farming possible in the area, which has caused an overall change in the village economy and social relations among the villagers. Under the traditional subsistence economy, the living conditions of people did not differ much from family to family and this is considered to have been the base for mutually cooperative and reciprocal relations among the villagers. But the initiation of cash crop farming, represented by orange growing, has widened economic disparities among the people and has thus prompted competative, individualistic and selfish human relations in the village. Tosan was selected by the local government as an exemplary sight-seeing village in 1982 for its beautiful seashore scenery. With this decision, the village has received a great deal of investment for environmental improvement from the local government in such areas as housing improvement, road pavement, drainage construction, and the installation of new sanitary toilets.

B. Socio-Economic Characteristics : A Comparative Description

As mentioned above, we have selected purposively five communities for current research to emphasize the ecological factors in water use and sanitation behaviour. In the following we will examine further the socio-economic distinctiveness of each study community from a comparative perspective based on the results of the base-line survey.

1. *Demographic Composition*

Kuro, a metropolitan shanty town, has a population that is relatively concentrated in the young adult working ages of 15-39 compared to the other research communities. On the other hand, Kuro shows the least proportion of an aged population. The sex distribution is fairly even. The proportion of currently married women in the reproductive ages 15-49 in Kuro is the lowest among the survey communities. The proportion of the currently married is higher for men than for women in Kuro, unlike in other research communities. This phenomenon can be explained by the fact that the community has a particularly high proportion of young single girls working in the nearby industrial complex. Also, the people of Kuro are characterized by a high level of regional mobility. It is reported that only 2.5 per cent of the household heads have stayed in the area for more than 20 years.

Sam-pyung, a farming village near the Onsan industrial complex, is a contrast to Kuro in its demographic and social characteristics. The community manifests the largest share of aged population, the highest masculinity ratio, the lowest marital rate for men and the least mobility of resident population, among the survey communities. In Sam-pyung, outmigration is dominant over inmigration, and the outmigration has been concentrated among girls in early marrigeable ages. The patterns of age and sex compositions in the remaining villages, that is, Tong-jom, Myung-ji and Tosan, are somewhat in the middle of these two extremes. Roughly, however, Tosan reveals demographic characteristics closer to Kuro, while Myung-ji bears more resemblance to Sam-pyung.

Overall, the base-line survey results suggest that the demographic composition of the study communities has been determined largely by the trends and patterns of migration of the village in question, which are known, in turn, to have been related to the type of major economic activities of the area.

2. *Household Structure*

The average size of household is smallest in Kuro (4.4) and largest in Myung-ji (5.3). The size is relatively small in Tosan and large in Tong-jom. The small household size in Kuro is mostly attributed to the extremely bad housing conditions which make it difficult to form a large or extended family, and to a relatively large proportion of single households mostly formed by single workers employed in the nearby industrial complex. On the other hand, the case of Tosan is largely explained by the prevalence of nuclear families prompted by the traditional family formation principles of the island. As mentioned above in Section 5, nuclear family ideals have been prevalent and the solidarity of family and kinship is very weak in Jeju Island compared to the Korean peninsula. The relatively large household size in Myung-ji and Tong-jom can be accounted for by two factors ; that is the dominance of family-type inmigration and a relatively large proportion of non-relative household members. Tong-jom has a significant proportion of families of mining workers who have moved in recently and Myung-ji has attracted families with a large number of workers

Table II-1 : **Age and sex composition of the resident population** (%)

Community :	Kuro	Tong-jom	Myung-ji	Sam-pyung	Tosan	Total
A. No. of residents						
	720	640	526	671	722	3,279
B. Age						
0-4	8.3	10.3	8.6	4.2	9.3	8.1
5-9	10.5	13.3	9.5	7.3	11.6	10.5
10-14	13.2	11.3	12.4	9.3	16.4	12.6
15-19	10.9	10.9	13.7	14.7	14.8	13.0
20-24	12.6	10.1	12.4	12.1	7.6	10.9
25-29	9.2	7.1	5.9	8.7	6.2	7.5
30-34	7.4	5.6	5.5	4.5	3.5	5.3
35-39	5.3	6.3	4.2	3.0	7.3	5.3
40-44	6.3	6.4	5.9	5.1	5.5	5.9
45-49	5.2	5.8	5.9	7.2	7.3	6.3
50-54	3.4	2.9	4.0	5.7	3.0	3.8
55-59	2.8	3.1	3.8	5.4	2.1	3.4
60-64	2.5	2.7	3.8	3.1	1.7	2.7
65-69	1.4	1.6	1.5	3.7	1.3	1.9
70+	0.8	2.6	2.9	5.8	2.5	2.9
C. Sex						
male	50.1	50.9	51.7	55.7	50.2	51.7
female	49.9	49.1	48.3	44.3	49.8	48.3

Table II-2 : **Migration status of the resident population** (%)

Community :	Kuro	Tong-jom	Myung-ji	Sam-pyung	Tosan	Total
(N :	720	640	526	671	722	3,279)
A. % of life-time non-movers						
	12.9	25.2	16.0	51.9	14.6	23.9
B. Length of living in the community						
less than 5 years	66.8	37.8	21.0	6.6	33.8	35.1
5-19 years	30.7	33.1	38.0	17.6	43.9	32.7
20 years+	2.5	29.1	41.0	75.7	22.3	32.2
C. Reason for movement to the community						
occupation	13.4	48.4	23.8	4.6	10.4	19.6
economic R.	39.4	10.5	6.0	52.3	1.5	20.6
better housing	21.8	20.0	34.5	6.2	38.1	25.8
kinship or hometown	2.1	1.1	7.1	21.5	17.8	9.2
independent living	0.7	4.2	17.9	4.6	17.9	9.0
displacement	10.6	9.5	4.8	-	3.0	6.2
others	12.0	6.3	5.9	10.8	11.2	9.6

because it is advantageous for green-house farming in the area. These migration factors

are again associated with the relatively higher proportions of unrelated household members in these communities.

Table II-3 : **Household composition of research communities** (%)

Community :	Kuro	Tong-jom	Myung-ji	Sam-pyung	Tosan	Total
A. No. of households						
	164	129	101	139	157	690
B. Average No. of household members						
	4.39	4.96	5.21	4.83	4.60	4.75
C. Relation to head of the household						
head & spouse	40.4	35.9	35.9	35.5	38.6	37.4
children, grand children	53.3	51.6	58.0	54.1	58.2	55.0
parents, grand gandparents	1.5	3.4	3.4	4.2	1.4	2.7
siblings	1.9	4.1	0.6	1.3	0.6	1.7
in-law members	1.4	3.9	1.9	4.2	0.8	2.4
others	1.4	1.1	0.2	0.7	0.4	0.8

3. *Education and Employment*

The highest average level of educational attainment of men is observed in Tosan, while that of women is in Kuro. On the other hand, the lowest level is seen in Sam-pyung for men and in Tong-jom for women. The discrepancy between men and women in the average level of educational attainment is most noticeable in Tong-jom and least in Kuro.

The proportion of employed persons among the economically active population ranges 60 to 75 per cent in the case of men. The level of employment of men is observed to be similar among Kuro, Tong-jom and Myung-ji. The lowest level is seen in Sam-pyung due largely to the high proportion of aged population in the village. The level of employment of women varies greatly from one community to another. In Myung-ji and Tosan, the proportion of women in labour force is recorded as 77 and 73 per cent respectively, whereas it is only 17 per cent in Sam-pyung. In Tong-jom and Kuro, the corresponding figures are recorded as 33 and 40 per cent each. Such a big gender discrepancy in labour force participation between the study communities can be explained mostly by the major patterns of economy and the normative stipulation of women's economic role in each community. In the case of Tosan, women are traditionally responsible for the household economy to a substantive degree. In Myung-ji, green-house farming is labour intensive and requires incessant intensive care of the products, which in turn results in a very high rate of women's labour force participation. Women's employment or work participation is, however, discouraged in traditional Korean agriculture and this appears to be the main reason for the low level of women's labour force participation in Sam-pyung.

Along with the sex patterns in employment, the major type of economic activity also differs greatly from one research community to another. In Kuro, more than half of the economically active men and women are employed as labourers. The next dominant is sales and related occupations. Women show more concentration in these two categories (93%). One third of the male labour force consists of mining workers in Tong-jom, while labourers

and farmers constitute the major occupational categories for men. In the case of employed women, more than half engage in farming, and the majority of the remainder are employed in nearby city and town areas and mining companies as sales and clerical workers. There is no basic difference in the type of occupation between men and women in Myung-ji, where most work in farming, and in Tosan, where fishing and farming constitute the major occupational categories. In Sam-pyung, the majority of male workers are farmers. As well, there are some manual and skilled labourers. In the case of women about 30 per cent are employed inUlsan and Onsan as clerical workers.

Table II-4 : **Marital status, educational level and occupational status of the resident population**

(%)

Community :	Kuro		Tong-jom		Myung-ji		Sam-pyung		Tosan	
	M	F	M	F	M	F	M	F	M	F
A. Current marital status(for the aged 15-49)										
single	44.8	41.6	41.8	25.2	52.1	43.7	66.2	38.4	41.5	35.6
married	54.1	52.8	58.2	70.3	47.3	55.6	31.9	58.3	58.0	60.6
widowed	0.5	4.2	-	4.5	-	0.7	0.9	3.3	-	3.3
divorced	-	0.5	-	-	0.7	-	0.5	-	0.5	0.6
separated	0.5	0.9	-	-	-	-	0.5	-	-	-
total(N)	194	214	170	155	146	135	216	151	188	180
B. Level of educational attainment(for the aged 15-64)										
primary	19.5	33.8	22.8	45.1	17.2	32.1	16.5	16.5	15.8	34.0
secondary	29.4	27.8	25.4	23.1	21.3	21.4	17.6	16.5	25.0	19.7
high	43.4	32.9	43.5	18.7	46.2	26.8	42.0	24.2	49.0	28.1
junior college	2.7	1.7	3.6	0.5	3.6	0.6	1.6	0.5	1.0	-
college or univ.	4.5	1.7	1.0	-	7.7	4.2	10.2	2.6	9.2	4.4
none	0.5	2.1	3.6	12.6	4.1	14.9	12.2	39.7	-	13.8
total(N)	221	237	193	182	169	168	255	194	196	203
C. % employed(for the aged 15-64)										
	72.4	39.7	74.1	33.0	74.6	77.4	60.0	16.5	67.3	72.9
D. Occupational status(for the aged 15-64)										
professionals & managers	2.5	-	5.5	-	4.8	-	4.0	-	5.0	-
clerical workers	7.5	19.1	4.8	10.0	2.4	4.6	7.2	28.1	1.5	6.1
sales W.	16.9	10.6	4.8	15.9	4.0	6.9	1.3	3.1	0.8	2.7
farmers & fishermen	-	-	19.3	55.0	77.0	71.5	64.1	50.0	87.9	84.5
mining W.	-	-	33.1	3.3	-	-	-	-	-	-
transportation W	7.5	-	8.3	-	1.6	1.5	2.0	-	2.3	-
skilled labourers	41.9	36.2	13.1	-	7.1	12.3	18.3	12.5	3.0	4.1
unskilled L.	16.9	26.6	3.4	6.7	1.6	0.8	2.0	6.3	-	2.7
service W.	6.3	7.4	6.9	8.3	0.8	1.5	1.3	-	0.8	-
others	0.6	-	0.7	1.7	0.8	0.8	-	-	0.8	-
total(N)	160	94	145	60	126	130	153	32	132	148

4. *Life Style*

Except for Sam-pyung, the most important mass communication medium in the study

communities is television. In Sam-pyung, more persons are exposed to radio than television and less than 10 per cent of the residents read newspapers regularly.

An individualistic orientation is dominant in Kuro, a metropolitan shanty area, as exemplified by the total lack of the residents' participation in community work. In Tong-jom, cooperative community activities exist only among the native population. In all other study communities, the traditional type of cooperation dominates in everyday living, important social events and various economic activities.

Housing conditions are very poor in Kuro as mentioned earlier. The number of rooms used by a household is 1.45 and three persons live in a room on average. On top of that the average size of a room is very small averaging about 6.5 square metres. In the other four communities, most households use two or three rooms and two persons occupy one room on average.

Table II-7 : **Life style indicators of research communities** (%)

Community :	Kuro	Tong-jom	Myung-ji	Sam-pyung	Tosan	Total
(N :	164	129	101	139	157	690)
A. Average No. of rooms currenty in use						
	70.1	71.4	88.1	94.7	87.3	81.8
B. % of the respondents contacting the following mass media regularly						
reading newspaper everyday						
	34.8	30.6	31.3	7.8	25.4	26.1
listening to the radio everyday						
	51.2	41.1	36.3	57.0	63.1	51.1
watching T.V. everyday						
	96.3	86.4	91.3	25.2	87.0	77.7
subscribing magazines						
	2.5	7.3	6.7	0.8	5.5	4.3
C. % of the households raising the following animals						
dog	0.6	27.1	29.7	35.3	15.3	20.1
cat	—	9.3	8.9	19.3	—	7.0
pig	—	6.2	8.9	25.9	53.5	19.9
cow	—	19.4	19.8	51.1	7.6	18.6
chicken	—	16.3	5.0	25.9	7.0	10.6
others	—	7.8	9.9	4.3	18.5	8.0
none	99.4	57.4	49.5	22.3	35.0	54.1
C. % of the households participated in the following cooperative works of the community						
house building	—	16.3	31.7	3.6	29.3	15.1
road repairing construction	—	15.5	72.3	72.7	73.2	44.8
farming	—	27.1	40.6	5.0	66.2	28.6
products selling	—	10.1	3.0	—	15.9	5.9
mobilized labour	0.6	6.2	5.9	—	1.9	2.6
others	—	—	—	24.5	—	4.9
none	99.4	51.2	5.0	2.9	1.9	34.9

Table II-5 : **Household income and ownership of various objects** (%)

Community :	Kuro	Tong-jom	Myung-ji	Sam-pyung	Tosan	Total
(N :	164	129	101	139	157	690)
A. Household income during the last one year(in 1000 won)						
500 or less	1.3	11.7	4.3	5.6	8.7	6.2
500-1000	3.3	12.6	5.4	5.6	13.3	8.1
1000-2000	22.5	17.1	14.1	15.3	19.3	18.2
2000-3000	23.8	21.6	14.1	16.1	17.3	18.9
3000-5000	36.4	24.3	27.2	23.4	23.3	27.2
5000-10000	12.6	9.0	33.7	30.6	14.7	19.1
10000	-	3.6	1.1	3.2	3.3	2.2
B. % of the households owned living quaters						
	70.1	71.4	88.1	94.7	87.3	81.8
C. % ownership of the following items						
radio	70.7	75.8	70.3	76.1	77.8	74.3
bicycle	5.0	39.1	90.1	46.4	3.3	32.1
colour T.V. set	29.0	28.1	28.7	24.1	43.1	31.0
electric rice cooker	63.4	82.0	87.1	92.8	75.3	79.0
sewing machine	13.4	62.5	79.2	76.8	64.3	56.5
refrigerator	73.8	39.1	71.3	72.7	43.8	60.0
telephone	42.7	20.3	60.4	54.7	39.2	42.8
motorcycle	-	4.7	55.4	21.2	19.6	17.7
tractor, power tiller or rice transplanter						
	-	4.7	56.4	42.5	56.2	30.4

Table II-6 : **Ownership of land** (%)

Community :	Kuro	Tong-jom	Myung-ji	Sam-pyung	Tosan	Total
(N :	164	129	101	139	157	690)
A. Size of paddy field owned						
none	100.0	93.0	44.6	15.2	100.0	73.9
1500 pyung or less	-	6.2	45.7	27.6	-	12.9
more than 1500 pyung	-	0.8	9.8	47.2	-	13.2
B. Size of upland farm land owned						
none	100.0	71.1	35.0	28.3	63.5	62.4
900 pyung or less	-	10.1	22.0	57.2	3.2	17.3
more than 900 pyung	-	18.8	43.0	14.5	33.3	20.3
C. Size of orchard land owned						
none	100.0	99.2	93.1	81.9	30.6	79.4
3000 pyung or less	-	-	6.9	16.7	47.1	15.1
more than 3000 pyung	-	0.8	-	1.4	22.3	5.5

Chapter III

WATER SUPPLY SYSTEMS

A. National Overview

In Korea, the national policy to provide safe water to all people began to be pursued in the early 1960 s with the initiation of the first national economic development plan. Since then, the adoption of safe water supply systems, represented mostly by piped water provided by municipal governments (called *city water* in the following) and simple piped water mostly installed in rural villages, has progressed rapidly. Economic growth and overall modernization of the country since 1960 would be regarded as the major force for this change.

In urban areas, the government water supply projects have been concentrated in the expansion of city water supply system and the substantial increase in the capacity of city water supply. As a result, the proportion of households depending on city water has grown rapidly, the per capita daily use of piped water has considerably increased, and the use of piped water has been greatly diversified. In view of the rapid urban population growth since 1960, the achievement should have been highly distinguished. According to the 1960 population and housing census, the households using in-house piped water accounted for only 13.6% in all the urban areas of the country, while those relying on public stand-pipes accounted for 29.7%. In sum, 42.3% of urban households used safe city water in 1960. The equivalent figures for Seoul were 23.8%, 38.8% and 62.6% (NBOS b). By 1980, the proportion of housing units equipped with city water supply system grew to 83.1% in all urban areas (NBOS c) and to 92.7% in Seoul (see Table III-1). It further rose to 96.6% in Seoul in 1984 (City of Seoul, 1984). The per capita daily supply of city water was reported to have increased from 206 to 374 litres between 1960 and 1984 in the case of Seoul.

In rural areas, the construction of simple piped systems commenced in 1967 as a pilot project to enable villagers to have easy access to safe water and to solve the chronic problem of seasonal water shortage experienced by most villages (Kim D-M, 1979 : 15-16). Based on the project experience, the government adopted in 1972 a policy to expand various simple piped systems to rural villages all over the country. The policy coincided with the initiation of *Saemaul Undong* (New Village Movement) in 1970 which became the major force in the modernization of rural Korea through the active participation of villagers.

The start of Saemaul Undong itself was a big boost to the new water supply system installation project since it could mobilize support from both the central government and the community. The Saemaul Undong contributed to the water supply system project in still another way. The introduction of various technical innovations and environmental changes brought by the movement are known to have often broken down the overall community system and interruped behavioural balance in everyday living. Such problems were also observed in the water supply system and water use behaviour. For example, road widening, the construction of new sewage disposal systems, and the increasing use of chemical fertilizers, detergents and pesticides often resulted in the pollution of the traditional water sources, mostly shallow wells and springs. Disruptions occurred frequently in the traditional sanitary and water handling behaviour with environmental changes and the

Table III-1 : **Trends of city water supply for the whole country and Seoul,** 1955-83

Year	Capacity of supply (1000 t/ day)	Total population (in 1000)	Population covered (in 1000)	% covered to total population	Per capita daily supply (in l)
A. For the whole country *					
1955	270	21,526	3,475	16.0	71
1960	517	24,954	4,210	16.8	99
1965	750	28,317	6,000	21.1	106
1970	2,160	31,435	10,430	33.1	158
1975	3,842	34,709	14,761	43.1	216
1980	6,756	37,449	20,809	54.6	256
1983	8,386	39,951	24,728	61.9	273
B. For Seoul					
1955	-	1,574	1,014	64.0	-
1960	297	2,445	1,462	60.0	206
1965	530	3,470	2,557	73.0	165
1970	980	5,536	4,737	85.6	171
1975	1,870	6,889	6,140	89.1	290
1980	3,070	8,336	7,756	92.7	339
1983	3,670	9,204	8,857	96.2	360

* : Total population indicates the national population.
Source : NBOS, Korea Statistical Yearbook, various years.

introduction of new sanitary measures in the 1970 s. (This topic is fully discussed in Chapter VI.) Along with these side effects of rural development, serious concerns for water quality emerged in many rural villages. Consequently, the installation programme of simple piped water supply systems progressed in rural Korea successfully and swiftly during the 1970 s, as illustrated by Table III-2. There were only 568 simple piped water supply systems contructed by 1971, and the number increased to 18,010 benefiting about 40% of rural population by 1978. The figures rose to 3,378 systems and 63% in 1985 (MOSHA, 1979 & 1986).

Table III-2 : **Cumulative status of simple piped water supply system installation in rural Korea,** 1967-84

(numbers in 1000)

Year	Population of villages with 20+ households (A)	Target areas		Installed areas		Coverage	
		No. of villages (B)	Popula- tion (C)	No. of villages (D)	Popula- tion (D)	% of E to C	% 0f E to A
1967-71		21,205		568			
1975	14,354 *	33,895	11,079	4,552	3,376	30.5	23.5
1980	13,800	32,624	9,502	28,130	7,780	81.9	56.4
1984	11,436	39,302	11,436	33,707	8,792	76.9	76.9

*indicates the total rural population.
Sources : MOSHA, Yearbook of Public Health and Social Statistics, various years ;
MOIA, Ten Years of Saemaul Undong (Data), 1980.

The simple piped water supply system is supposed to be maintained by a village committee organized by guidelines prepared by the central government. The system is, however, known to have been maintained very poorly. The main reasons for this include little knowledge among rural people of the health implications of water supply, no trained manpower for system management in the village, long distances (usually half day distance by bus) between service shops and the village, difficulties in raising necessary maintenance costs due to a small number of households covered by each system, and lack of government supervision or interest (see Chapter V−G).

With this brief review of background information, let us now describe the development of water supply systems in the survey communities.

B. Kuro

1. *Overall Background*

As mentioned in the previous chapter, the Kuro residential area was created in the early 1960 s by the Seoul city government as a relocation site for the people removed from slums and squatter settlements downtown. During 1961–63, 1,200 public housing units, 1,100 simple houses and 2,352 relief houses were constructed in the area and public wells were provided by the government to supply potable water. The introduction of the city water supply system started in 1965 with the installing of public stand-pipes.

The public wells were shallow and simple operating manually. Each of them were used by 30−60 households at the beginning. Soon, a rapid population increase due to the large influx of the urban poor and rural migrants into the area caused a serious shortage of potable water. At the same time, the quality of well water was deteriorating seriously due mainly to improper drainage systems installed in the area and the lack of management of the wells. As a consequence, the public wells were ceased to function as suppliers of drinking water after two or three years of construction and the wells completely abandoned seven or eight years later.

As an alternative, the city government began to introduce a city water supply system in 1965, by installing stand-pipes in public places for communal use. Private pipe lines were allowed on request, but few houses had private lines because the costs involved were too high for most residents to bear. The installing costs of private lines were about 20−25 thousand won in 1966 which was eqivalent to the price of one relief housing unit in the area.

The introduction of public stand-pipes brought about an entirely new kind of problem. Both the amount and hours of water supply were totally controlled by the city government, and the residents were forced to behave accordingly. The amount of water supplied was rarely sufficient even for drinking and cooking, and the hours during which water was available were hardly convenient. The stand-pipes were in operation from late evening to early morning, thus forming a long queue of people with water fetching buckets. Late comers often had to wait in vain and housewives frequenly kept vigil all night or sleep half awake in order not to miss their turn. *The situation was like a war*, recalled many long time residents.

There naturally developed a search for new and more convenient sources of water. During the mid 1960 s through the early 1970 s, well-pumps were disseminated to relatively well-to-do households. The first type was a hand-pump called *mak* (crude or simple) pump, which refers to a manual pump pushed 8 to 10 metres deep into a ground well constructed by a wide cement pipe. In the research area, it is believed that there was a

hand-pump for every 15−20 housing units. Before long, *mak* pumps began to show many serious problems. Water dried up quickly and became polluted easily by drained water because water sources were shallow and the pumps were constructed without any sanitary considerations.

2. ***Emerging Systems***

In the mid 1970 s, hand-pumps were replaced by a small scale pressurized simple piped water supply system. In order to find safer water, a pipe was drilled about 20 to 30 metres into the ground and water for domestic use was drawn by a small electric motor. Although the dissemination of simple piped systems was a response to overall shortages of potable water and serious pollution of water supplied from public wells and hand-pumps, the most direct impetus to this was the availability of small electric motors in large quantity for a reasonable price beginning in the late 1960 s. Despite the increasing demand for simple piped systems, however, its dissemination was very slow at the earlier stages because the costs of installing a simple system were very high for the residents to bear which was about three times those for hand-pump installation.

It is interesting to note in the Kuro area that a neighbourhood of 6−8 households was organized to get a simple piped system installed for their exclusive use. They shared all the costs involved in its construction, use and maintenance. Through this common operation, they developed a closely knit interaction network for everyday living. This particular kind of neighbourhood group later played an important role in introducing the city water supply system to private housing quaters. As mentioned above, some well-to-do families installed private city water lines in the mid 1960 s, but the dissemination of the private lines was very limited until the mid 1970 s due largely to its very high installation expenses.

Meanwhile, serious questions were increasingly raised regarding the safety of simple piped water. As in the case of wells and hand-pumps, the quality of piped water was deteriorating (though the judgement was subjective) and the sources (deep wells) were gradually drying up, which was, in turn, accounted for by the rapid population growth and the consequent deterioration of the living environment. In addition, frequent mechanical breakdowns of simple piped systems caused its users various kinds of troubles. Without any other alternatives, people turned their eyes to city water.

To alleviate the burden of the installation costs of a city water supply system, the residents bent the regulations by using the neighbourhood networks developed in the use of simple piped water supply systems. According to the regulations, only individuals could apply for city water pipelines to private houses, but people here initiated the installation of private lines as small groups of three or four households. The application was filed by a representative of the group, thus officially installing a pipeline to that household only. Then, other neighbouring households illegally put their own lines by simply connecting them to the legal line. All the costs were equally shared by the households involved. By doing this, each involved individual household could bring down the installation cost to about one third or one fourth of the original one. Problems resulting from this, such as regular payment of the water bill, which is only charged to the household with legal ownership, and expense allocation incurred by various water works, are dealt with based on conventional measures developed in the operation of simple piped systems. The administrative authorities are aware of such illegal practices, but they do rarely report them in consideration of prevailing poverty in the area.

Currently, all households except five use private water taps in the kitchen, whether the

source is city water or well-piped water. As shown in Tables III−3 and 4, the city water system is dominant, covering about two thirds of the households surveyed. The remaining one third still use simple piped water. Only two households use both systems.

Table III−3 : **Water sources in use** (%)

Community :	Kuro	Tong−jom	Myung−ji	Sam−pyung	Tosan	Total
No. of households	164	129	101	139	157	690
A. No. of sources in use per household	1.01	1.46	2.10	1.81	1.73	1.58
B. No. of households using each source						
water source in use						
city water	105					105
in−house	102					102
outside	3					3
simple piped W.	61	119	98	126	155	559
in−house	59	107	97	118	137	518
outside	2	12	1	8	18	41
well water	−	21	1	122	−	144
shallow	−	9	1	29	−	39
deep	−	9	−	42	−	51
spring	−	3	−	51	−	54
under ground W.	−	17	51	1	93	162
pump	−	17	51	1	−	169
	−	−	−	−	93	93
others	−	31	62	1	−	69
rain	−	1	−	−	9	10
creek	−	30	2	−	13	45
paddle	−	−	−	−	1	1
water tunnel	−	−	60	1	2	63
C. % of households using each source						
city water	64.0	−	−	−	−	15.2
simple piped W.	37.2	92.2	97.0	90.6	98.7	81.0
well water	−	16.3	1.0	87.8	−	20.9
underground water	−	13.2	50.5	0.7	59.2	23.5
others	−	24.0	61.4	0.7	15.9	17.2

C. Tong-jom

1. *Old Sources*

The source of drinking water changed in most of Tong-jom in 1975 with the construction of a dam to treat white lead muck discharged from a nearby zinc mining factory located at a mountain valley in the upper part of the village. Previously the source of potable water varied in accordance with the geographical location of housing units, as summarized below :

Table III−4 a : **Water sources by use, Kuro** (%)

Source :	City W.	Simple P.W	Well	Underground	others
No. of cases	105	61			
A. Seasons of use					
all seasons	99.0%	100.0%			
N.R	1.0	−			
B. Distance of the source					
less than 100 m	97.1	95.1			
100 m−500 m	1.9	4.9			
N.R	1.0	−			
C. Whether used for drinking					
Yes	100.0	98.4			
No	−	1.6			
D. For cooking					
Yes	99.0	98.4			
No	1.0	1.6			
E. For bathing					
Yes	99.0	95.1			
No	1.0	4.9			
F. For cloth washing					
Yes	98.1	95.1			
No	1.9	4.9			

Table III−4 b : **Status of satisfaction with sources in use, Kuro** (%)

Source :	City W.	Simple P.W	Well	Underground	others
No. of cases	105	61			
A. Status of satisfaction with the source					
satisfied	48.6	16.4			
dissatisfied	9.5	27.9			
partly satisfied–partly dissatified	6.7	36.1			
D.K	35.2	19.6			
B. Reason for satisfaction with the source					
colour	55.2	49.2			
taste	55.2	26.2			
smell	53.3	47.5			
quantity	−	8.2			
coolness	−	1.6			
others	−	−			
C. Reason for dissatisfaction with source					
colour	1.0	−			
taste	−	49.2			
smell	1.0	3.3			
relations with others	1.9	1.6			
quantity	7.6	−			
contamination	3.8	14.8			
no good for cloth washing	−.	4.9			

a. *Brook Water* : A mountain brook which originates from a lime cave at nothernmost part of the village, called *Mul-naeng-i-gol* (water giving valley). People residing near the brook drank its water because of its excellent taste.
b. *Spring Wells* : Slightly more than 10 households which were in far from the brook and mostly located at the foot of the mountain were well users.
c. *Mountain Spring* : Three households near a highway drank water from a mountain spring because a nearby river was polluted with coal debris and the nearest well was approximately 500 metres away.
d. *Water Running from a Lime Cave* : Water running from a lime cave under the highway was used as potable water by a group of households in *Kumuso maul* located by the cave. The water is cool in summer and warm in winter and therefore is also known to have been adequate for drinking.
e. *Pumps* : The 4 th and 5 th *Pan* (the lowest village administrative unit) area was established after the 1972 flooding of the Hwang-ji River with people evacuated from a village near the stream. The residents here set up two pumps to obtain drinking water.

2. ***Changes in Water Source***

The brook, the major source of potable water in the past, was suddenly polluted with the construction of the white lead muck treatment dam since the polluted water in the dam was released into the brook. Even the water treatment facilities installed by the mining company could hardly save the brook water. Upon severe protests from the villagers, the company set up a simple piped system in 1975 using water running from a small lime cave in *Mul-naeng-i-gol* as its source. The system covers all the households in the village except those using water from mountain springs and wells mentioned in *b* and *c* above.

Also, a significant portion of the households with the piped system still rely on other supplementary sources such as wells and pumps. The major reasons for this include the shortage of water supplied through the piped system and the occasional detection of white sediments and impurities in the piped water particularly during the rainy season. Except in the rainy season, water supply through the simple piped system is rarely sufficient in the down-village which is located at the end of the system, although the water management behaviour of individuals is partially responsible for this, as discussed in Chapter V-C. Concern for the pollution of piped water is shared by all residents despite the repeated assuarance of its safety by the local government authorities. The following are the supplementary potable water sources currently used in the village :

a. *Mountain Springs* : Two areas in the village have mountain springs as the source of drinkable water. The first is the one described in *c* above. Three houses use a spring as the sole source of potable water in this case. The amount of water is reported to be sufficient except in the dry season. During the dry season (March through June), the households obtain water from a well located in the nearby 7 th Pan. A rubber hose is used to get the spring water into a small cement container built in the middle of the three households. If necessary, the hose can be streched to these houses.

Another family in the 8 th Pan drinks water from a mountain spring which, the family believes, originates from a high mountain, called *Yon-wha*, and accordingly has good quality. Although the simple piped system was installed in the house, the family is reluctant to use the water as they suspect that the water is polluted due to the proximity between the source of piped water and the lead muck treatment dam (about 500 metre

distance).

b. *Wells* : The area in which people drink water from spring wells is identical with that described in *b* above. In the area, only one house is equipped with the simple piped water system, although it is rarely used for drinking because of suspicion of pollution. In the case of four houses located by the highway —, the installation of the piped system was evaluated as not feasible. The other households were opposed to the installation because they were asked to bear the costs of installation unlike the households living in the up-village who drank brook water previously.

c. *Pumps* : In the houses which had hand-pumps before the introduction of the simple piped system, people still use the pumps as a supplementary source of potable water. The piped system was installed in these houses, but water supplied through the system is rarely sufficient for everyday living, sometimes even for drinking and cooking in the dry season. When piped water runs out, people here drink pumping water after boiling, because the latter is suspected of being polluted by water exhaust from the Tae-back city night-soil treatment plant located in the middle of the village.

3. *Simple Piped Water Supply System*

As mentioned above, a lead mining company constructed a muck treatment dam in 1975 in a mountain valley about 500 meters away from the village. The dam is located on a much higher level than the village, and therefore, the waste water from the dam flows into the brook running across the village. Although the company built a purifier, severe chemical pollution of the brook is still apparent. For example, white foams can be seen here and there, fish have disappeared completely, and the ground under the brook turned black. Upon protest of the residents, the company set up a simple piped water supply system for the village in 1975.

Water coming from a small lime cave in *Mul-naeng-i-gol* at a mountain slope, which is at the most upper part of the village, was used as the source of water for the system. Adopting a gravity system, an iron pipe was simply connected to the source and a water reserve tank was built in the middle of the village. Consequently, two areas are distinguished regarding the water supplied by the system ; that is, the upper area between the source and the tank and the down area below the tank. Water is supplied directly from the source through the pipe in the upper area, while the tank acts as an intervening reservoir in the down village. However, the quality of water is not expected to differ much since no sanitary treatment is given to water in the tank. The total number of households affected by the system reached 119 out of 129, as illustrated in Table III-5. The houses in which the simple piped system is installed have mostly two water taps ; a tap in the kitchen and a stand-pipe in the front yard.

D. Myung-ji

There are two simple piped water supply systems in Myung-ji. The first was adopted in *Nae-dong* (inner-village) in 1973 and the second was installed in *Oe-dong* (outer -village) two years later. Previously, three public wells constituted the major sources of potable water. Among them, two were said to supply good quality water, whereas the third was said to contain too much *iron*. The most serious problem with the wells was, however, the insufficient supply of water. Water was rarely sufficient even for everyday use and accordingly water fetching became the major work of women in the village. A

Table III−5 a : **Water source by use, Tong−jom**

(%)

Source :	City W.	Simple P.W	Well	Underground	Others
No. of cases	–	119	21	17	31
A. Seasons of use					
all	–	95.8	76.2	100.0	80.6
summer	–	4.2	14.3	–	19.4
winter	–	–	9.5	–	–
B. Distance from the house					
less than 100 m	–	95.8	71.4	94.1	87.1
100 m−500 m	–	2.5	28.6	5.9	9.7
500 m or more	–	1.7	–	–	–
N.R	–	–	–	–	3.2
C. Whether used for drinking					
Yes	–	95.8	100.0	70.6	16.1
No	–	4.2	–	29.4	80.6
N.R	–	–	–	–	3.2
D. For cooking					
Yes	–	95.8	81.0	52.9	19.4
No	–	4.2	19.0	47.1	80.6
E. For bathing					
Yes	–	93.3	47.6	47.1	58.1
No	–	6.7	52.4	52.9	41.9
F. For cloth washing					
Yes	–	90.8	57.1	64.7	83.9
No	–	9.2	42.9	35.3	16.1

housewife spoke of having come to a well 15 to 20 times a day.

These problems were partially solved with the introduction of simple piped water supply systems. In *Nae-dong*, dissatisfaction with well water was intense because of a severe ferrous smell. (This may be considered one of the major categories of judging water quality in traditional societies as suggested by Cambrowicz, 1984 : 96). The residents desperately searched for new good water sources and dug new wells one after another without much success. In the process, severe conflicts developed among the residents. To uproot all the troubles at once, they finally adopted an idea of installing a simple piped water supply system. Although the idea was approved at a village meeting, most households were reluctant to participate in the project at the beginning for they questioned the possibility of finding a good quality water source. Without any other choice, the project was pushed by five leading households on an individual basis. After the discovery of a new good quality under-ground water source, all residents began to participate in the project.

Since the water source is found 18 metres under the ground, a pressurized system was adopted : An iron pipe was sunk into the source and an electric motor of 0.5 horse power was connected to the pipe to pump up and distribute the water to each household. The costs of installing water supplying pipes from the pumping place to each house were borne by individual households. A total of 44 households in *Nae-dong* are now covered by this new system. Two years later, *Oe-dong* followed the encouraged by the success of *Nae-dong*.

Table III−5 b : **Status of satisfaction with sources in use, Tong−jom** (%)

Source :	City W.	Simple P.W	Well	Underground	Others
No. of cases	−	119	21	17	31
A. Status of satisfaction with the source					
satisfied	−	7.6	4.8	29.4	9.7
dissatisfied	−	11.8	9.5	17.6	9.7
partly satisfied-partly dissatisfied	−	78.2	85.7	41.2	51.6
D.K	−	2.4	−	11.6	29.0
B. Reason for satisfaction with the source(multiple response)					
colour	−	4.2	27.3	−	3.2
taste	−	38.1	72.7	41.2	9.7
smell	−	0.8	−	−	−
quantity	−	1.7	4.5	−	16.1
coolness	−	25.4	40.9	23.5	22.6
others	−				
C. Reason for dissatisfaction with the source(multiple response)					
colour	−	21.2	4.5	−	6.5
taste	−	13.6	9.1	−	3.2
smell	−	10.2	4.5	5.9	9.7
relations with other users	−	0.8	9.1	5.9	−
quantity	−	5.9	13.6	5.9	3.2
contamination	−	50.0	13.6	11.8	3.2
no good for cloth washing	−	12.7	18.2	−	12.9

Although the entire village is now dependent upon the simple piped water supply systems to obtain potable water, the amount of water supplied by the systems to each house differs greatly in terms of a house's geographical location. In higher areas or areas farther from the sources, the water supply is rarely sufficient. This is known to have partly caused by uncontrolled use of water by people in more favourably located areas. It is readily observed in the village that a stand-pipe, which is usually located in the front yard, is running even when it is not being used (see Chapter V−D).

In the case of the system being out of order, the villagers drink water from individual pumps after boiling. There are many individually owned manual and electric water pumps in the village used in green house farming. The sources of water are believed to be the Nak-dong River, which is notorious for severe chemical pollution as well as biological contamination.

E. Sam-pyung

Before the introduction of simple piped water supply systems in the early 1980 s, wells were the sole source of potable water in Sam-pyung. Although simple pipes are now installed in more than 90% of the houses, wells still play an equally important function along with the piped systems in providing water for drinking and cooking. There were

Table III−6 a : **Water source by use, Myung−Ji** (%)

Source :	City W.	Simple P.W	Well	Underground	Others
No. of cases	−	98	1	51	62
A. Seasons of use					
all	−	99.0	*	94.1	3.2
summer	−	1.0	−	5.9	95.2
N.R	−	−	−	−	−
B. Distance from the house					
less than 100 m	−	100.0	*	9.8	54.8
100 m−500 m	−	−	−	82.4	38.8
500 m or more	−	−	−	5.9	3.2
N.R	−	−	−	1.9	3.2
C. Whether used for drinking					
Yes	−	100.0	*	21.6	−
No	−	−	−	78.4	100.0
D. For cooking					
Yes	−	100.0	*	5.9	−
No	−	−	−	94.1	100.0
E. For bathing					
Yes	−	99.0	*	27.5	51.6
No	−	1.0	−	72.5	48.4
F. For cloth washing					
Yes	−	98.0	*	9.8	82.3
No	−	2.0	−	90.2	17.7

three public wells and 24 private wells in the village at the time of the fieldwork. Of the two types of wells, the private ones are considered to be a more adequate supplier of potable water, since these are much deeper than the public wells. After the installation of piped water supply systems, the public wells were used only for laundry, dish washing and bathing.

In Sam-pyung, the construction of simple piped systems was initiated in the early 1980 s as a Saemaul Undong project which was then partially supported by the government. In view of the topography of the village, three separate systems were installed : The natural flow system (or the gravity system) was adopted in the *Chong-kog* area, while the elevated storage system and the pressurized system were employed in the *Chong-dong* and *Sang -hae/Nae-hae* areas respectively. In Chong-kog, a water reservoir was constructed at a mountain valley which was then connected by iron pipes to a storage tank in the village and then to individual house taps. In Chong-dong, a tubular well was constructed three metres under the rice-paddy ground as the source of water. The water is supplied directly from the source to individual houses by motor pressure. The third system, which was adopted in the *Sang-hae/Nae-hae* area, selected one of the pre-existing wells as the source of water. The water is designed to be elevated to a reserve tank located at an upper part of the area by a motor pump and to flow naturally from the tank to each house.

Table III−6 b : **Status of satisfaction with sources in use, Myung−ji**

(%)

Source :	City W.	Simple P.W	Well	Underground	Others
No. of cases	−	98	1	51	62
A. Status of satisfaction with the source					
satisfied	−	86.7	−	29.4	9.7
dissatisfied	−	−	−	5.9	25.8
partly satisfied–partly dissatisfied	−	8.2	*	21.6	33.9
D.K	−	5.1	−	43.1	30.6
B. Reason for satisfaction with the source (multiple response)					
colour	−	92.9	*	39.2	8.1
taste	−	90.8	−	23.5	3.2
smell	−	90.8	*	33.3	21.0
quantity	−	1.0	−	−	−
coolness	−	−	−	−	−
others	−				
C. Reason for dissatisfaction with the source					
colour	−	2.0	−	17.6	54.8
taste	−	4.1	−	21.6	17.7
smell	−	4.1	*	19.6	30.6
relations with other users	−	−	−	−	−
quantity	−	−	−	−	−
contamination	−	1.0	−	2.0	1.6
no good for cloth washing	−	−	−	−	−

Even after the installation of simple piped systems, private wells have been used as the major source of potable water in Sam-pyung. This persistent reliance on well water is mostly due to the fact that the villagers are suspicious of the safety of the piped water sources as discussed in Chapter V−E. The proportion of population drinking simple piped water in each subarea is presented in Table III−8.

F. Tosan

There are three types of water sources available in Tosan ; surface water, shallow underground water and deep underground water. Surface water consists of stream and rain water. Before the construction of a simple piped system, raindrops falling from the eaves were collected into a fixed cement water container, and this was often used as potable water. On the contrary, stream water was almost exclusively used for the bathing of children and laundry.

Spring (or fountain) wells were the major source of drinkable water in Tosan in the past. Spring wells here are of two types : The first, called *pongchon-su*, consists of wells in mountain areas and the second type, called *yong-su*, covers those areas located by the sea shore. The latter is, however, reported to have been very inconvenient to use because of their relatively long distance from the village (about 150−300 metres) and their

Table III−7 a : **Water source by use, Sam−pyung**

(%)

Source :	City W.	Simple P.W	Well	Underground	Others
No. of cases	−	126	122	1	1
A. Seasons of use					
all	−	97.3	91.8	*	−
summer	−	7.1	4.9	−	*
winter	−	0.8	−	−	−
N.R, other	−	0.8	3.3	−	−
B. Distance from the house					
less than 100 m	−	97.6	89.3	*	*
100 m−500 m	−	−	4.1	*	−
500 m or more	−	−	−	−	−
N.R	−	2.4	6.6	−	−
C. Whether used for drinking					
Yes	−	71.7	89.3	*	*
No	−	27.6	9.8	−	−
N.R	−	0.8	0.8	−	−
D. For cooking					
Yes	−	71.7	89.3	*	−
No	−	28.3	10.7	−	*
E. For bathing					
Yes	−	65.4	72.1	*	−
No	−	34.6	27.9	−	*
F. For cloth washing					
Yes	−	59.1	73.0	*	−
No	−	40.9	27.0	−	*

unusability when the tide is high. The mountain wells became depleted significantly after the development of a piped water supply system using deep underground water as its source in 1974.

The search for deep ground water was initiated by the Jeju local government in the late 1960 s to solve the problem of chronic shortages of water, particularly during the non-rainy season. In connection with this project, a simple piped system was newly introduced to Tosan in 1974. A big reservoir was constructed at the top of Tosan mountain to store water which is elevated from 50 meters under the ground (or −23.89 ML). The average daily water supply of the reservoir is recorded to be 1,416 cubic meters which supplies 270 households including those in a neighbouring village.

Of the total of 157 households, 155 have the simple piped water supply system in the study community and all of them but one use piped water for drinking and cooking. Usually, each house has a stand-pipe in the front yard next to the kitchen. Since kitchens are so tiny in the area, only a few houses have water taps in the kitchen.

Table III−7 b : **Status of satisfaction with sources in use, Sam−pyung**

(%)

Source :	City W.	Simple P.W	Well	Underground	Others
No. of cases	−	126	122	1	1
A. Status of satisfaction with the source					
satisfied	−	65.1	83.6	*	*
dissatisfied	−	−	−	−	−
partly satisfied-partly dissatisfied	−	−	0.8	−	−
D.K	−	34.9	15.6	−	−
B. Reason for satisfaction with the source					
colour	−	4.7	4.6	−	−
taste	−	42.5	74.6	*	−
smell	−	0.8	1.6	−	−
quantity	−	−	−	−	−
coolness	−	−	0.8	−	−
others	−	−	−	−	−
C. Reason for dissatisfaction with the source					
colour	−	−	−	−	−
taste	−	−	−	−	−
smell	−	−	0.8	−	−
relations with other users	−	−	0.8	−	−
quantity	−	−	−	−	−
contamination	−	−	0.8	−	−
no good for cloth washing	−	−	−	−	−

Table III−8 : **Number of households by type of water source used, sub areas in Sam−pyung**

	Chong−kok	Chong−dong	Sang−hoe/Nae−hoe	Total
Type of simpe piped supply system	gravity system	pressurized system	elevated system	
% using piped water	7	11	12	30
% using well water	11	16	24	51
% using both sources	6	9	42	57
Total	24	36	78	138

Table III−9 a : **Water source by use, Tosan** (%)

Source :	City W.	Simple P.W	Well	Underground	Others
No. of cases	−	155	−	93	25
A. Seasons of use					
all	−	94.2	−	11.8	48.0
summer	−	5.8	−	86.0	52.0
winter	−	−	−	1.1	−
N.R., other	−	−	−	1.1	−
B. Distance from the house					
less than 100 m	−	98.1	−	27.9	80.0
100 m−500 m	−	0.6	−	66.7	16.0
500 m or more	−	−	−	3.2	4.0
N.R	−	1.3	−	2.2	−
C. Whether used for drinking					
Yes	−	98.1	−	−	12.0
No	−	1.3	−	100.0	88.0
N.R	−	0.6	−	−	−
D. For cooking					
Yes	−	100.0	−	−	12.0
No	−	−	−	100.0	88.0
E. For bathing					
Yes	−	98.7	−	92.5	72.0
No	−	1.3	−	7.5	28.0
F. For cloth washing					
Yes	−	96.8	−	69.9	92.0
No	−	3.2	−	30.1	8.0

Table III−9 b : **Status of satisfaction with sources in use, Tosan** (%)

Source :	City W.	Simple P.W	Well	Underground	Others
No. of cases	−	155	−	93	25
A. Status of satisfaction with the source					
satisfied	−	53.5	−	32.3	56.0
dissatisfied	−	5.2	−	−	−
partly satisfied-partly dissatisfied	−	22.6	−	1.1	8.0
D.K	−	18.7	−	66.6	36.0
B. Reason for satisfaction with the source(multiple response)					
colour	−	−	−	−	−
taste	−	28.7	−	−	−
smell	−	−	−	−	−
quantity	−	1.3	−	−	−
coolness	−	1.3	−	8.7	4.2
C. Reason for dissatisfaction with the source					
colour	−	0.6	−	1.1	4.2
taste	−	3.2	−	1.1	4.2
smell	−	18.5	−	1.1	−
relations with other users	−	−	−	1.1	4.2
quantity	−	5.1	−	−	−
contamination	−	0.6	−	−	−
no good for cloth washing	−	0.6	−	−	−

ChapterIV

EXAMINATION OF WATER QUALITY

A. Sampling Framework

To determine the safety of drinking water in each study community, we have conducted a series of micro-biological examinations on water samples for a one year period from April 1985 through March 1986 with an average interval of one month. The sample sites were selected in early September 1984 by the laboratory research team while the base-line survey was undertaken. Testing of water samples started, however, six months later due to the delayed arrival of testing equipment.

Since all the study communities are equipped with simple piped water supply systems, one or more water sources for simple piped systems were taken as the sample sites in each community. Except in Kuro, where two thirds of the housholds use city water, water running from a kitchen water tap was sampled for the quality examination in each study community. Public wells were selected as sample sites in Tong-jom, Samp-pyung and Myung-ji. In Tosan, the water storage tank built on the mountain as a component of the piped water supply system and a water container kept in a kitchen were sampled additionally. The latter was added particularly because almost every household in Tosan still uses a big water jar to reserve potable water. In Kuro, there are about 10 small scale private simple piped water supply systems and the distance between the source and in-house taps connected to the source is fairly short. Therefore, we decided to select three simple piped water sources there excluding in-house water taps from the sample. Also excluded is the city water supply system for its quality is known to be strictly controlled by the Seoul city government. The sampling framework of each study community is summarized below.

	Source	Reserve tank	In-house tap	Water Jar
Kuro	3 simple piped systems			
Tong-jom	1 simple piped system		1 tap	
	1 communal well			
Myung-ji	1 simple piped system		1 tap	
	1 communal pump			
Sam-pyung	1 simple piped system		1 tap	
	1 communal well			
Tosan	1 simple piped system	1 tank	1 tap	1 jar

B. Environmental Conditions of the Sampling Sites

1. ***Kuro***

Three simple piped water sources which had been used as wells previously were chosen for the water quality test. Each of the sources was constructed with a small piece of cement -made pipeline of about one metre in diametre. All three sources were drilled in about 30 metres. Among them, one (Source C) is located 20 metres away from a public lavatory.

2. ***Tong-jom***

There is only one simple piped water source in Tong-jom which has the following characteristics.

- The source is located on the lower part of a mountain slope.
- It is a spring gushing up in a copious stream.
- It is opened and not protected from exogenous contamination.
- A laundry place is located about 2 metres away from the source.
- A zinc mine is located about 4 kilometres from the source.
- The spring water is supplied without any chemical treatment.

Another set of water samples is collected from a tap about one kilo metre from the above water source which is connected to the source by a steel pipeline.

The third sample site is a public well located at the middle of a mountain slope. It is a natural spring gushing up in copious volume. Through a PVC pipeline, the water is supplied to neighbouring houses.

3. ***Myung-ji***

Of the two simple piped water sources, one located in the middle of green house farming area, which is manured occasionally, was selected for the testing of drinking water quality in Myung-ji. The water is pumped by an electric motor from a well drilled about 30 metres under the ground. About one kilometre away from the source, there is the Nak-dong River which is notorious for heavy chemical pollution.

An in-house water tap which is about 300 metres from the above water source and connected to the source by a steel pipeline was chosen for the second sample site. The third set of water samples was drawn from a communal pump which uses a manual air compressor. It is about 50 metres away from the green-house farming area.

4. ***Sam-pyung***

Among the three sources of simple piped water supply systems in the village, the one in Chong-kok was selected to be a sample site. Surface water coming from a neighbouring mountain is the source. A water reservoir was constructed in a valley of the mountain to collect the surface water and the samples were drawn from the reservoir. The reservoir is open and accordingly can not be assured of being protected properly from various external contaminants including harmful industrial discharge from the Onsan industrial complex.

The second set of water samples was taken from an in-house water tap about 100 metres away from a concrete water tank built as an intermediate storage tank for the source water. A communal well in Chong-kok was chosen as the third sample site. The top of the well was not covered to protect the water from external contamination despite its undesirable environmental sanitary location. It is located only two or three metres away from a sewage dump and a paddy field.

5. ***Tosan***

The source of simple piped water supply systems in Tosan is water elevated from about 50 metres under the ground by using an electric motor pump. The water is pumped up through a well-drilled hole into a rock layer. The source is about 10 metres away from an underground stream and two to three metres from farm land.

A water storage tank was built on top of a hill where the simple piped water source is located. The concrete tank, which consists of one of our sample sites in Tosan, is exposed to the air. An in-house water tap, still another sample site, is two kilometres from the water tank and the tap water is supplied through a steel pipeline. The last sets of samples were collected from a water jar (storing container) put in the kitchen of a house occupied by Mr Koh's family. Most households use such a jar and people often drink water from the jar in this study community.

C. Experimentation Procedures

Microbiological examination was undertaken by using the Millipore-Laboratory system for both the general counts of bacteria and coliform groups. Test procedures are summarized below.

Step 1. The sample was removed from the plastic bag and the date, type and location of each sample were written down on the case with an indelible marker.

Step 2. Sample liquid (or dilution) was poured into the sample case, filling it upto the upper (18 me) graduation.

Step 3. The sampler paddle was inserted firmly and quickly, following the guidlines, into the case with a buffer, and the unit was laid horizontally onto a flat surface with the membrane facing down. The unit was not agitated after being placed down, and it was checked whether the membrane was uniformly wetted.

Step 4. The paddle was removed and, with a firm snap of the wrist, the excess liquid was shaken off. The case was emptied and the paddle was reinserted. To prevent it from drying out during incubation, the paddle was seated firmly in the case to get an airtight seal.

Step 5. The sampler was incubated, grided side down, suing the time and temperature. (Coli-Counter Samplers : 35 C + 1 C, 22−24 hrs. Total Count Sampler : 28 C−35 C, 48−72 hrs.)

Step 6. After the incubation, appropriate colonies were counted, by using an illuminate magnifier.

Step 7. The colonies that grow on the surface of the sampler during incubation were counted as individual organisms. To obtain counts from the diluted samples, the number of colonies was multiplied on the paddle surface by the following factor.

Dillution Factor=

$$\text{Sample weight in gram} + \frac{\text{Dillution volume in ml}}{\text{Sample weight}}$$

D. Findings : Microbiological Problems

The results of water quality tests thus conducted during the one year period between April 1985 and March 1986 are presented in Tables IV−1 and IV−2. The results are summerized below.

Table IV-1 : **Quantitative General Bacterial Counts in Water Samples**

Sampling Area	Sampling Sites	No. of General Bacteria Colonies/ml											
		4	5	6	7	8	9	10	11	12	1	2	3
Kuro	1. SPWSS : A	34	10	10	25	4	9	36	25	11	12	13	35
	2. SPWSS : B	16	38	38	9	4	12	12	30	9	8	6	41
	3. SPWSS : C	39	35	35	28	1	4	21	34	25	7	9	27
Tong-jom	1. SPWSS	29	15	15	22	20	25	18	10	29	25	15	17
	2. In-house tap	40	20	28	24	21	36	31	16	32	31	17	25
	3. Communal well	20	41	15	13	3	9	10	14	19	35	13	27
Myung-ji	1. SPWSS	64	20	25	15	11	18	36	18	12	44	13	17
	2. In-house tap	70	45	30	530	14	32	50	24	31	30	40	36
	3. Communal pump	29	50	20	2	27	18	41	23	26	58	21	31
Sam-pyung	1. SPWSS	68	35	80	248	1520	130	72	44	52	32	25	31
	2. In-house tap	95	57	95	224	1530	172	95	65	61	58	47	63
	3. Communal well	26	31	40	75	1760	155	32	22	28	12	23	27
Tosan	1. SPWSS	2	10	10	4	0	0	36	15	28	9	4	11
	2. Water tank	7	35	4	4	0	15	48	22	42	32	20	30
	3. In-house tap	13	45	20	4	0	12	70	38	36	50	31	42
	4. Water jar	166	80	14	105	112	211	321	411	118	238	103	114

SPWSS stands for simple piped water supply source.

Table IV-2 : **Quantitative Determination of Coliform Group in Water Samples**

Sampling Area	Sampling Sites	No. of General Bacteria Colonies/ml											
		4	5	6	7	8	9	10	11	12	1	2	3
Kuro	1. SPWSS : A	0	0	0	0	0	0	0	0	0	0	0	0
	2. SPWSS : B	0	0	0	0	0	0	0	0	0	0	0	0
	3. SPWSS : C	0	0	0	0	0	0	0	0	0	0	0	0
Tong-jom	1. SPWSS	0	0	0	0	0	0	0	0	0	0	0	0
	2. In-house tap	0	0	0	0	0	0	0	0	0	0	0	0
	3. Communal well	0	0	0	0	0	0	0	0	0	0	0	0
Myung-ji	1. SPWSS	100	0	0	0	0	0	0	0	0	0	0	0
	2. In-house tap	100	0	0	0	0	0	0	0	0	0	0	0
	3. Communal pump	0	0	0	0	0	0	0	33	0	0	0	0
Sam-pyung	1. SPWSS	300	0	0	0	0	0	0	0	0	0	0	0
	2. In-house tap	300	0	0	0	0	33	0	0	0	0	0	0
	3. Communal well	100	0	0	0	0	0	0	0	0	0	0	0
Tosan	1. SPWSS	0	0	0	0	0	0	0	0	0	0	0	0
	2. Water tank	0	0	0	0	0	0	0	0	0	0	0	0
	3. In-house tap	0	0	0	0	0	0	0	0	0	0	0	0
	4. Water jar	300	54	130	150	250	100	66	50	100	0	33	67

SPWSS stands for simple piped water supply source.

1. ***Kuro***

No bacteriological problem was observed with the three simple piped water sources.

2. ***Tong-jom***

The simple piped water source is located far from the central residential area. This might have contributed to the negative results or the results within the acceptable limit in both the coliform group and the general bacteria screenings. But there still exists a possibility of external contamination of the source because of its poor construction and management. In this regard, toxic chemicals would be considered to be a more important pollution factor than hygienic bacteria in this case, since a large reservoir of wastes being produced in zinc separation process is located about 500 metres distant from the source, as discussed in Chapter VI-B in more detail. The sample communal well, which is well protected from external contamination factors, showed no microbiological problems at all.

3. ***Myung-ji***

The location of the simple piped water source is far from being ideal, and it suggests the villagers' poor knowledge of water hygiene. Nevertheless, most water samples are found to have been negative in the coliform group screening and free from bacterial contamination. The exceptions are the samples collected in April from both the simple piped water source and the in-house water tap connected to the source in the case of coliform group testing and the July sample of the in-house water tap in the general bacterial counting. Such an unexpected result would be explained by well timed chlorination. The samples from the communal well are not observed to have been contaminated by hygienic bacteria. But one should not exclude its contamination possibilities with various harmful chemicals coming from the adjacent paddy field.

4. ***Sam-pyung***

The water sampled from a simple piped supply system in the village is surface water flowing down the mountain. As the water source is totally exposed to external contamination, it is an indisputable necessity to treat water properly before it is supplied for domestic use. The water quality test results clearly confirmed the necessity of proper water treatment or of changing the water source. According to the general counts of bacteria, the level of contamination was well above the acceptable limit in summer and early fall. Chlorination of the source should be initiated, or done more frequently if done regularly in the past, although most samples showed negative signs in the screening of coliform groups. Coliform group contamination was observed only in water samples collected in April regardless of their source. The reason is not clear and it is not known whether the pattern is typical or not. Anyway, it is obvious that little precaution was taken in the selection of simple piped water supply sources and that their management was rarely sufficient. This would reflect the ignorance of the villagers on matters of water sanitation. Old rusted pipelines might be an additional cause of the deterioration of simple piped water quality in the village. Similar patterns were observed with samples from a communal well, except that the level of contamination of the communal well is slightly lower than that of the simple piped system.

5. ***Tosan***

The simple piped water supply system of the village did not indicate any special problem of hygenic bacteriological contamination. The water source is in a proper location which appears to be highly instrumental in protecting it from being bacteriologically contaminated. But the water storage tank on a hill is not considered properly constructed

to avoid pollution.

On the contrary, the water from a kitchen jar is found to have been contaminated with a coliform group throughout the entire one year of water quality testing, as revealed in Tables IV−1 and IV−2. The only exception is for January. The negative result observed in January may be associated with the custom of year-end total house cleaning in Jeju Island to get prepared for the new year's blessing. The result suggests that such a traditional habit of the villagers to store water in a container for long periods and to drink it occasionally may be a serious health hazard causing water borne diseases.

The counts of general bacteria also showed that most water samples, except those from Mr Koh's kitchen jar, were safe to drink. The samples collected in July and August manifested the least contamination unlike what was expected considering the weather condition of this season which is charaterized by high temperature and high humidity. This unlikely observation may indicate more frequent chlorination in summer than in other seasons.

E. Mineral Content of Water Samples

In all survey communities but Tosan, many people were concerned more about the chemical and mineral contamination of water due to the heavy use of chemical fertilizers and pesticides in farming and industrial discharge, than the biological contamination of the water. In this light, we have additionally examined the mineral content of water samples from all study communities except Kuro. For this, Inductively Coupled Plasma (5500 B Perkin-ELMER) was used. Test results are presented in Table IV−3.

A relatively high content of physiologically active elements, Ca and Mg, was found in the water samples from the simple piped water source in Myung-ji. No unusally significant content was observed in water samples from other areas. Unlike what is expected from the claim of the villagers, the Zn content in the Tong-jom samples was not particularly higher than those found in other community samples. In a word, it is very difficult to argue, based on the current test results, that the mineral contamination is an important health hazard in the study communities.

Table Ⅳ-3 : **Mineral Contents in Water Samples**

(Unit : ppm)

Sampling Area	Sampling Sites	Al	Ba	Ca	Co	Cu	Fe	La	Mg	Mn	Pb	Pd	So	Si	Sn	St	Zn
Tongjom	1. SPWSS	0.04 ±0.01	0.01 ±0.01	22.47 ±0.479	–	0.04 ±0.001	–	–	1.23 ±0.043	–	–	0.04 ±0.004	0.10 ±0.004	3.00 ±0.02	0.11 ±0.02	0.02 ±0.002	–
	2. In-house tap	–	0.01 ±0.001	21.36 ±0.337	–	–	–	–	1.22 ±0.015	–	–	–	–	3.33 ±0.128	–	0.02 ±0.004	–
	3. Communal well	–	0.01 ±0.002	27.46 ±0.205	–	–	–	–	1.03 ±0.01	–	–	0.05 ±0.003	–	2.81 ±0.035	–	0.03 ±0.002	–
Myungji	1. SPWSS	0.06 ±0.02	0.35 ±0.005	35.01 ±2.437	–	0.01 ±0.013	–	–	11.15 ±0.379	0.02 ±0.001	–	0.04 ±0.002	–	12.58 ±0.163	–	0.23 ±0.003	
	2. In-house tap	–	0.35 ±0.003	38.78 ±4.275	–	0.04 ±0.029	–	–	8.46 ±5.96	0.02 ±0.001	–	0.07 ±0.003	–	3.08 ±0.267	–	0.23 ±0.001	
	3. Communal pump	–	0.36 ±0.007	55.43 ±1.549	–	–	–	–	24.59 ±0.661	–	–	0.02 ±0.004	–	2.88 ±0.065	0.76 ±0.183	0.34 ±0.001	–
Sampyung	1. SPWSS	0.02 ±0.01	–	10.10 ±0.041	–	0.01 ±0.002	–	–	3.47 ±0.005	–	–	–	–	18.47 ±0.039	0.85 ±0.169	0.02 ±0.002	–
	2. In-house tap	–	0.01 ±0.001	10.37 ±0.004	0.01 ±0.001	0.03 ±0.004	0.01 ±0.007	–	4.16 ±0.028	–	–	0.02 ±0.001	–	13.72 ±0.148	0.72 ±0.07	0.05 ±0.002	–
	3. Communal well	0.11 ±0.02	0.02 ±0.001	15.10 ±0.398	–	–	–	–	5.20 ±0.034	–	–	0.01 ±0.004	–	17.72 ±0.324	–	0.12 ±0.001	–
Tosan	1. SPWSS	–	0.04 ±0.001	15.90 ±0.121	–	0.02 ±0.001	–	–	4.41 ±0.103	–	–	0.01 ±0.009	–	16.98 ±0.171	0.66 ±0.605	0.02 ±0.004	–
	2. Water tank	–	0.03 ±0.002	15.73 ±0.321	–	0.02 ±0.001	–	–	3.74 ±0.125	–	–	0.01 ±0.004	–	14.73 ±0.143	0.32 ±0.042	0.04 ±0.001	–
	3. In house tap	–	0.04 ±0.005	16.35 ±0.416	–	0.02 ±0.003	0.01 ±0.001	–	3.68 ±0.130	0.01 ±0.001	–	0.02 ±0.006	–	3.78 ±0.018	–	0.08 ±0.001	–
	4. Water jar	–	0.05 ±0.02	12.99 ±0.086	–	–	0.02 ±0.007	–	3.22 ±0.040	–	–	0.03 ±0.006	–	3.57 ±0.264	0.24 ±0.024	0.08 ±0.001	–

SPWSS stands for simple piped water supply source.

Chapter V

WATER USE AND MANAGEMENT

A. Traditional Patterns

In the above, it is clear that the traditional sources of potable water in the study communities were either community wells or brooks. These are believed to have been the most dominant sources of drinking water throughout the country in the past. The typical folkways of handling water in traditional Korea should have largely stemmed from this simple fact. Another important factor in appraising the water use behaviour would be the traditional pattern of sex segregation, or sexual division of labour, in the family.

In traditional Korea, gender was the most critical determinant of one's life world. Between men and women, or between husbands and wives, completely different life worlds were prescribed by both custom and law. Following Confucian teachings (more specifically the Chushi's teachings), men's world was confined to the outer-family world, while the in-family world constitutes the women's domain. In other words, family affairs and works were supposed to be in the hands of women, whereas community affairs and occupational activities were areas in which women should not intervene. Parallel to this, strict sex segregation was imposed in everyday living. Mixing of men and women, or boys and girls, was allowed neither in work nor in play. These gender role principles were also applied to the pattern of water use and water handling behaviours : All the water handling in the house was the responsibility of women as observed in other cultures (e.g., Elmendorf & Isely, 1983 : 200), while water use for agriculture was the sole concern of men.

To fetch potable water from, and to do laundry at, wells and brooks, meant for a woman to meet other women casually. In other words, wells and brooks were the most common informal meeting place of women in traditional Korea. Generational selection was also often observed in the use of water sources if there were several wells and brooks.

Although some well-off households had private wells inside the house, the dependence on wells, public or private, and brooks should have necessiated the use of big water containers in the kitchen for cooking and other immediate uses. Since a kitchen was considered a place exclusively for women and it was regarded as disgraceful for a man to enter the kitchen, water serving became a women's duty in traditional Korea. For instance, if a man felt thirsty, he would not go to the kitchen or to a water tap by himself, rather would ask his wife, the mother or a daughter, or a sister to bring water to him. For night use, however, a water kettle or a water pot was commonly placed in the room.

There were two types of drinking water provided in the Korean family. After and during each meal, *sung-nyung* was served. *Sung-nyung* is water warmed in the *bab* (steamed rice) pot made of iron or nickle silver after the cooked bab is taken out. Elderly people were often served with *sung-nyung* only. Besides this, water from a water pot or container in the kitchen was habitually taken without any treatment. Tea was rarely served as an alternate in traditional Korea.

The introduction of simple piped water supply systems in rural Korea has changed little this general custom of drinking water. Still, potable water is handled and served by women. Water is usually stored in a water jar or container for cooking and drinking, and sometimes it is used for dish washing if the amount of supplied water is sufficient. On the

other hand, a distinctive pattern of water use has emerged with the introduction of the city water supply system in the ordinary urban family. Urban people became very reluctant to drink water directly from the tap or the container in fear of its uncleanliness. Rather they drink water after boiling. Most households prepare in the morning for drinking, a jar of so-called *barley* or *corn* tea, which is made by boiling water with roasted barley or corn grains. When water supply is insufficient or intermittent, a container is used to reserve water, but it became less frequent with the improvement of city water supply systems.

In most rural villages, there has rarely been a single water source sufficient or adequate for all purposes. Each source has its own distinctive use. Also, step-wise use of water has been widely practiced as a way to save water. Although simple piped water supply systems are installed in the majority of rural villages, its use mostly confined to drinking and cooking, and sometimes to dish washing. Laundry and baths are done with water from wells, pumps or brooks. On the other hand, there is little diversity of water source in urban areas. City water is commonly used for all purposes.

With this brief background information, let us now examine the specific water use and handling behaviour in the survey communities with a focus upon sanitary conditions.

Table V-1 : **Water drinking behaviour**

(%)

Community :	Kuro	Tong-jom	Myung-ji	Sam-pyung	Tosan	Total
No. of households						
	164	129	101	139	157	690
A. % of households which a housewife is in charge of water management and fetching.						
	95.1	94.5	82.1	94.3	94.3	92.8
B. % of the respondents who have ever taken so-called "medicine-water"(a kind of natural water).						
	19.3	9.6	6.8	0.8	9.0	9.7
C. Treatment of water before drinking						
no treatment	39.9	72.7	67.3	69.8	87.8	67.0
boiling water	60.1	26.6	32.7	28.8	11.5	32.5
warming water	—	0.8	—	1.4	0.6	0.6
D. % of households taking potable water directly from the source						
	95.7	62.5	93.1	81.3	35.5	72.6
E. Frequency of cleaning storage for potable water(% out of storage users)						
everyday	57.1	72.3	55.6	11.1	53.5	52.4
once a while	42.9	27.6	44.4	85.2	44.5	46.0
never	—	—	—	3.7	2.0	1.6
(No. of storage users						
	7	48	7	26	101	189)

B. Kuro

In understanding water use behaviour in Kuro, it is necessary to bear in mind the prevalent structure of the housing in the area. As mentioned earlier, the typical house in the survey community is the so-called *relief house*, which consists of one small room and a tiny space to put a *yontan* (or coal briquet) fire under the room floor. In this space, there is a water tap and most water use activities such as cooking, dish washing, laundry and

Table V−2 : **Place of water disposal by water use** (%)

Community :	Kuro	Tong−jom	Myung−ji	Sam−pyung	Tosan	Total
No. of households	164	129	101	139	157	690
A. After dish washing						
covered drainage	100.0	77.2	85.1	89.1	65.0	83.4
exposed drainage	−	8.7	7.9	2.9	1.3	3.6
others	−	14.1	7.0	8.0	33.7	13.0
B. After house cheaning						
covered drainage	100.0	78.7	85.1	91.3	51.6	81.0
exposed drainage	−	8.7	7.9	3.6	1.9	3.9
others	−	12.4	7.0	5.1	46.5	15.1
C. After bath(only for those taking a bath in the house)						
covered drainage	100.0	75.4	85.0	95.5	67.3	84.8
exposed drainage	−	10.3	8.0	1.5	1.9	3.8
others	−	14.3	7.0	3.0	30.8	11.4

Table V−3 : **Appearance and location of swampy puddles** (%)

Community :	Kuro	Tong−jom	Myung−ji	Sam−pyung	Tosan	Total
No. of households	164	129	101	139	157	690
A. Whether there are any puddles near the house	1.2	27.0	34.7	13.0	17.0	16.9
B. Seasons of appearance						
all	−	54.3	77.8	91.7	38.1	60.8
summer only	50.0	45.7	22.2	8.3	61.9	38.1
C. Location of puddles						
around drainage	100.0	38.9	54.5	40.0	52.0	47.7
toilet	−	33.3	−	−	−	6.3
creek	−	5.6	3.0	−	36.0	10.8
others	−	22.2	42.5	60.0	12.0	35.2

shower/baths are conducted. The space, which is called the kitchen here, is too small even to keep a big water pot in. Therefore, water is served directly from the pipeline whenever the need arises through a small plastic hose connected to the tap. The bottom of the space is cemented and has a drain hole.

Water directly from the tap is rarely served for drinking in Kuro, regardless whether it is city water or simple piped water. The quality of city water is widely suspected in most

parts of Seoul including the Kuro district since it often contains impure elements such as mud and iron rust. On the other hand, water from simple piped systems installed privately is commonly thought by its users as unsafe to drink because of its salty taste which is getting worse with the environmental deterioration of the community due to a rapid increase of the resident population, as stated earlier. Although the residents who are dependent upon simple piped systems question seriously the quality of water, they have rarely requested any laboratory tests of water safety. Very few cases of testing have invariably shown negative results. The same result was obtained by our tests as discussed in Chapter IV-D.1. Most people are very reluctant to accept such findings which go against their common sense appraisals of water quality, and as a result, a negative attitude toward water quality testing appears to have emerged.

It is customary in Seoul for people to drink barley tea or coffee after the meal, instead of having *sung-nyung* or untreated piped water. Those who prefer to drink *raw* (or untreated) water either use a purifier or purchase mineral water in the market. About 40% of the households in the survey community of Kuro, however, serve piped water without any treatment, and 60% after boiling mostly to make barley tea. Here, no households use water purifiers or drink mineral water available in the market because of their extreme poverty.

The residents are accustomed to water saving as exemplified by the step-wise use of water. It is very rare for a woman to dispose water after dish washing, laundry and kitchen towel washing. Instead, the used water is reused for other purposes like mop washing, kitchen towel washing and cleaning of kitchen or other open spaces. The pattern of water reuse are shown below :

1 st use		2 nd use		3 rd use
dish washing	------→	kitchen towel washing	------→	kitchen cleaning
dish washing	------→	mop washing		
kitchen towel washing	------→	mop washing		
laundry	------→	mop washing	------→	open space cleaning

C. Tong-jom

Unlike in other parts of Korea, the kitchen is located in the centre of the housing structure and has a cattle stable at one corner in Tong-jom. This peculiar structure would be due to the severe cold prevailing during the winter. Accordingly, most water work is done in the kitchen, which necessiates a big water storage or a water tap in the kitchen. With the introduction of a simple piped water supply system, there developed a new kitchen structure, while the traditional structure is still used by the houses using traditional water sources.

In a kitchen with a water tap, the most common practice is to have the tap unlocked most of the time and have water flow into the sink (or basin) continously. In some houses, there is a built-in water container made of cement. The container is put either above or beside the sink. If there is a container, a water tap is installed right above the container.

Naturally, water runs into the container first through the open top. Water is, in turn, released to the kitchen sink through a hole in front of the container or it overflows into the sink. Water in the sink, which is made of cement too, then overflows into the drain. In short, the tap water runs into a container, a sink, and a drain without interruption. The water is supplied free of charge regardless of what amount is used and this explains why the custom of unconstrained use of piped water was developed in the village. This lack of control in the up-village is known to cause a severe shortage of piped water in the down -village. In most traditional types of kitchens, there is no drain and a bucket is used to collect waste water which is later disposed in the front yard, a vegetable garden, or an outside drain.

The most common pattern of serving drinking water in Tong-jom is to take water directly from the tap or to scoop water from the container with a gourd or a bowl. Although the residents complain of black debris often floating on the piped water and are greatly concerned about the possible contamination of the water source by permeation of the lead waste dam water into the ground, they still drink water without treatment. Taking *sung-nyung* may be considered an exception, but it is known to have no anti-septic effects. In other words, the concerns of water quality are not aimed for any type of action, which may account for the lack of general knowledge on the quality and management of water. Anyway, the structure of built-in containers is such that they are difficult to clean and the sink is not washed frequently. It is often observed that there are remnants of food at the bottom of a sink, while water overflows. Since the container and the sink is located very close and the container is uncovered, it appears to be highly probable that the water in the container could be contaminated.

In the houses with a traditional water supply system, the pattern of water use for drinking and cooking is almost identical with the typical traditional pattern of Korea, as mentioned above. There is a water storage jar in the kitchen : Some are big and others are small. When a small jar is used to store potable water, it is washed whenever water is retrieved. But a big jar is washed only once in a while. Which kind of jar is used seems to depend on the season and the distance of the kitchen from the water source.

Some households use chemical disinfectants in dish washing, but the majority still wash dishes with water only. Dish washing and cooking preparation are usually done in the sink and dishes are rinsed directly with water running from the tap if the simple piped system is installed in the kitchen. After dish washing or rinsing, the water is used either to clean mops or kitchen towels. It is an irony here that there is almost no control of water use particularly in the up-village, while kitchen towels and mops are washed with used water. This clearly indicates that the villager's water use behaviour still complies with the traditional pattern which would have developed to save labour from water retrieval in the past. It is also found that sanitary considerations are virtually non-existent in water use and handling, as examplified with the way kitchen towels are treated. (the observation of kitchen towel disinfection contradicts the survey result given in Table VI-2.) Similar indifference toward sanitation is seen in food preparation, as well. Water gathered in the sink is used for cooking preparation and the cooking board is not disinfected properly. In some cases, the cooking board is not even washed after every use.

The management of the simple piped water supply system is to be carried out by a committee organized by villagers with the guidance of the government. The system, however, has been evaluated as being maintained very poorly. For example, the water reserve tank in the middle of the village has never been cleaned nor chlorinized since its

construction in 1975. The major reasons for poor maintenance include little knowledge of the health implications of water among rural people, no skilled manpower in the village to manage the system, long distances (half day by bus) between maintenance shops and the village, difficulties raising funds for maintenance expenses due to the small number of households (about 40 households) covered properly by the system, and improper supervision of the system by the local government. The National Institute of Health identified the problems in the management of simple piped water supply systems in rural Korea in 1985. The problems, which are presented below, are also applied to our study communities including Tong-jom. These are :

(1) There is overall lack of public health knowledge in relation to water supply.
(2) Skilled village man-power for the proper management of water systems is very limited.
(3) Repair-shops are usually located in an urban or township area which is located a half -day distance away on average.
(4) The average simple piped water supply system covers around 30 to 50 houses. This is posed as the main difficulty in raising enough funds for maintenance costs such as the employment of a skilled operator.
(5) The government guidance supervision are grossly lacking due mainly to limited man -power.
(6) Water safety tests are rarely conducted because of the negligence of village maintenance committees.

It is recalled by the villagers that cattle died suddenly after the construction of a lead muck treatment dam at a mountain valley about 500 metres away from the village. The cattle died of swollen liver, which was found to have been caused by drinking brook water contaminated by the water released from the dam. After the dam construction, it was observed too that crops and vegetables could not grow in the fields near the dam. The residents believe that lead muck flying from the dam kills them despite the denial of the charge by the lead mining company authorities. Severe dust flying from the dam is, however, easily confirmed during winter. A thick black dust film is noticed on top of the white snow near the dam and the thickness diminishes as the distance increases. On a windy day, the dust flies all over the village. People are also worried about the possibility that the waste water in the dam may penetrate into the ground and ultimately the water source.

The residents have paid, however, little attention to the safety of water sources in Tong-jom. Most sources are found to be exposed to easy contamination through air or due to improper management. The source of simple piped water supply is neither covered nor protected properly from water flowing in from a laundry area built just next to the source. Originally, the source and the laundry area were separated by a low cement blockade, but it has long ago been compromised, so that the laundry water can flow into the source of potable water. People in Tong-jom often complain that coal dust is found in water from wells as well as in the piped water. However, residents have not yet developed the habit of putting the cover back on top of a well after use.

D. Myung-ji

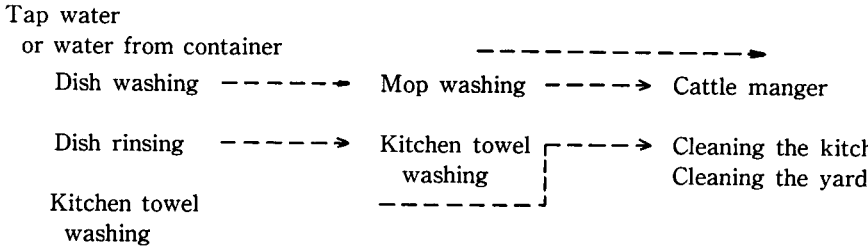
Water use behaviour in Myung-ji is very similar to that of Sam-pyung, although most

people in Myung-ji drink water supplied by simple piped systems. Most water works such as cooking, dish washing, and body cleaning are done at the stand-pipe located in the front yard. In the kitchen, there usually is a large water container which is more important in winter than in other seasons, and water work in the kitchen is often carried out with water fetched in a bucket from the stand-pipe. Water is reserved in a container even during summer for in case of emergency of electrical failures which result in the cutting off the piped water supply.

The residents mostly drink either *sung-nyung* or plain water without any treatment. Although some drink barley tea, most people say that plain water does not cause diarrhoea at all and those with *poor stomach* need to drink boiled water. The villagers think that water is safe unless it has rusty colour or ferrous taste. So, they often drink water directly from pumps if they feel thirsty while working in the green house. In the upper part of the village which suffers from a poor piped water supply, people drink rather frequently water from wells or pumps.

There is little control of water use in Nam-ji, as well. It is frequently observed that the water tap is turned on while the water is overflowing a water fetching bucket. Such behaviours may be simply accounted for by the fact people are not accustomed to the proper use of a piped water supply system. As a result, households located at the end of the system or in the upper area suffer greatly from shortages of water. This prompted the upper villagers to reject the sharing of costs involved in the operation and management of the system, which, in turn, justifies the down-villagers' unconstrained use of tap water.

Dish washing is done with a luffa and detergent is used in some well-to-do households. Except for farming, water works are almost exclusively carried out by women and girls. As in other survey communities, water is used step-wise, as illustrated below.



In conjunction with green-house farming, there are many hand or small electric pumps installed privately all over the farm fields. Since the source of the water is believed to be the bed of the Nak-dong River, which is known for severe chemical pollution, water from pumps is not frequently used for drinking. Although the main use is for green-house farming, pumps provide abundant water for various water works. In other words, people's concern for the amount and quality of water is limited to potable water in Myung-ji.

E. Sam-pyung

The traditional pattern of water use still prevails in Sam-pyung. There is a pot in the kitchen to store potable water. *Sung-nyung* is commonly served with a meal. In addition, people drink plain water, whether it is from a well or a stand-pipe in the front yard. From the management point of view, piped water is considered to be much safe to drink than

water from wells. The villagers think, however, largely based on the taste and smell, that piped water is of much inferior quality compared to water from wells. Only in the case of the households far away from the nearest well is piped water be used for drinking. It was also observed that water for drinking was retrieved from distant wells using kettles. The villagers said that many people used to drink water after boiling it as a form of barley tea, but that nowadays, people mostly drink plain water. Such a change in water drinking habit was said to have developed after watching television programmes arguing that plain and natural water contains essential minerals for health and is as sanitary as boiled water (referring to city water in the latter argument). The idea was said to have been accepted and pushed by the village leaders. The recently increasing popularity of water from wells over piped water largely coincides with this change in the perception of the quality of potable water.

The concern over the sources of piped water supply is paramount in Sam-pyung because the villagers are suspicious of the ground water near the Hoe-ya River which flows into the nearby Onsan sea. Onsan sea is a centre of national attention for its controversy over the deadly effects of industrial pollution. The sea water flows backward into the river during the high tide. The impact is clearly seen through the many dead or disfigured fish caught in the river. There are additional sources of pollution of the river, too.

At an upper stream of the river, there is a chemical detergent manufacturing plant and discharges from the factory are alleged to be released into the river. The river also receives water from a water way running across the village which is used for agriculture. The waterway is, however, very filthy and smelly, particularly during the summer.

Contamination of the water way is largely blamed on the development of pig farms in a village located at a mountain slope from which water runs into the village. The farms were small so that no sanitary control could be imposed in building pigpens and in slaughtering pigs. As a result, all the farm wastes are thrown into a mountain stream which is connected to the waterway in the village. Despite the complaints of the villagers, no sanitary improvements have so far been made.

The management of wells would have significant sanitary implications in Sam-pyung since about half of the households drink water from wells. Usually, the top of a well is very low and the water bed is high, so that people retrieve water from the well with a gourd while half sitting. The surrounding area of each well is cemented and the place is commonly used for laundry. From this structure, we can imagine how easily water in wells can be contaminated during clothes washing or other water use activities at the wells. Also, swampy areas are often found around a well because of poorly constructed drainage systems. No concern about the safety of well-water is, however, noticed in the village.

Dish washing and cooking is done either in the kitchen or at a cemented area for water work next to the water source in the front yard whether it be a stand-pipe or a well. In dish washing a vessel is used. Used dishes are put in the vessel, water is filled, and dishes are rubbed with a luffa. Detergent is often used, particularly if dishes are oily. Then, dishes are rinsed with clean water in another, or in the same, vessel. The used water is often re-used for wahsing mops and kitchen towels, for cleaning a rice cooking kettle, and for preparing cattle feed, as illustrated below :

Laundry is usually done at a spring or a well. It was said in the village that a woman would be criticized if she washed clothes with piped water because of the shortage of piped water supply. (It seems, however, that the villagers worry more about the common share of water use costs.) But the more important reason for clothes washing at a spring or a

Step-wise use of water in Sam -pyung

Dish washing	----------→		Gathered in a slop pail, then used for cattle feed preparation
Dish rinsing ------→	Washing kitchen Washing a kettle Washing hands and feet	----→	Mop washing

well is apparently that women enjoy going there to meet and chat with other women while laundering.

F. Tosan

Traditionally, water was scarce in Tosan and diverse sources of water were used for different purposes. As in other parts of the country, each household had a couple of big water containers in the kitchen, which might have been used as a device to save labour for water retrieval. Even after the installation of a piped water supply system, the use of containers has continued. People in Tosan rarely use water from the tap for drinking or cooking. Rather, they first reserve water in the container and use this water whenever the need arises. Another container is installed outside the kitchen to gather raindrops from the eaves for purposes other than drinking and cooking. People here drink alternately barley tea, plain water and *sung-nyung*.

Housewives give diverse reasons for their using water containers in the kitchen. One woman said that she uses a container because her husband does not like to drink tap water directly because it has a chlorine smell. The most important reason would be found, however, in the women's economic role and activities in the village. In Tosan, as in other rural villages in Jeju Island, many women are sea-divers and thus make a great contribution to the household economy by diving for shell fish. Accordingly, they have relatively less time to do domestic work which are again the sole responsibility of women. They used to carry spring water in a pot called *hobok* on the way home from sea-diving. The use of a water container in the kitchen work and potable water service may be thought to have had an important function as a time saving device. This would explain why the use of water containers has not waned at all even after the introduction of a piped water supply system.

Dish washing is usually done in the garden just outside the kitchen where the stand-pipe is located. Therefore, tap water is mostly used for dish washing, unlike in the other rural survey communities. This somewhat peculiar pattern can be explained by the fact that a kitchen is so tiny that it only has room for a big pot to reserve potable water and a fire place to heat *ondol* (the floor of a room made of stone and mud, or cement). No attempt to install drains in the kichen in the village can also be understood in this context. The relatively minor importance of the kitchen in Tosan and more generally on Jeju Island may be related to the fact that rain water collected in a container outside the kitchen was the major source of potable water in the past.

Dish washing behaviour in Tosan is not much different from the other study communities. All dishes are washed in a plastic vessel. After rinsing them in another vessel, dishes are put in a (bamboo) basket which is usually placed just outside the kitchen door. The

waste water is either collected in a slop pail which then goes to a container in pig sty, or disposed of in the vegetable garden nearby. Unlike in the past, the step-wise use of water is rather limited in Tosan, compared to other study communities, due most probably to a greater diversity of water sources in use.

Light laundry is done in the house either at the stand-pipe or in the bathroom, while heavy laundry is done at spring wells by the sea shore. Most houses have a bathroom but many people, mostly men and children, take baths at spring wells during the summer and on warm days following the traditional custom which was developed when there were no bathrooms in the houses. The bathroom is used more commonly by women.

G. Summary of the discussion

We have discussed above the patterns of water use behaviour in respective research communities. Let us now summarize the findings from a comparative perspective.

(1) In all survey communities, safe water supply systems were adopted during the last ten year period. City water pipelines were connected to about two-thirds of the households in Kuro, Seoul. Simple piped water supply systems were installed privately to the rest of the households. In all the rural communities, simple piped systems were installed to secure safe water. But the traditional sources of water are still in use in those villages although the degree of reliance on them differ.

(2) Except Sam-pyung, an agricultural village, piped water constitutes the major source of drinkable water. In Sam-pyung, privately owned wells are an equally important source along with simple piped systems. In Tong-jom, a mountaineous mining village, some households prefer to drink spring water from the mountain. Both in Sam-pyung and Tong-jom, the major reason for drinking water from traditional sources rather than tap water from recently installed simple piped systems is the widely held suspicion that the sources of piped water supply systems are contaminated chemically. Similar concern is apparent among the households with simple piped water supply systems in Kuro.

(3) The management of simple piped systems is rarely evaluated to be proper in all survey communities. Although the systems were mostly introduced under guidelines prepared by the government in conjunction with Saemaul Undong, there is virtually no government intervention in the management of the systems. A series of water quality tests have revealed no bacterial contamination of any kinds of piped water sources in the survey communities, but it is highly likely that the improper management of water sources and water supply systems causes contamination of water while in use in the case of simple piped systems. Anyway, people pay little attention to the safety of water sources even in the communities where the villagers are very sensitive to environmental deterioration due to industrial pollution and its possible impact on the sources of potable water.

(4) Unconstrained use of piped water poses the major problem in water supply through simple piped systems in rural communities where no elaborate system of cost allocation among users is developed yet. Water taps are left open during the daytime even though water is not used. As a result, the residents living in the distant areas from the water source tend to suffer from a shortage of water supply and have to find alternative sources

of water, that is, traditional sources. A shortage of water supply usually prompts people living distant from the piped water source to refuse the sharing of various expenses and this often justifies the unconstrained use of piped water for those living less distant.

(5) The water use behaviour of a village is largely determined by the housing and kitchen structure, the type of subsistence economy, the availability of and accessibility to water sources, and people's perception of sanitation in the village.

(6) Traditionally, each household keeps a big water storage in the kitchen and water from the container is served for drinking. The custom has more or less survived in the survey communities and is most noticeable in Tosan and Sam-pyung. According to a series of laboratory tests, water from a container is registered to have been bacteriologically contaminated in Tosan. The situation in other rural villages is not known because no such tests were conducted there. It is, however, highly likely that the water stored in the kitchen is exposed to biological contamination to a significant degree.

(7) Step-wise use of water is a common practice in all survey communities. After dish washing, water is frequently used for washing kitchen towels and mops and finally for cleaning the kitchen floor or other open space. In some villages, used water is given to animals. Such behaviour was undoutedly developed as a way to save both water and labour in retrieving water in the past. The continuation of such a practice may partly indicate that people in all survey communities have little knowledge of the sanitary implications of water use behaviour.

Chapter VI

SANITARY CONDITIONS AND BEHAVIOUR

There have been vigorous government efforts to improve the sanitary environment in rural Korea since the early 1970 s with the initiation of the national rural development movement called *Saemaul Undong*. Included among its programmes were the installation of simple piped water supply system, the replacement of old latrine type of toilets by new sanitary types of toilets, the construction of an underground drainage system, and housing improvement. The impact of the movement has been selectively felt in the research communities. As mentioned above, either city water or simple piped water supply systems were introduced into all the survey areas. The installation of new sanitary toilets has, however, progressed little. Drainage systems and housing conditions are not satisfactory from a sanitary point of view in all study communities.

It is also noticed throughout the nation that the implications of Saemeul Undong for community health and sanitation are very limited. Many communities including all our survey villages have experienced various sanitary and health problems, mostly water and air pollution, caused by external forces. This fact needs special attention in discussing the people's perceptions and behaviours regarding sanitation in the survey communities.

Table VI−1 : **Type of toilet in use and toilet behaviour** (%)

Community :	Kuro	Tong−jom	Myung−ji	Sam−pyung	Tosan	Total
No. of households	164	129	101	139	157	690
A. % of the houses equipped with private toilet	5.6	87.5	99.0	99.3	95.5	74.1
B. Types of toilet being used						
traditional latrine type without purifier	36.7	98.4	98.0	92.9	29.7	67.5
flush type with purifier	−	0.8	1.0	−	−	14.9
flush type without purifier	63.3	0.8	1.0	6.4	3.2	2.3
traditional latrine type with purifier	−	−	−	0.7	67.1	15.3
C. % of the households using night chamber pot	56.9	70.9	81.4	28.6	33.1	53.8
D. Frequency of toilet disinfection						
never	−	19.5	23.4	31.1	33.1	27.3
once a year	−	28.8	46.8	9.1	4.1	19.4
more often	100.0	51.7	29.8	59.8	62.8	53.3

A. Kuro

Housing conditions and living environment of Kuro are extremely poor. Most housing units are composed of one small room (about 6 square metres) and a small space (about 3 square metres) between the room and the gate. The total housing space is usually less

Table VI−2 : **Frequency of kitchen towel sterilization** (multiple answers)

Community :	Kuro	Tong−jom	Myung−ji	Sam−pyung	Tosan	Total
No. of households	164	129	101	139	157	690
(multiple answers possible)						
use chemicals	19.0	0.8	3.0	2.2	35.3	13.7
boil	87.1	86.2	88.9	50.4	59.0	67.4
dry in the sun	14.7	7.3	54.5	57.6	98.1	47.1
wash only	−	0.8	4.1	−	1.3	1.0
others	0.6	−	−	0.7	−	0.3

Table VI−3 : **Percentages of the respondents who have ever eathen the following food ilems in raw** (%)

Community :	Kuro	Tong−jom	Myung−ji	Sam−pyung	Tosan	Total
No. of respondents	164	129	101	139	157	690
any raw food	100.0	98.4	99.0	68.8	98.1	92.9
egg	29.4	54.7	53.5	4.3	59.2	39.4
vegetables	100.0	97.7	97.0	51.8	94.9	94.9
beef	1.2	5.5	5.9	−	17.8	6.3
chicken	−	0.8	−	−	−	0.1
pork	0.6	4.7	−	−	21.7	6.0
fish	6.1	30.5	56.4	24.5	89.8	40.8
others	−	7.0	45.5	0.7	24.2	13.7

Table VI−4 : **Seasonal taking behaviour of the respondents** (%)

Community :	Kuro	Tong−jom	Myung−ji	Sam−pyung	Tosan	Total
No. of respondents	164	129	101	139	157	690
A. % of those who take a bath at least once a week						
spring	42.9	44.5	40.4	2.2	84.6	44.2
summer	99.4	96.9	99.0	94.3	100.0	98.0
autumn	39.9	42.6	36.4	2.3	45.1	28.1
winter	34.0	26.6	28.3	2.3	45.1	28.1
B. % of those who usually use a public bath						
spring	100.0	71.0	72.9	44.9	19.5	62.6
summer	1.2	4.0	1.0	0.8	1.5	1.7
autumn	100.0	70.7	74.0	47.4	15.9	62.6
winter	100.0	75.6	97.0	55.1	54.2	76.4

than 10 square metres. As ways of expanding the housing space, some residents built one more story on top of a house, thus creating a two story building and others have invaded the road in front of the house to obtain more housing space, thus narrowing the road significantly. Such housing extensions are, of course, illegal and often very dangerous. As a result, the road became so narrow in most parts of the area that even a small car could

not get in.

Virtually every house is heated with *yontan* (a kind of coal briquet) which produces harmful, sometimes deadly, carbon monoxide gas. *Yontan* is also used for cooking in Kuro. Consequently, the area is filled with carbon monoxide gas and visitors come to feel uncomfortable or dizzy after an hour stay there. The situation is worse during winter. Also, many swampy areas which emanate foul odors develop in Kuro during the rainy season due to poor drainage system.

In the study community of Kuro, there are only nine out of 164 households living in houses equipped with private (in-house) toilets. People in other households use public toilets. There are three types of public toilets in the survey community ; that is, toilets with movable night-soil collection tanks made of plastic, flush type cement toilets with purifying container and latrine type cement toilets without purifying container. The first type of public toilets are managed by the users, while the local government is in charge of the other types of toilets. The distribution of these three types of toilets in the survey community is given below :

type	No. of toilet buildings	No. of excreta disposal sets	No. of urine disposal sets
With movable tank	6	31	9
Flush type	5	30	7
Latrine type	1	6	2

Among the three types, the flush type of toilets are the cleanest and this type of toilet building is managed by a local government employer. The manager cleans the toilet once a day and disinfects it every two or three days during the summer. Disinfection is rarely performed in winter. Yet these public toilets, although better than the other types of toilets, are still a major source of sanitary problems in the area. The toilets are surrounded by houses and accordingly, mis-management and improper use of them can easily cause serious environmental problems. The areas are often observed to be filthy with water discharged from the toilets while cleaning. Some houses suffer from a terrible toilet smell coming through underground drainage linked to the purifying container. The most annoying problem with such flush toilets is their frequent breakdowns due to the improper use of flushing system and vandalism. Once broken down, the toilet is closed down for a few days for repair, and this creates tremendous inconvenience to the users. During winter, special care is needed to keep the flushing water unfrozen.

The latrine type of public toilet is also managed by the local government and has no risk of breakdown. But the system is difficult to keep clean and sanitary. Night-soil often overflows and sometimes leaks into the ground. Smell is difficult to control with this type of toilet, since it contains night-soil in an uncovered cement tank. The tank is emptied manually once in a while and a disgusting smell travels all over the area while the soil is taken out and carried away.

The worst sanitary problems are noticed with the simple toilets with movable plastic tank. The government is only responsible for replacing the tank when it is full. All other managerial matters are relegated to the users. Despite its merit of being safe from night -soil leaking, it gives rise to many other, more serious, problems. The toilet is very tiny and very poorly ventilated. Besides, there is no lid to cover the mouth of night soil tank.

In a word, the simple plastic toilets are in extremely filthy condition.

In addition to the physical problems of public toilets, the shortage of toilet facilities poses various sanitary problems in the research community of Kuro. It is estimated that about 700 persons use 12 public toilets, and long waiting lines are seen in front of them every morning between six and eight o'clock. Therefore, people often have to urinate in the kitchen and let their children have bowel movements on a piece of newspapaer in the kitchen, in the living room or on the street and the newspapers are then disposed into a drain. In many households, a chamber pot is used at night because of the inconvenience of visiting a public toilet when it is dark.

As mentioned above, only nine houses, or 5.6% of the resident houseoulds, are equipped with private toilets (see Table VI−1). But their sanitary conditions are not much better than those of public toilets. All the toilets are of the traditional latrine type without a purifying container. Even if somebody wants to build a flush toilet in his house, it is, usually, opposed by neighbours who fear that they may suffer from toilet smell coming through the common drainage to which the purifying container is connected.

No house in the study community of Kuro has a bathroom so the residents take a bath (or a shower) either in the kitchen or in a public bath depending upon the weather. Almost everybody takes a shower in the kitchen in the summer, while virtually all residents visit public bath houses in other seasons. Because of humid weather, people take a shower or a bath frequently, at least once a week, during the summer, but during the winter, the majority take a bath once a month.

In Kuro, alkylated detergent is commnly used in washing dishes, fruits and vegetables. People clean kitchen towels with detergent mostly, and also boil frequently for disinfection. Usually in kitchen work, enough sanitary precautions are taken. Such a sanitary concern is rather inconsistent with other sanitary practices in everyday life. For instance, hands are rarely washed after visiting the toilet or before having a meal.

B. Tong-jom

It was mentioned above that the sanitary environment of Tong-jom has changed drastically during the last ten or more years since a lead muck reservoir was built near the village in 1975. More recently, the environment has been affected additionally by the construction of a night-soil treatment plant and a slaughter house in the middle of the village, both of which purport to serve the entire Tae-back city. All these three facilities appear to have grave implications for the health of the residents. The brook which runs across the village is completely contaminated and produces a bad smell. Although once the major source of portable water, it became virtually useless. On top of this, the air is believed to carry lead muck and coal dust. The sanitary conditions are worse during summer ; the smell is unbearable near the night-soil treatment plant and the slaughter house.

Originally, Tae-back city disposed night-soil collected in the city to the current plant area. A hugh pool was dug and night-soil was poured into the pool. It gave rise to many environmental problems, so the villagers presented a petition of complaint to the city government. In response to this, the government built the current plant as an alternative. The plant worked well during the first few years, but serious problems began to emerge as the amount of night-soil brought into the plant increased rapidly with the rapid population growth of the city.

The following is a list of the environmental problems allegedly caused by the plant.

(1) Roads in the village are not paved, and thus when vehicles carrying the night-soil to the plant pass the village a cloud of dust erupts. Many households near the road complain about it.

(2) People living close to the plant are tortured by a strong night-soil smell coming from the plant. The smell increases when the vehicles dispose the soil into the plant.

(3) After the construction of the plant, flies, mosquitos and insects multiplied greatly, indicating an adverse sanitary result of the plant for the village. In summer, their density increases to the point that rooms should be closed even if people feel stuffy in the room because of hot and humid weather. On the meal table, people have to fan flies away continuously while eating. The villagers filed many petitions before the city government asking for the removal of the plant or frequent disinfection. But the response has so far been negative.

(4) The plant adds pollution to the brook already contaminated by the lead muck treatment reservoir. The waste water released from the plant is said to be improperly treated. Some argue that the plant even releases night-soil without treatment at night. The evidence they produce is the yellowish colour of the water down-stream which also gives off a terrible night-soil smell.

The Tae-back city slaughter house was built in Tong-jom on February 1985. The villagers said that a good thing about the construction was that they were able to eat more meat after that. The house, however, added an additional problem to the already deteriorated sanitary environment of the village. Because proper sanitary or anti-pollution measures were not introduced in constructing the slaughter house, the waste is mostly released to the brook without proper treatment. The brook near the house often turns red through the animal blood disposed. The house smells frequently. During summer, it functions as a breeding ground for flies, mosquitos and insects.

Environmental control is very poor in still another way in Tong-jom. People are rarely concerned about sewage and cattle dung scattered or piled in front of their houses. They do not hesitate to step on them and then enter the kitchen. The drainage system is very primitive, as well. Drainage outside the kitchen is uncovered and shallow. There once was an attempt to introduce a sanitary underground drainage system in the village as a Sae-maul Undong project. A leader of the Sae-maul women's club in the village built a sanitary drainage in her house with a Presidential grant for a demonstrative effect. The drainage was, however, broken down soon and nobody from the local government came to repair it although the problem was reported. After the incident, few people in the village became to care for sanitary drainage.

As mentioned earlier, kitchen is located in the centre of the house and many activities in addition to cooking and heating are performed in or around the kitchen. For instance, face and hand washing, laundry and bathing are often done in the kitchen especially during winter. But the kitchen is very difficult to keep clean, tidy and sanitary since *yontan* (coal briquet) and wood are the common fuel here. When *yontan* is used, harmful carbon monoxide is produced, while the use of wood makes it difficult to keep the kitchen clean.

In relation to the kitchen structure, another important feature may be that a cattle stable is located either at a kitchen corner or adjacent to the kitchen. Because all the food remnants are put in a manger and cattle's dung is kept for a while in the stable, the stable is usually very dirty and smelly, and accordingly, we may assume that the sanitary condition of the kitchen is affected by this factor. For example, there is usually a cloud of flies in kitchens with a stable inside or nearby.

The kitchen is cleaned once every three or four days on the average. The kitchen floor is generally dirty because people often go through the kitchen to enter the main or other rooms. In some houses located by highways, the kitchen is heavily covered with dust. Nevertheless, people rarely close the kitchen door or clean the kitchen. Food and rice left -overs are kept in the kitchen covered by a meal cloth, and it is frequently observed in summer that a cloud of flies sit on the cloth.

All households except two still use traditional toilets in Tong-jom. There are three types of traditional toilets in the village. The first is a simple toilet which has a big latrine with a pot to store night-soil, the most common type throughout the country. The night -soil stored in the latrine is taken to a vegetable garden to be used as a fertilizer. The second type of toilet is similar to the first type, but has a small hole at the upper part of the back side of the latrine, so that the night-soil is naturally pushed out to the ground at the back of the toilet if the latrine is full. The night soil thus released is used as a fertilizer after being dried. The third type is a simplified modification of the second type. It has no latrine, and the night-soil container is made by laying stones on the ground. Foot steps are laid on top of the container and there is a hole at the back of the container from which night -soil is released outside.

Although the majority of residents say that they sterilize the toilets once in a while with insecticides used for farming, it appears that toilets are seldom sterilized. Most toilets are unsanitary and dirty. Swamps appear frequently around toilets, particularly during summer. After visiting a toilet, people rarely wash their hands. Two households constructed flush type sanitary toilets as an exemplary project of the Sae-maul Undong. But new sanitary toilets were not favourably received in the study community because no manure or fertilizer can be produced with them. A night chamber pot is widely used during winter and put either in a room or on the kitchen range (*bu-too-mak*) beside a side kitchen door linked to a room or the main floor. Urine collected in the pot is usually used to ferment grass to make fertilizer.

In many households, kitchen towels are usually cleaned with plain water or with water once used for dish rinsing or washing and boiled together with clothes once in a while. A chopping board is commonly washed in plain or used water. It is, however, often observed that the board is hung or put aside unwashed. The frequency of bathing and body washing varies seasonally to a great extent. During the summer, a shower is taken frequently in the in-house bathroom, in the kitchen or by the stand-pipe in the yard. In the winter, the villagers visit public bath houses in Tae-back city or nearby mining towns once a month on average. People here rarely wash their hands before a meal. Sewage is usually burned in the front yard or in the kitchen stove if wood is used. In the down-village, a sewage collection truck comes regularly to pick up sewage from a garbage bin placed in front of each house.

C. Myung-ji

It is widely observed in Myung-ji that the changing way of life since the early 1970 s has created various kinds of environmental problems. Unlike in Tong-jom and Sam -pyung, there is little external effect on environmental sanitation in this study community. Rather, the lagging behavioural adjustment to the newly introduced technical innovations is apparently the major cause of environmental pollution in Myung-ji.

Sewage disposal was said to be no problem in the past because there was no significant amount of sewage produced. Almost every household raised animals such as dogs, pigs, chickens and cattle, and the animals were fed with food remnants. Food remnants which were not good for animal feed was mostly thrown to a cattle stable to get mixed with cattle dung and straw to make manure. In the households not raising cattle, these were put into the toilet to make a compost. Flamable wastes were used as supplementary fuel for cooking, heating or boiling cattle feed. The ashes thus produced were thrown onto a manure pile. In other words, there was no *waste* to be disposed and accordingly no idea of *sewage disposal* developed in the traditional setting.

Sewage has increased tremendously and its treatment has changed greatly since the early 1970 s. As people became more prosperous, the remnants of food increased. At the same time, animal raising was noticeabely reduced with the introduction of green-house farming. Chickens and dogs are avoided because they often damage green-house farming by tearing down vinyl, pecking seeds and treading down plants. Pig farming is also avoided since people do not like the smell of a pig sty. Cattle raising is thought to be complementary with green-house farming because a large amount of compost can be produced through it which is essential to prevent a rapid deterioration of soil quality. The villagers believe that the best compost is a mixture of cattle dung, straw and food remnants treaded down by cattle. Some even raise cattle nowadays only to obtain compost. But cattle raising requires an extra labour force that is not tied to farming or other works for a livelihood since someone has to cut fodder for cattle feeding and pasture the cattle. Children and the elderly assumed the job in the past, but only the elderly are available for the work nowadays because children are occupied with schooling. In other words, cattle raising is only possible nowadays when there is an elderly man in the household. As a result, the number of households raising cattle has been reduced from 40 to 10 during the last 10 years and thus, a problem of disposing food remnants has emerged. People increasingly throw them away just outside the house.

Similarly, the problem of flamable sewage disposal has increased. Such sewage as papers and vinyls has increased greatly with the rising standard of living since their value as supplementary feul disappeared with the substitution of wood as the main fuel by *yontan*, oil and gas. As a consequence, sewage has accumulated, causing environmental pollution.

In order to solve this problem, a sewage dump was built in the village with government aid. The dump was, however, constructed on the periphery of the village because people living in the central area objected to having it in the middle of the village. Those residing near the structure are also against others' using the dump because they argue that they would suffer from the bad smell if sewage is piled up. In addition, the villagers think it a nuisance to travel to the dump to dispose wastes, so they throw them away at any nearby place whether it is a hill or the agricultural water tunnel. (Children play and women wash clothes in the tunnel during the summer.) It is often observed that sewage is scattered all over the village after a heavy rain or a severe wind. When asked, the majority of people

admit that such improper sewage disposal behaviour is an important cause of the environmental pollution of the village. Nevertheless, the villagers appear to mind little the sanitary implications of such behaviour and there prevails the idea that sewage will go away to somewhere by itself eventually.

Traditional toilets are still dominant, but the number of new sanitary toilets has rapidly increased recently. There were only two sanitary toilets at the base-line survey in August 1984, the number of which increased to 25 by the completion of the fieldwork in October 1985. The most important reason for this increase is thought to be the change in the economic system from subsistence agriculture based on rice and barley cultivation to a market oriented agricultural system based on green-house farming.

The typical traditional toilet is simple to construct : A hole is dug into the ground, then a big pot (or a jar) is put in the hole and two foot steps are laid on top of the pot. Night-soil collected in the pot was used as fertilizer. These types of traditional toilets are difficult to clean because no water draining structure is installed. The relatively small night-soil container makes it inevitable that night-soil must be taken out of the pot frequently, which results in the toilet area being smelly and messy.

Due to the greatly reduced use of night-soil as a fertilizer and a severe labour shortage throughout the year, newly introduced sanitary toilets became popular recently. The popularity was boosted by a government subsidy provision which provides 50% aid if the government model is adopted. Accordingly, the model, called *sam-jo-sik* (toilet with three compartments) was employed by most of the households which constructed new toilets replacing the old type. The basic structure of the model is illustrated below.

Recommended structure and suggested effects

Part	Structure	Effects
Underground	Walls be constructed between compartments with water-proof cement Should contain night-soil for at least four months	Parasites be killed due to a long duration of night-soil storing Use of night-soil as a fertilizer
Night chair (extrata & urine diposal structures)	Should be eqipped with ordinary set (improved model), set cover & releasing pipe	Reduces smell Prevents night-soil splash Removes visual rejection
Upper space	Should have a sealed gas release pipe, cleaning facilities, insect preventing nets on windows, and ventilation facilities	Smelly gas be released Prevents the penetration of insects

Theoretically, the government recommended model should not have any serious sanitary problems. But the new type of toilets have given rise to new sanitary problems becauce the government instruction to seal the compartment walls with water-proof cement was not complied with in order to save expenses. As a result, night-soil often leaks

into the ground to contaminate the area surrounding the toilet. Nevertheless, people are generally satisfied with the new type of toilets as the toilet is easy to clean, produces less smell, and requires less labour to dispose night-soil.

Night soil disposal has emerged to be a serious cause of environmental pollution in the study village. In the past, night-soil was essential for farming and all the soil was used as fertilizer. Things have changed. The amount of night-soil needed for farming decreased significantly and the problem of night-soil disposal surfaced. In Myung-ji, about half of the households take care of the soil by themselves, and the remaining half rely on a dung truck to dispose of the soil. In the former case, people usually dump the soil in open places like a paddy field or a hill. The dung truck disposes of the soil in places where the customer requests. If there is no specific request, however, the soil is dumped in any place that is convenient, thus creating severe environmental deterioration of the village.

Night-chamber pots are extensively used in Myung-ji. A pot is put in every room. The pots are emptied at the toilet or to a urine barrel placed next to the toilet. Some women clean the pots with soap, while others do not clean them at all.

When water was scarce, there was little concern about water disposal. After the introduction of a simple piped water supply system, however, the amount of water being used in each house increased tremendously and drainage came to have important implications for the environmental sanitation of the village. With the installation of a piped water system, mostly stand-pipes in the front yard, a simple water drain system was built privately inside the house, either by installing a drain pipe under the ground or by digging a water path on the ground. But there developed no village-wide drainage system, and accordingly, water disposed through in-house drainage is released to the open space outside the house thus often creating swamps which function as breading areas for flies and mosquitos.

To get rid of flies and mosquitos, insecticides are used occasionally and this is effective only temporarily. It was frequently observed that people use insecticides not for sanitary considerations, but to avoid discomfort. Fumes of barley stalk were said to have been used to drive away mosquitos, and cattle scurf was used to kill flies in the old days. Little sanitary concern of the villagers in everyday living is clearly evidenced by the observation that they wash clothes, wash hair, take a bath and swim at the water tunnel during the summer where all kinds of wastes (including rotten fruit skins, cigarett butts, insecticide bottles, dead frogs, snakes and rats, and so on) flow with the water. Paying little attention to such contamination, people say that they prefer the water because it gives a good slippery feeling and soaps disolve well in it. But the more important reason for such an extensive use of the tunnel water may be that it does not require labour to fetch and dispose water.

People take a shower mostly at the stand-pipe during the summer, if there is not enough water in the tunnel. In other seasons, they visit a public bath in Nam-ji township two or three times a month. More frequent bathing is difficult since the trip to a public bath takes about three hours including bathing hours with expenses.

Hand washing and clothes changing after dirty or unsanitary work, like manure shuffling, insecticide spreading and toileting, are seldom practiced here. Rarely, whether it is an adult or a child, washes their hands before a meal, except some high school children. Many primary school children are found not to brush their teeth at all.

D. Sam-pyung

The overall sanitary conditions of Sam-pyung have deteriorated since the development of the Onsan industrial complex started in 1974. Since that time, sanitary concerns in everyday life have been increasing gradually among the villagers along with the rising educational level of their children, greater urban experience among the villagers and ever-growing exposure to mass media. It was discovered, however, that concerns for environmental pollution overshadowed the individual sanitary concerns of the residents of Sam-pyung. There may be two reasons for this. Firstly, environmental pollution is a newly emerging phenomenon, while ordinary sanitary problems are embedded in traditional customs and culture. Secondly, environmental pollution poses an immediate threat to the villagers in terms of both health and farming, whereas the sanitary behaviour of individuals produces no immediate visible effects.

There are four external sources of environmental pollution in Sam-pyung. These are (1) toxic gas discharged by factories in the Onsan industrial complex, (2) the pollution of the Onsan sea due to the release of industrial wastes which is, in turn, believed to affect the water quality of the Hoe-ya River running in front of the village, (3) river pollution by chemical detergents discharged from a factory located up-stream on the river, and (4) the formation of small-scale pig farm industries in a nearby area. Except for the first, all other sources of pollution can be assumed to have a direct impact on the quality of various sources of water used in the village, as discussed in the previous chapter. Therefore, our discussion on the relationship between sanitation and environmental pollution here will be confined to the sanitary implications of air pollution caused by fumes from the Onsan industrial zone.

The survey village is about two kilometres away from the Onsan industrail complex and the two areas are separated by a hill. Accordingly the village is considered relatively safe from the industrial air pollution. Such was the case until 1982 when an aluminum factory raised chimneys to a level well above the hill in response to a series of strong protests from the Onsan residents. Now, the fumes from the chimneys can easily travel to the village by the aid of wind. This gas has a foul odor and is known to cause headaches, and so this prompted petitions from the affected villages requesting the central as well as local governments take appropriate measures to protect them. But no improvement has been made so far except the methods of deception by the factory with the cooperation of the local government. The villagers claim that the toxic gas is discharged in a condensed form on very foggy nights to destroy the visible evidence. However, the effect is immediately felt because the gas is condensed. The smell is unbearable though the gas is not seen and many orchard trees and grasses are often found to be dried up the next morning. The villagers say that the *Myun* (the lowest administrative apparatus) officials cut the affected trees and grasses to destroy the evidence.

Our fieldworkers had also often experienced the terrible smell and headaches in the village. They rarely stayed for more than a month at a time for fieldwork because they became sick and lost appetites during prolonged stays in the village. Neverthelss, all the pollution tests conducted by various agencies have failed to support the claims of the villagers. Even in the village, passive attitudes prevail and no effective anti-pollution drive was ever staged, partly because most young people have left the village already or are planning to leave the village soon. The older generation says frequently that they have no choice but to stay because they are too old to start a new life in a foreign place.

Such severe contamination of the air, though not proven, is believed to have another sanitary implication in relation to food preserving customs and behaviours. It is customary in Korea that the left-over *bab* (boiled rice) and side dishes are usually preserved for the next meal. Particularly, women and children eat the left-overs. Accordingly, in such an unsanitary environment, the method of preservation of left-overs would have important health implications. In Sam-pyung, *chan-bab* (left-over *bab* or cold *bab*) is usually stored in a bowl and side-dishes are mostly put on the eating table often with improper covering. The fieldworkers frequently observed that the colour of *chan-bab* changes quickly when the factory fumes are in the air. In other words, it is highly probable that people would have eaten spoiled foods frequently because of industrial air pollution. Considering the fact that all kitchen facilities are exposed to the open air, air contamination due to industrial discharges may deserve special attention in the study village.

In Sam-pyung most toilets are of the traditional latrine type and nine out of 139 houses have flush toilets without purifiers. Traditional toilets are mostly unpleasant and filthy and attract flies and insects. The toilet is, however, rarely cleaned or disinfected. A flush toilet is much cleaner, but is not satisfactory from a sanitary point of view because it releases untreated night-soil directly into the underground drainage system. Night chamber -pots are not widely used in Sam-pyung unlike in other rural areas. When used, it is put on the floor (*maru*) outside (bed) rooms.

The typical housing structure of Sam-pyung shows a straight line drawn from left to right (character one type in Chinese script). The kitchen is located at one end, most often at the east end. There are two doors in the kitchen ; one is open toward the front yard and the other faces the back yard. These doors are open most of the time except during the winter, and thus the kitchen can be readily affected by industrial waste discharged through the air. Potable water is also vulnerable since it is stored usually in a container with an open top in the kitchen.

Most kitchens in the research village are more or less of the traditional type, having a small space of two to three *pyungs* (6 to 10 square metres). As the main (living) room is heated in the kitchen with *yontan* or wood, the kitchen is usually untidy and often dirty. It is common to find many rats and flies in the kitchen. In a word, sanitary control is very difficult to impose on the traditional kitchen.

The majority of the households in Sam-pyung use two or three kinds of kitchen towels : One is used exclusively for the final dish cleaning and the others for cleaning kitchen tables, chopping boards, oily dishes and so forth. The towels are sterilized either by boiling in water or drying in the sun after being washed. But the behaviour of women regarding kitchen sanitation varies profoundly between households. Some disinfect the towels after every use and others once every two or three days. Some housewives do neither clean nor dry chopping boards after use.

Refrigerators are used in many households to preserve *kim-chi* (cabbage pickle) and underlying dishes (dishes prepared once and eaten for a prolonged period of time) during the summer. The refrigerator is popular among housewives as a labour saving device. They used to have to prepare side dishes for every meal during the summer, but this became unneccesary because foods could be kept fresh for a long time in the refrigerator. A few of problems were, however, noticed in the use of refrigerators in Sam-pyung : People rarely clean the refrigerator, they put too much food there and think that it can keep food and dishes fresh for a very long time, at least for one month in the case of underlying dishes.

Beside the personsality of household members, particularly that of the housewife, the sanitary conditions of a household appear to be determined by such factors as the degree of housewife's participation in farming, the economic situation of the household, the ages of children, the experience of urban living of children and the housewife, and family composition. Usually, the younger generation, which has a higher level of educational attainment than the former generation on the average, shows more concern for sanitation and the urban experience is positively related to sanitary concerns in everyday living. Also women have more interest in sanitation than men.

E. Tosan

Tosan is free from industrial pollution. The local government chose the broader Tosan region as a site for mass tourism and accordingly made a great deal of effort to improve its environmental conditions. The road was paved and new sanitary toilets were installed in virtually all houses with government subsidies in 1982 and 1983. A drainage system was also constructed along the main road to prevent flooding. Such government projects to improve the environment appear to have produced only visual change.

Although new sanitary toilets with three compartments were installed, the majority of households still keep and use the traditional latrine type toilets simply to raise pigs. About 100 out of 157 households raise pigs in Tosan and the method of pig farming on Jeju is most unique. Pigs are raised on night-soil in the toilet ; pigs are placed underneath toilet foot -steps to make them eat night-soil directly when discharged. In other words, the use of new sanitary toilets would mean having to give up low labour pig farming. Thus, the newly built toilets have never been used as toilets and rather turned into ordinary storage rooms in the majority of the households.

Since night-soil is consumed by pigs, the conventional toilet does not cause the problem of night-soil disposal. It is, however, known to have been associated with a serious sanitary hazard. It has been a breeding bed of flies and mosquitos which were responsible for most of the epidemic diseases that erupted in the village. The residents obtain protein from the pigs raised in the toilet, which are known to be the host of bladder (cysticercosis) worms. The newly introduced toilets have a big night-soil container with three compartments under the ground. No night-soil disposal problem has emerged with the new sanitary toilets for the containers will not be filled up in the next five years. Poor ventilation is, however, cited as one of their flaws. On the other hand, the conventional toilet is filthy and smelly. A slop pail kept in the toilet usually causes a terrible smell. People urinate mostly either beside the toilet or at a corner of the front yard. They rarely use a chamber-pot. Disinfection of conventional toilets is avoided because of pig raising.

Most households use conventional kitchens. It usually occupies a small space of eight square metres and is used mostly to heat the main room and sometimes to do cooking. It is generally equipped with a fire place with a hole on its top where an iron oven is put. Wood (or wood scrub) is used for heating. In many households, cooking is done not in the kitchen but in an open space in front of the kitchen where a stand-pipe is located. Some young educated housewives built modern kitchens eqipped with a sink and a sink range. But such a modern kitchen is avoided in Tosan largely because no proper drainage system has yet been developed. Even though there is a built-in sink, it is very inconvinient to use since it simply requires additional work to dispose waste water. In some households, a slop pail is kept to solve this problem despite its smell and sanitary problems.

As mentioned above, a full drainage system was constructed along the road by the local government as an environmental improvement project in the early 1980 s. But this system was not built to serve the village. Drains in the village are not connected to it. Water drain is not considered to be a problem here because of the extremely water absorbent characteristics of the soil, and this explains why no drainage was built in Tosan in the past. With the increasing use of water, however, a new, but simple, in-house drainage system was recently introduced. A ditch type water way of 10 to 20 metres' length is dug to drain water from the stand-pipe next to the kitchen to an artificial hole filled with stones to let water penetrate into the ground quickly. But, these drainage systems are frequently clogged with food remnants discarded after dish washing, thus creating many puddles in the house in which maggots can hatch.

In many households, a (plastic) bucket is placed just outside the kitchen to collect wastes from cooking, meals and dish washing. These wastes are then used for pig feeding. Other sewage is put in a kitchen or garden corner until it is burned or taken to the village dump.

Most houses in Tosan have a bathroom, but not everybody takes a bath in the bathroom. In some houses, it is used as laundry area, particularly during the winter and on rainy days. Many people take a shower at the stand-pipe during the summer and visit a public bath in Pyo-sun myun in other seasons. Tosan people take a bath or a shower much more frequently compared to the other study villages. In Tosan, residents wash themselves every one or two days during the summer and two or three times a month in other seasons.

As in other rural areas, housewives have little time to concern themselves with problems of sanitation because they work outside until late in the evening. If there is a middle or high school age daughter, she helps with housework such as dish washing, house cleaning, mop washing and meal preparation. In other words, the sanitary condition of a household depends greatly on the housewife's work status, type of work she is engaged in, and the availability of helping hands.

F. Summary of the Discussion

Sanitary conditions and the nature of sanitary problems vary greatly among the research communities. Environmental pollution poses a crucial hazard deteriorating the quality of life in all study communities except Tosan, an island village. Industrial pollution directly linked with the national industrial development programme appears to be very critical in Sam-pyung. Factories built in a nearby industrial complex allegedly have contaminated a river running down through the village as well as the adjacent sea. Air pollution due to harmful fumes discharged from those factories is said to have resulted in the withering of trees and grasses. A chocking smell is often present in the air. Different environmental problems caused by forces external to the community are experienced in Tong-jom. On approval of the city government of Tae-back, some pollution producing facilities were installed in or just outside the village. A lead muck treatment dam was built in the upper valley of the village. A city night-soil treatment plant and a city slaughter house were installed recently in the middle of the village. These resulted in the complete change of the community environment. The brook running across the village is seriously contaminated and the entire village, particularly the down-village, is suffering from filthy smells and dirt. There are clouds of flies, mosquitos and insects elswhere in the village

during the summer. Air pollution is amply evident during the winter by the falling of lead muck and coal dust on the snow. The effects of the night-soil treatment
plant and the slaughter house are easily identified by smell and the colour of the brook water.

Toilet, sewage disposal and drainage are the most dominant factors affecting sanitary conditions in Kuro, Myung-ji and Tosan. In Kuro, a metropolitan squatter area, most people use public toilets, which are very difficult to manage and to keep clean. Public toilets are very filthy, though some are better than others, and often give rise to swamps around them. Many underground drainage systems are connected to the night-soil treatment tanks of public toilets, and thus function as a mechanism to spread toilet smells all over the village. In addition, the region suffers greatly from air contamination due to the almost exclusive use of *yontan* for heating and cooking which discharges harmful carbon monoxide. The air contamination due to *yontan*, which was one of the major causes of death in the area until the early 1970 s, is particularly severe during the winter.

On the other hand, in Myung-ji, the environment has deteriorated mainly through the disruption of the ecosystem. The introduction of market oriented green-house farming has altered the entire economic situation of the village. Labour intensity has noticeably increased, labour exchange has come to be of no use since green-house farming needs very fine care, and thus a severe strain in labour supply has developed. Green-house farming also reduced greatly the use of night-soil as a fertilizer. Consequently, the problem of night -soil disposal has emerged. To alleviate thet rouble of taking night-soil away from the toilets, with the persuation of the government, people began to replace the old latrine type of toilets with newly improved sanitary toilets with purification tanks. The new toilets contributed to saving labour because they require less frequent night-soil disposal, but they failed to solve sanitary problems related to night-soil disposal. Night-soil is now mostly dumped on the hill behind the village. The increasing home use of water after the introduction of simple piped water supply systems gave rise to the problem of waste water disposal since no underground drainage system was yet developed. Many puddles where maggots can hatch were formed outside the house. The increasing amount of sewage and the change of fuel and heating systems are known to have produced a similar effect. Sewage piled up in the village for there was no measure developed to take care of the increasing volume of sewage that followed the socio-economic changes of the community.
People simply dispose sewage any place outside the house, often into the agricultural water tunnel. Sewage flies all over the village on windy days. In short, environmental disruption was created by the changes in life style and the poor integration of development programmes in Myung-ji. Similar problems are noticed in other research communities, but to a much lesser degree.

Individual households are equipped with few sanitary amenities in all the study communities. For example, there is no single toilet which is equipped with a ventilator, and rarely any thing is done to protect the kitchen from flies and insects. Although the sanitary conditions of the research communities have changed considerably, little change has been observed in the sanitary behaviour of individuals in rural villages. Housewives, who are mostly responsible for family sanitation, pay little attention to the sanitary conditions of the house, kitchen and toilet, and the sanitary practices of household members such as hand washing before a meal or after going to the toilet. In general, middle or high school girls and children who have urban experience show a relatively greater concern for sanitation in all the study communities.

Chapter VII

HEALTH CONDITIONS AND BEHAVIOUR

Korean society entered an epidemiological transition in the mid 1960 s with major changes in the demographic characteristics of the people and a drastic growth of national economy. Mortality has declined and the pattern of morbidity has changed all over the country since the early 1960 s. Until the mid 1960 s, the major causes of death were infectious and parasitic diseases, tuberculosis, diseases of the respiratory system and diarrhoea. Currently, the majority of people die of diseases of the circulatory system, neoplasms, poisoning and accidents. People suffered very frequently from acute and malignant diseases previously, while chronic diseases prevail nowadays (Kwon, 1986 : 33-40). People have been exposed to a lesser risk of dying at all ages, but the improvement of survivorship is most noticeable in infancy and childhood. The introduction and wide spread dissemination of the so-called miracle drugs, or antibiotics, and the improvement of the public health system are credited with bringing about the mortality decline and the epidemiological changes upto the mid 1970 s. The effects of economic development and the resultant rise in the standard of living on mortality and health began to be felt strongly from the mid 1970 s. This was accompanied by an increasing differentiation in the level and patterns of mortality and morbidity among various socio-economic groups (ibid : Ch. III & IV).

The patterns of mortality and morbidity are known to have a significant bearing on the life style of Koreans. For instance, male supermacy or boy preference in everyday living and the general value system of Koreans have created more favourable mortality conditions for male children than for female children. The Korean pattern of mortality shows a very high risk of dying for men at ages 40 and upward compared to other societies with a similar national mortality level, due most probably to their indulgence in alcohol drinking, heavy smoking and severe work pressure (ibid : 14 & 77).

Koreans manifest peculiar health behaviours in many respects. They use pharmaceutical stores extensively for primary health care, but, in the cases of prolonged suffering, they visit herb doctors, pharmacists and doctors of western medicine alternately. Unrestrained use of drugs including antibiotics and poisonous drugs based on self-diagnosis or the advice of friends is very common. There is a widely held belief that invigorants (or supportive medicine in literal translation) are essential for prolonged health and strength. Such peculiarities in health behaviour are partly explained by culture, but the important reason for this phenomenon may be the government's lack of interest in, or incompetence in integrating various health and medical organizations into a viable system by exercising strong control over health and medical industries.

It has already been observed that the safety of tap water was confirmed by a series of micro-bacteriological tests of water quality in all survey communities with the partial exception of Sam-pyung. The same result was obtained for other potable water sources. An additional set of tests which were conducted to examine the status of mineral contamination also revealed negative results. In a word, the policy to introduce piped water supply systems has so far been successful, though the systems actually installed and its management are far from being satisfactory. Only one set of tests were conducted for potable water stored in a container (see Chapter IV-A), but the result is enough to suggest that

water use behaviour has important sanitary and health implications in Korea as well as in the survey communities. In this regard, we will examine below health conditions and behaviours as observed in the study communities with an emphasis on water use and the sanitary behaviour of the residents.

Table Ⅶ−1 : **Morbidity status of households and individuals** (%)

Community :	Kuro	Tong−jom	Myung−ji	Sam−pyung	Tosan	Total
(1) Percentage of households having had at least one member who sick						
A. During the last one month	40.9	62.8	48.5	35.5	40.1	44.8
B. During the last one year (excluding the cases included only in A)	40.9	21.7	32.7	25.9	28.0	30.17
C. Total :	64.6	73.6	69.3	56.1	59.2	64.1
(2) Percentages of persons who was sick						
A. During the last one month	12.4	13.9	14.4	8.8	10.8	11.9
B. During the last one year (excl. A)	11.0	5.5	8.7	5.4	8.0	7.7
C. During the last one year (A+B)	23.3	19.4	23.2	14.2	18.8	19.7

Table Ⅶ−2 : **Percentages of persons who was sick by the length of illness**

Community :	Kuro	Tong −jom	Myung −ji	Sam −pyung	Tosan	Total
A. Of those reported for the last one month						
less than a month	77.0	44.4	91.4	86.4	70.7	68.8
1−11 months	13.5	21.4	5.2	11.4	26.7	17.2
more than a year	9.5	34.2	3.4	2.3	2.7	14.1
B. Of those reported for the last one year (exc l. A)						
less than a month	26.9	67.9	38.9	33.3	64.9	44.8
1−11 months	25.4	7.1	13.9	33.3	33.3	24.4
more than a year	47.8	25.0	47.2	33.3	1.8	30.8
C. Of those reported for the last one year (A+B)						
less than a month	53.2	49.0	71.3	63.6	68.2	59.8
1−11 months	19.1	18.6	8.5	20.8	29.5	19.9
more than a year	27.7	32.4	18.1	15.6	2.3	20.4

A. Kuro

According to doctors and pharmacists working in the area, there has been a drastic change in the pattern of prevalent diseases in Kuro during the last few years. There were many people suffering from food poisoning and heavy diarrhoea by the end of the 1970 s. These symptoms were reduced considerably in recent years due probably to the rapid dissemination of refrigerators. Another important hazard of life in the area was carbon

Table Ⅶ-3 : **Percentages of persons who was sick by disease symptom**

Community :	Kuro	Tong -jom	Myung -ji	Sam -pyung	Tosan	Total
A. During the last one month						
digestive	25.3	46.6	29.2	44.6	12.1	33.3
respiratory	34.5	6.9	34.7	5.4	31.9	20.6
circulatory	3.4	27.0	4.2	5.4	3.3	12.3
metabolic	10.3	12.6	9.7	23.2	12.1	12.9
dermatological	6.9	0.6	4.2	—	3.3	2.7
others	19.5	6.3	18.0	21.4	37.4	18.1
B. During the last one year (exc 1. A)						
digestive	15.9	41.3	13.7	31.7	14.9	21.5
respiratory	17.0	19.6	23.5	7.3	25.4	19.1
circulatory	15.9	13.0	3.9	7.3	—	8.5
metabolic	13.6	17.4	33.3	36.6	7.5	19.5
dermatological	1.1	—	2.0	2.4	1.5	1.4
others	36.4	8.7	23.5	14.6	50.7	30.0
C. During the last one year (A+B)						
digestive	20.6	45.5	22.8	39.2	13.3	28.8
respiratory	25.7	9.5	30.1	6.2	29.1	20.1
circulatory	9.7	24.1	4.1	6.2	1.9	10.9
metabolic	12.0	13.6	19.5	28.9	10.1	15.4
dermatological	4.0	0.5	3.3	1.0	2.5	2.2
others	28.0	6.8	20.3	18.6	43.0	22.6

note

1. diarrhoea, stomach-ache, stomach ulser and diseases related to digestive organs
2. cold, coughing, headache pneumonia. tuberculosis and diseases related to respiratory organs
3. hypertension, heart disease, chest pains or complaints, palsy and diseases related to circulatory organs
4. diabetes, neuralgia, rheumatism and diseases related to metabolic organs

monoxide poisoning due to the use of *yontan* for heating and cooking. The poisoning was so common that phamaceutical stores had to be prepared to receive patients every morning. The gas poisoning became negligible in the early 1980 s with the introduction of a new type of *yontan* boiler called the *saemaul* boiler. Although, the area is considered to be vulnerable to infectious diseases in view of the afore mentioned filthy environment, there was no case of infectious or contageous diseases reported in the area.

Allergic skin diseases are prevalent among young girls working in garment factories. Respiratory diseases, which are frequent among children, are thought to be related to the severe air pollution which is itself attributed to a high residential density and the presence of an industrial complex nearby. Various health problems are noticed among the middle aged. Backaches and leucorrhea, widely found among women, are believed to be related to improper post-natal care, induced abortion, and physical weakness. Most prevalent health problems for middle aged men are hypertension, stomachache and liver related diseases. These are mostly accounted for by heavy work pressure, fear of losing a job, psychological instability, over-work and heavy alcohol drinking. Hypertension, neuralgia and diabetes are the most common diseases among elderly people.

Although not as frequently as in the past, many people suffer from acute diarrhoea,

Table Ⅶ−4 : **Percentages of persons who was sick by method of treatment**

Community :	Kuro	Tong −jom	Myung −ji	Sam −pyung	Tosan	Total
A. Of those reported for the one month.						
visit to clinic	42.1	56.9	59.7	22.4	61.9	51.3
visit to pharmacy	47.4	27.6	22.6	38.8	29.8	32.5
others	2.6	−	1.6	8.2	1.2	2.0
herb medicine	2.6	5.7	11.3	16.3	7.1	7.6
none	5.3	9.8	4.8	14.3	−	6.6
B. Of those reported for the last one year(exc 1. A)						
visit to clinic	67.1	67.6	60.5	45.5	56.9	60.7
visit to pharmacy	22.8	26.5	25.6	18.2	32.8	25.5
herb medicine	5.1	−	9.3	15.2	3.4	6.1
others	−	−	2.3	6.1	3.4	2.0
none	5.1	5.9	2.3	15.2	3.4	5.7
C. Of those reported for the last one year(A+B)						
visit to clinic	54.8	59.2	60.0	31.7	59.9	54.9
visit to pharmacy	34.8	27.4	23.8	30.5	31.0	29.8
herb medicine	3.9	4.5	10.5	15.9	5.6	7.0
others	1.3	−	1.9	7.3	2.1	2.0
none	5.2	8.9	3.3	14.6	1.4	6.2

Table Ⅶ−5 : **Percentages of Households having had at least one of its members shown the listed symptom recently**

Community :	Kuro	Tong −jom	Myung −ji	Sam −pyung	Tosan	Total
fever	13.6	30.2	14.1	1.4	31.0	18.2
abdominal pain	11.7	42.9	25.3	7.2	24.5	21.5
headache	13.0	36.5	25.3	25.4	34.0	26.5
nausea	6.8	35.7	13.1	11.6	8.4	14.4
diarrhoea	16.0	32.8	22.8	27.5	20.6	23.5

enteritis and stomachaches during the summer. Particularly, diarrhoea prevails among children. It is observed in the areas in which many women work outside, leaving children at home without care takers. The children are given small amounts of money (about 500–1500 won) to take care of themselves until their mothers return from work in the evening. They usually buy ice-cakes with the money during the summer, some of which are believed to be unsafe containing many colitis bacteria, and this is the cause of the high rates of acute diarrhoea and enteritis among children during the summer. In other words, water borne diseases are fairly common during the warm months in Kuro although the water quality tests confirm the safety of drinking water. In addition, hemorrhoidal infection occurs frequently due to irregular bowel movement and nutritional deficiency.

In sum, the survey community of Kuro reveals a high morbidity rate and a distinctive pattern of prevalent diseases, which can be explained by its poor environment, the sanitary problems of the work place, improper child care, job insecurity, and malnutrition. Although it is not mentioned by doctors or pharmacists, the prevalence of stomach ache,

diarrhoea and enteritis is undoubtedly related to the dietary habits of the residents particularly to the consumption of chili-hot foods at every meal.

Compared to the middle or lower upper class residential areas of Seoul, according to the owners of pharmaceutical stores in the survey area, people take medicines heavily in Kuro because they are more concerned about everyday physical condition than overall long term health problems. The majority of the workers in the area are employed in manual or blue collar jobs. It is customary for them to lose three days' wages for one day of absence from work. So, whenever they feel sick, they take medicines which are readily available from pharmaceutical stores without a doctor's prescription for the immediate relief of pain in order not to miss work. In a word, poverty often prevents them from recovering fully from illness.

The residents of Kuro use various types of medical and health institutions in the case of illness, such as hospitals, clinics, health centres, pharmacies, oriental clinics, and herb drug stores. Among them, pharmaceutical stores play the most important role in primary health care. Almost everyone visits a pharmacy if he or she feels something wrong with his or her body. There they buy medicines on their own request or take ones recommended by the pharmacist. If the suffering persists for some time, they began to look for other solutions. They usually go to the regional health centre because it provides services to the poor free of charge or for a nominal fee, although the quality of services provided by health centres are thought to be very inferior. People often visit hospitals with a free check-up ticket provided to those classified as living under the poverty line, but rarely use hospital facilities beyond the simple examination due to its high costs. There is no clear role distinction between general practitioners and specialists in the Kuro area. They all act as general practitioners and there is no referral system to get access to treatment from a specialist. The two are in a competative rather than complementary relationship. Medical costs have risen sharply in connection with the booming medical industry and the rapidly expanding coverage of medical insurance among middle class workers in recent years. In other words, the recent medical and health development of Korea has not benefited the poor at all, rather it has denied further the accessibility
of the poor to modern and sophisticated medical services (Kwon, 1986 : 56-57).

The mounting concerns for everyday physical conditions do not result in proper health behaviour in the survey community. People are interested mostly in the immediate relief of unpleasant symptoms by any measure regardless of its possible long-term effects. Such a behaviour pattern of the residents and their perception of health may well be reflected in the use of pharmacies, the most important health institution in Kuro, as summarized below :

(1) Many people visit pharmacists even in cases of serious and prolonged suffering and pharmacists rarely recommend them to see a doctor.

(2) Pharmacists rarely say anything about the disease which the customer might have contracted, its causes and precautions to be taken. If a customer asks for particular drugs, they give it to the customer without any inquiry.

(3) Medicines are often sold by a person who is not qualified for drug handling. Only when a prescription is needed do people look for a licensed pharmacist.

(4) Some ask for medicines bearing specific brand names, but the majority request any medicine to cure certain symptoms.

(5) Antibiotics and invigorating drinks are in greatest demand.

B. Tong-jom

In Tong-jom, people use clinics and hospitals extensively since a significant portion of the workers are employed in mining firms and accordingly covered by the national medical insurance scheme. They say that it is less costly to visit clinics or hospitals than to visit pharmaceutical stores if the patient is medically insured. Some mining firms run their own clinics. Also, there is no particularly distance-wise advantage for the villagers to visit a pharmacy because both clinics and pharmacies are located not in the village but in either Tae-back city centre or downtown Jang-sung. Even for minor ailments such as colds and diarrhoea, the villagers tend to visit clinics rather than pharmacies.

On the other hand, the indigenous residents who are mostly engaged in farming appear more or less to rely on or indulge in folk medicine based on shamanism. Many people conduct shaman rituals or practices, while receiving modern medical treatment. Some seem to distrust the western type medical practitioners' capacity to cure certain traditionally prevalent diseases, especially those of children. For example, a folk practice called *Taking out ja-re* is prevalent in the village in the case of a children's disease which is often diagnosed as influenza or stomach-ache by doctors. It is often said that they immediately know if a child has a ja-re which causes a serious illness, and that the modern medicines and drugs are of no use in these cases because doctors and pharmacists know nothing about the disease. *Ja-re* is said to be recognized in herb (or Chinese) medicine, and the child with it is said to recover in two or three days after it is taken out. This is performed either by elderly persons or herb doctors.

If a patient has not recovered long after having been treated in ordinary medical insitutions like clinics, hospitals and pharmacies, a *gut* (a kind of shaman ritual) is usually arranged in the belief that such a disease is caused by the penetration of an evil spirit into the body and only a shaman is capable of driving it out. People say that it works sometimes although they do not have strong faith in it.

Diverse folk treatments are still applied to various diseases and symptoms. For instance, wormwood or wood ashes are applied to finger cuts, soy-been pastes to bruises of the head, persimmons for diarrhoea, acupuncture for backache and natural honey for vomiting with diarrhoea and chills. Also various kinds of fruits, vegetables and roots are used to regulate physical conditions.

Diarrhoea is widely found in Tong-jom (see Table Ⅶ-5), but people rarely think of it either as a disease or a symptom of a disease unless it lasts for some time. The major reasons may include the fact that diarrhoea is so common in the survey community and that it is a nuisance to see a doctor or a pharmacist with a supposedly minor problem since it takes one or two hours to travel to the area where the services are available. This relative disadvantage in the accessibility to modern medical and health services may hinder people to get prompt medical service when they contract diseases, thus helping a minor disease develop into a chronic or serious one. The prevalence of chronic disease conditions in the community, as confirmed by the base-line survey results (see Table Ⅶ-1), may be partly explained by this pattern.

Many people in the village have a history of prolonged suffering from stomach pain, cough, tuberculosis and neuralgia. Among the mining workers, such occupational diseases as silicosis, bone fracture and neurosis are widely found. Stomach ulcer is said to be very

common among men in their forties and fifties. Hemorrhoids and appendicitis are the most prevalent diseases which need surgical treatment in Tong-jom.

In pharmaceutical stores, people usually ask for specific drugs based on self-diagnosis. They obtain information on drugs mostly from television advertisements. This appears to facilitate the misuse of drugs. People usually ask for a drug if one or two symptoms they suffer coincide with those on the drug advertisement, which frequently leads to the misuse of drugs. Misuse of drugs is also very likely to occur since wives or children often go on errands to get medicines for other members of the family. Specific drugs are usually requested in such a case, but some simply ask for drugs by telling the pharmacist what symptoms the sick person has.

Diseases are commonly conceived in the survey community as individual misfortune which can only be cured by medicines and medical services including folk treatments. People talk about unsanitary environment and it is often observed that all members of a household share a common health problem. But, these factors are rarely alluded to in their dealings with individual illness. The concept of family or community health is totally alien since only individually oriented health care services have ever been in existence in the region. As a result, the villagers have neither made any serious efforts to improve the quality of their living environment nor adopted any effective preventive measures to fight the deteriorating health conditons of the village. Concerns for health emerge only when a curative need arises, although it is believed that the people's health would be greatly enhanced if several environmental hazards were removed.

The prevalence of chronic diseases or prolonged suffering, as partially evidenced by the observation that a very high proportion of those reported sick during the last one year had had symptoms for more than a year (32.4%), may well indicate how environmental deterioration has affected the health of the villages since the mid 1970 s. The sanitary impact of the new water sources and the new water use behaviours are difficult, if not impossible, to determine. As shown in Table Ⅶ-5, many symptoms which may be linked to the drinking of unsafe water such as diarrhoea, stomach ache and vomiting are very common in Tong-jom. In view of the water quality test results, which revealed no significant biological and chemical contamination of potable water sources, we may suspect that water handling behaviour and the use of water containers would have important implications for health in Tong-jom. This assumption is still valid even after taking another important cause of stomach-ache and diarrhoea into consideration : that is, the eating of chili-hot food and excessive alcohol drinking. Stomach-ache and diarrhoea is very common in Tong-jom, more than what would be expected when taking into account eating and drinking habits. The community also has a high incidence of headache and nausea and this is thought to be linked directly to air pollution by lead muck.

Another interesting observation in the morbidity pattern of the area is the prevalence of venereal diseases, particularly among men working in mines. It is said that miners drink heavily after work at bars in the town and they frequently contract venereal diseases there through contacts with bar girls (or prostitutes). The contractors usually visit health centres for the government institute treats them free of charge under the venereal disease eradication programme.

C. Myung-ji

After the introduction of green-house farming, new health problems have emerged in

Myung-ji. The majority of the adult population suffers from so-called *vinyl-house disease* during the winter which are characterized by such symptoms as dizziness, vomiting, backache, chronic fatigue, problems of the respiratory system, insomnia, exccessive urination at night, paralysis, exccessive sweating and headache. Conditionds which are thought to contribute to the rise of these symptoms are high temperature combined with high humidity inside the green-house, small space of work, low roof, prolonged hours of work, carbon monoxide contamination and the use of insecticides in a large amount.

The average temperature inside the green-house is kept at around 30 degrees celsius even during cold winter days. Sometimes the temperature rises to 40 degrees. In other words, there is a 30 to 50 degree difference in temperature between the inside and the outside of the green-house during the winter. This is thought to be responsible for the prevalence of colds among green-house farming family members, particularly among children and elderly people. The prevalence of fatigue with chill and fever and neuralgia among the elderly is also attributed to their work in the green-houses.

Green-house farming has caused a critical hazard to health in still another way. It has increased the consumption of *yontan* and insecticides tremendously. Some remove 100−200 pieces of the burned-up *yontan* and replace them with new ones every night until around one o'clock. So they often are not able to sleep through the night and are exposed to carbon monoxide. Although no deaths from this have been reported, many people complain of headaches and being dizzy. The disposal of *yontan* ash is also problematic. It is thrown away almost any place and therefore *yontan* ash is piled here and there all over the village. When a strong wind blows, the ash flies all over the village so that it becomes difficult to open one's eyes and breath easily.

The amount of insecticides and weed killers used for green-house farming is about eight times greater than in ordinary farming. With the increasing use of insecticides, the number of eels, water snakes and paddy spirals inhabiting the nearby water reservoirs, which were the major animal protein suppliers in the village, has dwindled sharply. On the other hand, the extensive use of weed killers has extinguished wild greens which were the major supplier of inorganic nutrients. In addition, the heavy use of insecticides and weed killers presents a direct threat of poisoning to the green-house farm workers. In short, green-house farming has apparently deteriorated the sanitary conditions of the village to a significant degree, although it contributed greatly to the enhancement of living standards. A very high incidence rate of respiratory diseases (see Table Ⅶ−3) in the area can only be properly explained in this context.

As for the major likely causes of diseases in the study community as perceived by the villagers, they seem to be fully aware of the health implications of green-house farming. Our simple survey indicates that 68% of the respondents chose the over-use of insecticides as the most important health hazard. The proportion decreases in the order of over-work (45%), the improper management of waste water (37%), sewage (29%) and night-soil (21%), over indulgence in alcohol drinking (16%), and the exccessive use of chemical fertilizer (14%). Among them, the excessive use of insecticides and over-work are considered to be a direct result of green-house farming.

Parasitic infection such as liver clonorchiasis was the most common epidemic disease here for long time since people ate raw fish caught in the Nak-dong River which flows down through the village. Because of vigorous education and campaigns, the incidence of parasitic diseases has been reduced substantially and people are now aware of its danger. But many adults were found still infected by liver flukes according to a blood test conducted

on January 1986 by the local health centre (42.6% of men and 26.5% of women). There appears a resurge of raw river fish eating in this area after the introduction of special vermifuges to cure liver clonorchiasis, although people conceal the fact. A groundless saying is widely spread by fish shop owners that digestant kills parasites and therefore it is safe to eat raw fish if taken with a digestant. Anyway, unlike what is asserted by the villagers, it is almost certain that every adult eats raw fish in the village.

As in Tong-jom and Tosan, diarrhoea and stomachache are fairly common in Myung-ji, indicating the possible prevalence of water borne or water related diseases. Compared to the other communities, however, the risk of illness due to the contamination of potable water is not particularly high in Myung-ji. The bacteriological tests of potable water sources and tap water showed no positive signs of contamination. About 90% of the households drink water from simple piped systems and the use of water containers is less prevalent here than in the other rural survey communities. But, as discussed earlier, the contamination of food due to a filthy environment which is itself caused by the complete lack of water, sewage and night-soil disposal systems is very likely in the village.

There is generally a great deal of concern for personal health is in Myung-ji. When people feel sick they immediately go to pharmaceutical stores located in the township area which is about 20 minutes distance from the village. It takes 10 minutes on foot and another 10 minutes by bus. If pains and symptoms persist after taking medicines obtained from pharmacists, they visit clinics or hospitals. If there is still no change, then people turn to herb or folk medicine. Shaman rituals take place when all other measures fail. The reliance on modern drugs and modern medical services has rapidly grown with the diffusion of green-house farming. Green-house farming is not only labour intensive but requires skilled and devoted workers. It is often heard in the village that small negligence causes a big loss in green-house farming. So the traditional labour rotation system and frequent labour replacement are avoided, if not taboo, in green-house farming. This explains why people in Myung-ji are so sensitive to their physical condition and seek immediate recovery from an illness, disregarding its long-term effects. The villagers usually trust the effects of medicines sold at pharmaceutical stores and thus tend to use various drugs exccessively. Such a short range concern for personal health problems and the overall trust in the effects of western medicine are considered to have contributed to the diminution and mystification of the role of herb or folk methods of disease treatment in Myung-ji. Unlike in other areas where folk medicine constitutes a normal method of disease cure, the villagers here treat it as something mysterious, and accordingly tend to rely on it only if they feel that there is no easily available cure in modern medicine.

D. Sam-pyung

In Sam-pyung, industrial pollution is conceived as the most critical hazard to health. As mentioned earlier, the Onsan region has been the centre of national attention during the last ten years for its allegedly high level of industrial pollution. People in the region believe that the effect of the pollution is critical as evidenced by the increasing number of dead fish and dried-up trees. Rumours have spread people collapsing suddenly in the residential areas about 500 metres away from the industrial complex. Their worries over industrial contamination are doubled by socio-economic losses as reflected in such new sayings spreading around the area as *Don't eat sea-weed, rice and fish from Onsan.* or *Don't marry a boy or a girl from Onsan.* The residents of the survey village believe that the seriousness of the

pollution is not fully revealed because the government puts pressure on local officials to conceal the extent of the pollution in order to protect the industrial firms that have moved into the zone. There is a wide spread distrust of the public servants as well as the industrial firms. Yet no movement of the residents has been organized, except for isolated demonstrations, to find a fundamental solution. Rather, people tend to think to leave the area if the time arrives.

In the survey community, there are two main kinds of industrial pollution ; air pollution due to sulfurous acid gas discharged from non-ferrous factories two kilometres away and pollution of the Hoe-ya River by the chemical discharge from a detergent factory. The alleged symptoms of discomfort due to exposure to sulfurous acid gas are severe headache and nausea. The proportion of the villagers who had headaches recently was reported as 25% and that for nausea was 12% according to the base-line survey in 1984. But these proportions are not particularly high compared to the other survey communities and this may be explained by the growing insensitivity to those symptoms as people are becoming accustomed to such air pollution. The river pollution may have grave health implications for many because they eat raw fish caught in the river. It was often observed that some whiling eating fish in raw said *Not knowing is the best medicine*. The villagers suspect that the river pollution contaminates the simple piped water supply, particularly that in Chong-dong, but our water quality tests could not support this claim.

Another serious concern of the villagers in terms of health is insecticide poisoning. According to a villager, about 40% of the farmers have recently experienced chill, suffocation, headache, stomachache, diarrhoea, exhaustion, trembling and temporary unconsciousness while spreading insecticides over the field. There is an additional concern over the sanitary impact of the extensive use of chemical fertilizers and insecticides in the village. People suspect that it may pollute the source of piped water (particularly in Chong -dong where the source is located is located near a paddy field) and also contribute to destroying sea-weed and fishery products through the contamination of the Onsan sea. In the case of Chong-dong, a sewage dump located next to the water source is still another source of possible water contamination, and, in fact, the threat of piped water contamination reached such a point that most people now use the piped water only for laundry and bath.

Diarrhoea is very common in Sam-pyung. According to a base-line survey, 27% of the households reported that one of its members experienced diarrhoea recently. The proportion is higher than those in the other survey communities except Tong-jom. But considering the very low proportion of children in Sam-pyung and that diarrhoea is most prevalent among young children, it may be argued that diarrhoea is as much as a problem in Sam -pyung as in Tong-jom. The pattern and basic causes of diarrhoea seem to be the same in Sam-pyung and the remaining survey communities : that is, higher prevalence in the summer due to the difficulty of preserving food and the dietary habit of eating many hot dishes. In addition, the general bacteriological examination of water samples in Sam -pyung revealed that there was significant contamination of both tap and well water during the summer months, particularly in August (see Table IV-1). It is also likely in the survey village that the extensive use of water containers induces bacterial contamination of potable water even if the original water source is safe. In conclusion, it would be safe to argue that the relatively high rate of diarrhoea in Sam-pyung is due to the contamination of potable water.

Contagious diseases such as malaria and typhoid were reported to have occurred,

during the three years preceding the fieldwork, in Sang-hoe, a sub-village located near another mountain village, where pig farming has flourished. As mentioned earlier, pig farming in a neighbouring village is an important source of environmental contamination in Sam-pyung and provides a breeding ground for various insects. Although the potable water sources in the village are safe during most of the year, this does not mean that these are well protected from any kind of future contamination. Some are vulnerable such as the ones which were constructed very close to toilets, manure piles and swamps without proper protective measures.

There is only one drug store in the village. It is run by a person with no qualifications and is allowed to sell a limited number of drug items, about 20 altogether. Also, there is an unlicensed (illegal) medical practitioner in the village, called *saemaul doctor* by the villagers and there are several elderly people who act as medicine men in the village. The nearest pharmacy and the government health centre are located in Nam-chang, 10 kilometres away from the community. These local services are not much used for its poor quality. The villagers usually visit the nearby cities, Ulsan and Pusan to get modern medical and health services. When drugs are needed, people go to Ulsan or Nam-chang rather than purchase them at the village store. The role of the illegal medical practitioner is largely confined to advising sick people what to do and to providing them with emergency treatment only. The villagers prefer to visit clinics and hospitals rather than pharmacies even for primary care because the time and cost of going to a large scale pharmacy with a good reputation is not much greater than that of clinics and hospitals, all of which are located in Ulsan or Pusan.

Shaman rituals and herb medicine are widely practised in Sam-pyung. When a person becomes ill, the most common practice here is to prescribe folk medicines to the patient on the advise of elderly people who are believed to know by experience the nature of the problem. For ordinary or commonly found symptoms, various folk ways of treatment are available, but the measures to deal with a specific symptom or disease are not standardized at all. People often perform a small ritual to expell evil spirits following the advise of an elderly man who is thought to know shaman medicine. Some visit a buddist monk for a medicinal spell to gain release from the evil spell. Many adopt such shaman practices along with the use of modern medicines. On the other hand, people visit clinics and hospitals in cities when they are critically ill, but their dependence on or their use of modern medical and health facilities is not consistent. Even though seriously ill, the villagers do not visit clinics or hospitals continuously as required until they are fully recovered. Rather it is common for people to visit a certain modern facility once, then go to a herb doctor the next time and consult with a shaman at still another time.

This peculiar pattern of medical behaviour in the village appears to be accounted for partly by its demographic and geographic characteristics. The dominance of aged people in population composition may explain a great deal of the prevalence of shaman practices and herb treatments. Also, the physical distance to cities and towns may have been associated with the intermittent use of modern medical facilities. It is also observed that elderly people often dismiss some commonly found diseases like cold, diarrhoea, headache and stomachache as nothing unusal, thus causing a delay of treatment until their condition becomes more serious.

The villagers are also found to act slowly on disease symptoms compared in other communities. This pattern of behaviour may be related with the traditional labour exchange system in farming which is still functioning in the village. It is relatively easy in

traditional agriculture to replace labour if someone is ill. It would have contributed to developing less health problems or illness among the villagers in Sam-pyung compared to other areas where labour is difficult to replace or absence from work means a significant loss of income.

E. Tosan

Health problems in Jeju Island are known to be distinct from those found in other parts of Korea because of its distinctive climate and culture as well as its geographical isolation from the Korean peninsula. A number of endemic diseases have prevailed in Jeju, like deficiency diseases, elephantiasis and cysticercosis infection. Women divers, who are mostly in their forties or more, suffer from symptoms related to sea diving such as headache, neuralgia, backache and ear trouble. Women divers, whose number has dwindled to about 20 from 80 during the 1970 s and 1980 s because of hard labour, usually take medicines for headache before diving. This, in turn, causes them various gastrointestinal problems. Among endemic diseases prevailing in Jeju, elephantiasis is mediated by mosquitos and should accordingly be assumed to have an important association with water use and disposal behaviour and the water management system in the region. Although there are still many mosquito breeding grounds, elephantiasis has recently been controlled to a considerable extent through the regular disinfection of the area by the local health authorities and the increasing use of mosquito killers. Previously, people frequently contracted the disease by drinking spring water by the sea. Such a risk was almost completely removed after the installation of a simple piped water system in 1974.

The incidence of filaria infection was reduced greatly as well. According to a series of tests conducted for Tosan 2 nd Li, the proportion of those infected by filaria was reduced from 27% in 1968 to less than 1% in 1985, as is shown in Table Ⅶ-6.

Table Ⅶ-6 : **Results of filaria infection tests in Tosan 2 nd Li,** 1968-85

year	No. of cases tested	Positive cases	% positive	Treated cases
1968	369	99	26.8	88
1969	419	52	12.4	39
1970	266	17	6.4	16
1978	363	20	5.5	13
1985	176	1	0.6	1

Source : Nam Jeju Health Centre

Compared to the national average, Jeju Island has shown a much greater incidence of cysticercosis infection. According to a series of stool tests, cysticercosis infection is about three to six times greater for Jeju than for the entire nation. For instance, the rates were 4.4% for Jeju and 0.7% for the whole country in 1969, and 2.3% and 0.7% respectively in 1976. If a more refined measure was adopted, the rates are thought to have gone up significantly. The high incidence of cysticercosis infection in Jeju is undoubtedly explained by pig raising in the toilets, for a pig acts as a host for the particular cysticercosis infection prevailing in the region. Another reason for this high rate of taenia infection is the custom of eating pork and their intestines raw. Before the development of a medicine (Prazequantel) to cure the disease it was known to be one of the most serious health hazards in

the island.

According to the base-line survey, the currently most prevalent diseases in Tosan are those related to the respiratory system which include cold, pneumonia and headache. On the other hand, the incidence of diseases of the circulatory system is very small. The prevalence of respiratory diseases can be explained partly by the humid climate and partly by sea diving in the case of women divers as mentioned above.

People in Tosan are on the alert nowadays for the spread of hepatitis B. During the fieldwork period of November 1984 through October 1985, there were three deaths from hepatitis and one hepatitis patient admitted to a hospital in the research community. Although the way of spreading of hepatitis B is relatively unclear, it may be thought to be related to eating and drinking habits of the villagers, which follows the general cultural pattern of Korea. When men drink socially they share spoons and chopsticks to scoop or pick up accompanying soup or food. Also people share all foods except cooked rice and soup, and take them directly from dishes to mouth on the meal table. In other words, contraction to hepatitis through mouth is highly probable while eating and drinking.

The bacteriological tests of various potable water sources reveal that water from the sampled container in the kitchen were contaminated significantly throughout the entire test year except for January. The use of a big water jar (or container) is common in Tosan and people frequently drink plain water directly from it, particularly at night, while the container is washed once in a while, in some cases once in a year as a ritual of preparation to meet the traditional new year which falls usually between late January and mid February. From these observations, we may expect a high prevalence of water borne diseases in Tosan. But the base-line survey results as well as the fieldwork observation does not show any evidence of a particularly greater prevalence of diarrhoea and stomach -ache in Tosan than in the other survey communities (see Table Ⅶ-5). Considering that the contamination of water due to improper water management and water use behaviour is also highly likely in other rural villages, it may be inferred that water borne or related diseases are still widely found all over the country, including areas where safe water supply systems are in operation.

The residents of Tosan rely heavily on pharmacies for disease treatment. Most people visit pharmacies in the nearby town, Pyo-sun, for primary care or the treatment of minor ailments. If they are seriously ill, people visit doctors in Jeju City or Su-gui-po City. If they feel that a doctor's treatment has no effect, they turn to traditional (folk) or shaman medicine. The heavy reliance on pharmacies can be explained mostly by two factors, accessibility and cost. Modern clinics and hospitals are located in cities which require 40 to 60 minutes of travel from Tosan, while it takes about 10 minutes to visit a pharmacist in the township of Pyo-sun. In addition, the doctor's service is very costly for most Tosan residents because they are not medically insured.

F. Discussion

According to the base-line survey, the proportion of persons who contracted diseases during the last one year preceeding the survey ranges from 14% for Sam-pyung to 23% for Kuro and Myung-ji. The proportion of households having had at least one member who was sick during the same year ranges from 56% for Sam-pyung to 74% for Tong-jom. Diseases are reported to have been least prevalent in Sam-pyung by both measures. It is apparent, however, that the perception of illness differs greatly from one community to another and

the concern for personal health is least in Sam-pyung. This may be taken as an indication that minor irritations are considered as normal in Sam-pyung, while people often feel sick with the same symptoms in the other survey communities. This differential conception of health would have developed largely in connection with the prevalent occupational activity, the availability of modern health services and the demographic composition of a community.

Traditional farming does not necessarily require the continuous good health of farmers throughout the entire year since there are slack seasons of three or four months, while blue collar workers on temporary employment and green-house vegetable growers have a keen interest in their physical condition since an ailment means to them a significant loss of income and sometimes a loss of job. Also, replacement of a worker is easy in traditional agriculture because of the traditional labour exchange system and the simple nature of farming. Availability of and accessibility to modern health or medical services, the standard of living and the demographic composition of the residents are of particular importance in explaining the patterns of disease treatment in each survey community. Less availability of modern medicine or health services and the dominance of elderly people in community life tend to boost the dependence on herb medicine and shaman cures, whereas poverty coupled with an exemption from the benefits of the national medical insurance scheme appears to drive people to rely more on cheap services like those provided in pharmacies and by herb doctors.

Although people use diverse medical and health institutions to cure diseases in all survey communities, each community shows different reliance on certain types of service and different patterns of using those services. In general, there is no single type of health institution which is trusted by all the villagers. If a man has been ill for some time, what he usually does is visit all types of medical institutions one after another. Except for Kuro, an urban community, folk medicine and shaman practices are still widely observed. But, in the areas where everyday health is directly linked to their earnings such as in Myung-ji, Tosan and Kuro, people rely mostly on pharmacies and clinics and resort to traditional methods only if the symptoms persist after visiting modern institutions. On the other hand, herb medicines and shaman practices function as the primary medical institution in traditional agricultural societies.

Because of the anthropological nature of the study, the only information on illness collected in this research are the symptoms described by the respondents and accordingly it is very difficult, if not impossible, to determine the types of diseases the resident population had suffered. The absence of records and inadequate knowledge on diseases on the part of the respondents did not allow a refined classification of diseases. Nevertheless, a crude categorization of diseases was attempted in both the fieldwork and the base-line survey and this appears to provide some clues to the patterns of disease prevalence in the survey communities.

In Kuro, food poisoning, acute diarrhoea and carbon monoxide gas intoxication were the most common diseases until the 1970 s. But the installation of city and piped water supply systems, the increasing use of refrigerators and the introduction of a safer *yontan* boiler system have contributed greatly to reduce the incidence of such diseases. Diarrhoea became much less prevalent, as in the other survey communities, after the introduction of piped water supply systems. Currently, respiratory diseases and gastrointestinal disorders including diarrhoea are widely found, due probably to a filthy environment and air pollution created by the heavy use of *yontan* as the major fuel. Prevalence of respiratory

diseases is also observed in Myung-ji and Tosan, which may be explained by different environmental factors. Green-house farming which requires the heavy use of pesticides and chemical fertilizers, a very high in-house temperature even during the cold winter, and the use of a large amount of *yontan* is apparently responsible for this in Myung-ji, while the observation in Tosan may well be explained by high humidity and sea diving (in the case of women).

Diseases of the digestive organs including abdominal pain and diarrhoea are known to be very common elsewhere throughout the country. A high prevalence of the diseases are also observed in all the survey communities, although particularly high rates are seen in Tong-jom and Sam-pyung where people are suspect of the safety of potable water. The prevalence of digestive diseases in Korean society is largely explained by the habit of eating chili-hot meals and heavy alcohol consumption. It was, however, noted that among the study communities, Sam-pyung is the only area where general bateriological contamination tests produced positive results for some summer months (July to September). Also the probability of potable water contamination while water is handled in the kitchen is relatively high in Tong-jom. These observations indicate that water borne or water related diseases may still somewhat prevail in the two villages. Considering that all research communities share problems of water handling and management, the contamination of drinking water would be conceived to be a partial cause of diseases of the digestive system in the remaining survey communities, too.

In Kuro and Tong-jom, the prevalence of occupational diseases is very high. Skin diseases are fairly common among women workers employed in cloth manufacturers in Kuro, and silicosis and bone fracture are often seen among mine workers in Tong-jom. Backache and neuralgia prevail among farmers and the elderly. Endemic diseases are still found in Tosan and Myung-ji where people eat raw pork or river fish. These observations clearly suggest that the pattern of morbidity of a community is determined to a significant degree by the pattern of work and the way of living in the community.

Chapter Ⅷ

WATER SOURCE AND HEALTH

In the previous chapter, we examined the general health conditions of the resident population in each study community in connection with the sanitary environment of the village and the health behaviour of individuals in a socio-cultural context. We have also tried, though not totally successfully, to establish linkages between water use behaviour and water borne or related diseases based mostly on qualitative fieldwork materials. Another attempt was made in Chapter Ⅳ to examine the safety of selected water samples as a direct cause of various diseases and symptoms prevalent in the research communities. The laboratory examinations showed that the sampled water sources had no particular sanitary problems except in Sam-pyung. The result is very much at odds with the claims and suspicions of the residents. In addition, it should be admitted that the water safety test is not a satisfactory measure to determine the overall quality of water as an explanator of the prevalent diseases in the research communities because of a deficiency in the sampling framework.

At the initial stage of the study, our laboratory team chose the sample sites for water quality tests with crude first hand information on water supply systems in each survey community, and the test had continued for a one year period with water samples collected at the same sites, following the procedures adopted by most previous studies on water quality (see Chapter Ⅳ-A). It was later found, however, that a proper and valid sampling framework could only have been developed after the detailed list of water sources was prepared and the major contamination mechanisms of drinking water were identified through fieldwork. The lack of this type of sampling system weakened greatly the value of water quality examinations in investigating the importance of water as a factor in community health.

As a way to partially resolve the conflicting results from microbiological test and field observation, we will briefly discuss in this chapter the relationship between water source and morbidity based on the base-line survey data. Two sets of data are used as morbidity indicators : that is, reportings of individual illness during the last one month and during the last one year, and information on households with any of its members having ill symptoms recently. The two sets of data tabulated by the type of potable water source are presented in Table Ⅷ-1 through Table Ⅷ-4. One thing should be reminded here is that any relationship standing out of the tables does not necessarily mean that there is a causal linkage between water source and health. Rather, it can only be interpreted as indicating a probable linkage between the two and to point to problem areas in the study of water quality in Korean villages. With these qualifications, let us now examine the observed relationships between water source and morbidity in the research communities.

A. Kuro

Kuro has two types of water sources, city water and simple piped water systems. Of them, the residents seriously suspect the safety of the latter. Many believe that the quality of simple piped water has been deteriorated considerably in recent years with increasing environmental contamination of the area through rising population density, poor drainage and unsanitary public toilets.

Table Ⅷ−1 : **Per cent sick persons by water source**

During :		(A) the last one month		(B) the last one year (including A)	
Water source	(N)	total	abdominal pain	total	abdominal pain
〈Kuro〉					
city water	(456)	9.9	2.4	19.5	4.4
S−P−W*	(264)	11.0	3.8	19.3	5.7
〈Tong−jom〉					
S−P−W	(437)	19.0	12.8	23.8	16.7
others	(207)	16.9	7.2	20.8	8.2
〈Myung−ji〉					
S−P−W : A**	(226)	10.6	3.5	17.2	4.4
S−P−W : B**	(238)	10.6	4.6	16.4	6.7
thers	(62)	12.9	3.2	24.2	3.2
〈Sam−pyung〉					
S−P−W	(137)	5.1	3.6	10.2	4.3
well water	(249)	7.2	4.0	12.0	6.0
both	(285)	6.3	2.8	11.2	4.9
〈Tosan〉					
S−P−W	(708)	10.2	1.0	17.8	2.3
spring water	(8)	37.5	−	50.0	−

* : simple−piped water supply system
** : A for Nae−dong and B for Oe−dong

Table Ⅷ−2 : **Per cent households with members showing ill symptoms recently by water source**

Water source	(n)	Fever	Abdominal pain	head−ache	Nausea	Diarr−hoea
〈Kuro〉						
city water	(104)	11.5	9.6	14.4	6.7	16.3
S−P−W*	(60)	16.7	15.0	10.0	6.7	15.0
〈Tong−jom〉						
S−P−W	(91)	29.7	40.7	36.3	31.9	33.0
others	(38)	28.9	44.7	34.2	42.1	28.9
〈Myung−ji〉						
S−P−W : A**	(44)	13.6	34.1	31.8	18.2	25.0
S−P−W : B**	(45)	13.3	15.6	22.2	8.9	24.4
others	(12)	16.7	25.0	8.3	8.3	8.3
〈Sam−pyung〉						
S−P−W only	(30)	−	13.3	33.3	10.0	23.3
well water	(51)	2.0	5.9	25.5	15.7	27.5
both	(57)	1.8	5.3	21.1	7.0	28.1
〈Tosan〉						
S−P−W	(153)	30.7	24.2	34.0	8.5	20.3
others	(3)	33.3	33.3	33.3	−	33.3

* : simple−piped water supply system
** : A for Nae−dong and B for Oe−dong

According to the base-line survey, this claim is not well supported. No significant difference is noticed in terms of water source with the proportion of sick persons during the one month period or one year period before the survey. On the other hand, the proportion of households with members having shown the symptoms of fever and abdominal pain recently are much higher in the households equipped with simple piped systems, compared to those with city water supply systems. A reversed pattern is observed with headache as evidenced in Table Ⅷ-2. In the case of diarrhoea, the difference is not significant.

Two explanations are suggested for this indecisive result. It may indicate little quality difference between the two types of water source. The alternative is that the residents who are concerned about the safety of water are likely to take preventive measures such as drinking only boiled water. As discussed earlier (Chapter Ⅴ-B), majority of the households in Kuro are known to rarely drink tap water without treatment.

B. Tong-jom

In Tong-jom, villagers are highly suspicious of the quality of simple piped water. Such a suspicion can be totally disregarded as groundless if only the results of the laboratory water quality test are considered. When morbidity rates are compared between the two groups of residents, simple piped water users and other water source users, the former shows much higher morbidity than the latter, and the difference is more pronounced when only the incidence of abdominal pains is counted. As presented in Table Ⅷ-1, 12.8% of the residents who drink simple piped water are reported to have had abdominal pain during the one month prior to the survey, whereas the equivalent proportion for the other water source users is 7.2%. The discrepancy is widened further when one year is adopted as the reference period.

A different picture emerges from Table Ⅷ-2. The proportion of households with at least one member having had the symptoms of abdominal pain and nausea recently are smaller among the households equipped with the simple piped system. On the other hand, the same households manifest a higher proportion in the case of diarrhoea. In other words, no conclusive pattern is observed with the proportion of households with members showing ill symptoms recently in terms of the type of potable water source.

The discrepancy between the two kinds of information may be attributed to different conceptions on the part of the respondents of illness and ill symptoms, different time references and different units of observation (individual vs. household). Such a gap is consistently found in other survey communities also, and we personally feel that individual morbidity data are a much more reliable indicator of health conditions than household data on ill symptoms in so far as our survey results are concerned.

C. Myung-ji

People drinking pump water in Myung-ji show a great deal of anxiety about the chemical contamination of water. The anxiety may be supported to some degree by the fact that the morbidity rate is much higher among pump users than simple piped water users. According to Table Ⅷ-1, the difference in morbidity is greater when the rate is calculated with people who were sick during the last one year excluding those suffered during the last one month. Unlike the total morbidity rate, the incidence of abdominal pain is more freqently observed with the simple piped water drinkers. The lower rate of abdominal pain

among pump users may be ascribed to their greater concern for water quality than simple piped water users which leads them to drink water that was treated by such methods as boiling. These observations may be accepted further to suggest that chemical or mineral contamination may be somewhat problematic in the case of pump water as people suspect, though not confirmed by the water quality tests mentioned in Chapter IV-D.3.

Symptoms related to bacterial contamination appear to be much more frequently found among the households with simple piped systems, which is in agreement with what is observed with the incidence of abdominal pain above. Of the two simple piped systems, the one in Nae-dong, which was installed a few years earlier than the other one, is more clearly associated with ill symptoms, as is shown in Table VIII-2), indicating a probable difference in water qualilty between the two simple piped water sources.

D. Sam-pyung

The idea that simple piped water is inferior to well water in its quality is widely held in Sam-pyung, as discussed in Chapters VIII-E and V-E. Although such an idea is not particularly related to the concern for water safety, it explains why well water is more popular than simple piped water all over the village. Contrary to what the villagers suspect, if the three simple piped systems are put together, there is no significant difference in morbidity between simple piped water users and well water users. No conclusive patterns can be found from the proportions of households with members who have shown ill symptoms recently.

On the other hand, the three simple piped systems show a significant difference in their relationship with the health status of their users. The one in Chong-kok, which adopts agravity system and is identified to be biologically contaminated by the water quality examination mentioned in Chapter IV-D.4, reveals the highest rates both in total morbidity and the incidence of abdominal pain. The lowest rates are noticed with stomach-ache among the villagers drinking water from the simple piped system in Chong-dong, suggesting that the villagers' worryies are not justified. They show a keen concern for the safety of the latter source since it is located in the middle of a paddy field near the Hoe-ya River which is known to be heavily contaminated with industrial discharge. Frequent complaints of headache among its users, as illustrated in Table VIII-4, may account for this chemical pollution. The apparent relative safety of the Chong-dong system from biological contamination may be explained by the fact that the system supplies water directly from the source to in-house taps adopting a pressurized method. The other systems send water through one or two intermittent storages. In the case of Chong-kok, water is collected in a mountain reservoir and the reservoir water is sent to a storage tank before being released to each house. This observation can be taken as a partial evidence to the claim that water contamination is highly likely through air or on the ground in an area suffering from environmental pollution like Sam-pyung, as discussed in Chapter VII-D.

It would be safe to assume that communal water storage, as well as water jars in the kitchen, can be a source of water contamination if not properly managed. This assumption is corroborated by the results of water quality tests from an in-house water jar in Tosan (see Chapte IV-D.5).

Table Ⅷ-3 : **Per cent sick persons by water source, Sam-pyung**

During :		(A) the last one month		(B) the last one year (including A)	
Water source	(N)	total	abdominal pain	total	abdominal pain
〈Chong-kok〉					
S-P-W only	(36)	11.1	8.3	16.7	8.3
well water	(64)	7.8	6.3	10.9	7.9
both	(27)	3.7	3.7	11.1	7.4
〈Sang-hoe / Nae-hoe〉					
S-P-W only	(53)	5.7	3.8	13.2	3.8
well water	(108)	10.2	4.6	16.7	7.4
both	(213)	6.1	2.3	11.7	4.6
〈Chong-dong〉					
S-P-W only	(48)	-	-	2.1	2.1
well water	(77)	2.6	1.3	6.5	2.6
both	(45)	8.9	4.4	8.9	4.4

Table Ⅷ-4 : **Number of households with members showing ill symptoms recently by water source, Sam-pyung**

Water source	Total No. households	Fever	Abdominal pain	head-ache	Nausea	Diarr-hoea
〈Chong-kok〉						
S-P-W only	(7)	1	1	1	1	2
well water	(11)	-	-	-	-	2
both	(6)	-	1	-	-	1
〈Sang-hoe / Nae-hoe〉						
S-P-W only	(12)	-	2	4	2	4
well water	(24)	1	3	9	6	10
both	(42)	1	2	7	2	14
〈Chong-dong〉						
S-P-W only	(11)	-	1	5	-	1
well water	(16)	-	-	4	2	3
both	(19)	-	-	5	2	1

Morbidity of well water users also differs significantly in the three sub-areas in the village. The Sang-hoe/Nae-hoe area shows the highest morbidity while Chong-dong the lowest. The highest proportion of symptom manification among well using households is observed in Chong-kok, whereas the lowest proportion is reported in Sang-hoe/Nae-hoe.

It is interesting to note in Sam-pyung that morbidity differs considerably between sub-areas classified in terms of water sources and that morbidity is lowest in the area where people are most concerned about the safety of water because of poor topographical and environmental conditions at its source. This suggests another alternative explanation to the observed differentials in morbidity, that one who is aware of water contamination is more likely to engage in water sanitation behaviour. Thus, the apparent relationship between morbidity and water source may be considered relatively unimportant and the differences in morbidity can be explained by the different water use and sanitation behav-

iours of individuals in accordance with their perception of water quality in each sub-area.

E. Tosan

In Tosan, all households except three (out of 158) use simple piped water for drinking and cooking. Accordingly, it would have no meaning to examine the different health implications of the different water sources in Tosan. Nevertheless, it is interesting to note that the total morbidity rate is significantly higher among the users of spring water, as expected.

F. Remarks

In each research community, the residents are suspicious of the safety of one or more of their water sources, while the water samples from various water sources, except for Sam-pyung, show no positive sign of water contamination according to a series of microbiological tests and a mineral content examination. The question here is whether the perceptions of people should be put aside as groundless. To answer this question, we have examined one more piece of information : that is, the relationship between morbidity and water source in each study community based on the base-line survey data.

The analysis does not support either argument clearly. The results are only in partial agreement with the villagers' claims, suggesting that it would be unwise to disregard the residents' claims as altogether groundless. Such an analysis based on a questionnaire survey has an inherent defect since it can not account for numerous interfering factors, but the results are still sufficient to indicate that the blind acceptance of water safety test results has its own limitations in examining the sanitary implications of water source. It further suggests that questionnaire survey and quanitative analysis of survey results are useful to formulate important hypotheses on the perception of water quality and water use behaviour in various socio-environmental contexts, as already suggested by Belcher (1978 : 43).

ChapterIX

CONCLUSIONS : SUMMARY AND RECOMMENDATIONS

A. Background of the Study

This research was conducted with the purposes of establishing the relationships among water source, water use and various aspects of environmental as well as personal sanitation in Korean villages, and identifying the major socio-cultural factors, ecological elements and life styles of the residents which influence the observed relationships. Based on the research findings, we have further intended to formulate policy recommendations in community water sanitation.

Since the study put its emphasis on the behavioural and ecological aspects of water sanitation, anthropological fieldwork was adopted as the major method of data collection. Through several screening procedures, five ecologically distinctive communities were selected as research and fieldwork sites. These include a metropolitan shanty town, a typical agricultural village near an industrial complex, an agricultural-mining village, a green-house farming village and a fishing-cash crop farming island community. Fieldwork was carried out in each study community over a one year period from November 1984 to October 1985.

To obtain quantitative data, a base-line survey was conducted by using structured questionnaires at the early stages of the research (August and September 1984). The data were used primarily to develop fieldwork strategies and to direct the course of fieldwork. The information was adopted further to detect the basic patterns of water use and sanitation behaviour, and to link them to personal and family health. On the other hand, statistical inference from the data was minimal because their statistical usefulness was limited by the small sample size and the superficial nature of the information.

As a way to determine the safety of drinking water, we conducted a series of microbiological examinations of water samples over a one year period from April 1985 through March 1986, and a count of mineral contents with samples collected at the last stage of the testing. The samples were taken from the major water sources, in-house water taps, a community water reserve tank and a kitchen jar.

The findings from the three approaches are by and large supplementary. But many conflicting results were also revealed. It appears to indicate largely the problems in data obtained by a more standardized method since a strict standardization can only be achieved at the cost of limiting its scope to a very limited spectrum ignoring all other important aspects in explaining a given phenomenon in a natural setting. The current report, therefore, has utilized fieldwork information very heavily. Discussions based on the results of the base-line survey and the laboratory water safety testing have been rather limited.

In concluding this report, we will present the major findings of the research on a chapter-by-chapter basis. The discussion will then proceed to their policy implications with an effort to formulate recommendations to upgrade government water sanitation policy on the community level.

B. Summary of the Findings

1. *Water Supply Systems*

Since the early 1970 s, there has been a rapid change in potable water supply systems all over the country with the government effort to provide safe water to the entire population. In cities, city water supply systems have been expanded greatly to cover the residential areas of the poor and high altitude areas. In rural villages, the installation of simple piped water supply systems was the results of the programme of "safe water for all". The impact of these programmes is readily noticed in all of our study communities. Traditional water sources such as wells, springs and brooks were mostly replaced by modern systems, either city water or simple piped systems although some still use old sources. For the purposes of bathino and clothes washing, diverse sources of water are in use in the sample rural villages. The status of water use in terms of water source in each study community is summarized in Table IX−1.

Table IX−1 : **Per cent distributions of water uses by water source***

	No. of sources	City water	Simple piped	Well	Under−ground	Others
Kuro (no. of households : 164)						
drinkin	165	63.6	36.4	−	−	−
cooking	164	63.4	36.6	−	−	−
bath	162	64.2	35.8	−	−	−
cloth wash	161	64.0	36.0	−	−	−
Tong−jom (no. of households : 129)						
drinkin	152	−	75.0	13.8	7.9	3.3
cooking	146	−	78.1	7.5	6.2	4.1
bath	147	−	75.5	6.8	5.4	12.2
cloth wash	157	−	68.8	7.6	7.0	16.6
Sam−pyung (no. of households : 139)						
drinking	201	−	44.8	54.2	0.5	0.5
cooking	201	−	44.8	54.2	0.5	0.5
bath	172	−	47.7	51.2	0.6	0.6
cloth wash	164	−	45.1	54.3	0.6	−
Myung−ji (no. of households : 101)						
drinking	110	−	89.1	0.9	10.0	−
cooking	102	−	96.1	1.0	3.0	−
bath	144	−	67.4	0.7	9.7	22.2
cloth wash	153	−	62.7	0.7	3.3	33.3
Tosan (no. of households : 157)						
drinking	158	−	98.1	−	−	1.9
cooking	158	−	98.1	−	−	1.9
bath	257	−	59.5	−	33.5	7.0
colth wash	238	−	63.0	−	27.3	9.7

* : No response is excluded.

The reasons for this multiple use of water sources are diverse. The shortage of water supplied through the prime source, whether it is a simple piped system or a city water system, may be listed as the most important reason. The shortage of water supply is often

caused by the waste of piped water on the part of some resident households. The second major reason may be related to the traditional life style of women and children. Communal wells and other laundry places functioned as the most important informal place of social gathering for women, and children used to play and swim in brooks, while cleaning their bodies in the summer. Many people, particularly in Sam-pyung, think that well water is superior to simple piped water in terms of essential quality. In some communities, the safety of simple piped water is grossly suspect.

2. *Laboratory Tests of Water Quality*

The results of a series of microbiological examinations of water samples reveal little hygienic bacteriological problem in the study communities throughout the one year period of testing, although the management of various water sources and water supply systems are not at all adequate. The only exception is the case of Sam-pyung where a significant general bacterial contamination of all water samples was noticed during the summer months. One important limitation in the sampling framework is that samples do not cover all the major drinking water sources in the study communities.

The amount of coliform is found to have been considerable in the April samples from simple piped systems in Myung-ji and Sam-pyung and also in the April sample from a communal well in Sam-pyung. For other samples including those from other water sources and in-house taps, no coliform contamination was noticed. Any plausible explanation is difficult to provide for this peculiar observation.

A considerable amount of coliform was found in water samples from a water jar kept in the kitchen in Tosan throughout the entire year of testing except January. No water sample was collected from water containers in other areas, but a similar observation may well be expected in other study communities where water containers are heavily used to store drinking water.

According to an examination of mineral content, a relatively high content of physiologically active elements, Ca and Mg, was found in water samples from a simple piped water source in Myung-ji. No unusually significant content was noticed in water samples from other sources.

3. *Water Use and Management*

Simple piped water supply systems have been installed in all research communities since the early 1970 s. In Kuro, the systems are small scale and privately owned. Because of extreme poverty, there is rarely any sanitary consideration given to the quality of water among the simple piped water users in Kuro. In other villages, all systems are communal, and most of them were installed through the government decree under Saemaul Undong and are supposed to be maintained by an ad hoc village committee. It was found, however, that the construction was improper and the maintenance committee has rarely functioned as it was supposed to.

All the potable water supply systems are known to have been exposed to various kinds of contamination factors. But, villagers have paid little attention to water contamination due to the improper management and use of water and water supply systems, even in the villages where the quality of potable water is highly suspected by the villagers themselves.

There is an overall shortage of water in the study communities. Accordingly there has developed a pattern of stepwise water use. It was commonly observed that kitchen towels and chopping boards are washed with water used for dish washing or rinsing. The shortage

of water supply is mainly explained by the fact that all simple piped supply systems constructed in the research areas are of relatively small scale and accordingly, the amount of water produced by the source is not enough to be used for a variety of purposes without constraint. The stepwise use of water is also thought to have been developed in the traditional setting as a way to save water and labour for water fetching. Unregulated use of simple piped water aggravates the situation further in most villages. It was often observed with the households in a favourable location that in-house water taps are left open while the water overflows or it is not in use.

The traditional custom of keeping a big water jar in the kitchen to store potable water is still prevalent in many rural villages. Our laboratory test results and fieldwork observations clearly suggest that the custom has important adverse sanitary implications.

Diverse patterns of water use were noticed in the research communities. The major factors affecting the water use behaviour of a village were found to have been the housing and kitchen structure, the type of subsistence economy, the availability of and accessibiity to water sources, and the villagers' perception of sanitation. Some patterns of water use, such as visiting wells or springs for laundry and the preparation of drinking water for night use, are mostly explained by the traditional life style and family system.

4. *Sanitary Conditions and Behaviour*

Our research communities have shown somewhat distinctive sanitary problems. Sam-pyung suffers greatly from industrial pollution caused by the establishment of industrial zones in the nearby Onsan area. Industrial discharge has affected the village through the air and a river which runs into the Onsan Sea. As well, the development of pig farming in a neighbouring village is known to have deteriorated the environment of Sam-pyung by polluting ground water coming from the mountain. Tong-jom has been affected by external factors also, but through different mechanisms. Pollution prone facilities, a lead muck reservoir, a night-soil treatment plant and a slaughter house, were constructed in or around the village either by the Tae-baik city government itself or with its permission. These are the direct causes of the serious contamination of air and brook water, and also responsible for various kinds of sanitary problems in the village.

Living conditions and its change within a community account for most hazards in environmental sanitation in Kuro and Myung-ji. Poor public toilet systems, inadequate drainage, population congestion and the diffusion of carbon monoxide gas into the air by the heavy use of *yontan* for fuel are listed among the major factors in environmental pollution in Kuro. On the other hand, the introduction of green-house farming and the resultant rising standard of living explain most of the newly emerging environmental and sanitary problems in Myung-ji. The phemonenon of cultural lag appears to be particularly relevant in explaining the current environmental deterioration of Myung-ji.

Various community sanitation improvement programmes introduced through the Saemaul Undong are not evaluated as being very successful so far as our research communities are concerned. In Tosan, the majority of houses have installed new sanitary toilets, but virtually all of them are now turned into storage areas because the new toilets have no utility for traditional pig raising on Jeju Island. Simple in-house drainage systems were tried in Tosan and Tong-jom, but the systems are found to have created more problems than the old ones. In Myung-ji, new sanitary toilets have been disseminated rapidly during the fieldwork period. It was, however, noticed that the new toilet does not match at all with the poor housing structure there. New sanitary toilets are known to create new

sanitary problems such as night-soil disposal, the leaking of night-soil into the ground and poor ventilation in Myung-ji and Sam-pyung. Because of difficulties in maintenance, underground drainage systems are avoided in most rural areas.

People in all study communities are concerned about environmental pollution. Nevertheless, their concerns have rarely been transformed into any participatory action to improve their community environment. What is important in this context is that concepts of community or family sanitation have not been developed. Also, it was observed that problems in sanitary behaviour in the communities studied are very serious.

5. *Health Conditions and Behaviour*

The prevalence of illness is reported to have differed greatly among the study communities according to the base-line survey. The lowest morbidity was seen in Sam-pyung and the highest in Kuro and Myung-ji, contrary to what is expected from various health indicators. The validity of this observation is questionable. It is very likely that the morbidity pattern was distorted because of crude measurement. Illness was determined in the survey through the subjective reporting of the respondents rather than through medical examinations.

The perception of illness or the concept of health differs considerably between the research communities, and it explains the large part of their reported morbidity differences. Such differences in perception appear to have developed in connection with the kind of occupational activity, the accessibility to modern health services and the demographic composition of a community. Keen interest in physical conditions were noticed in among urban labourers and green-house farmers, for whom missing work meant a substantial loss of income. On the other hand, ordinary farmers whose labour can be easily replaced paid less attention to their health. Also, the accessibility to modern health services and a higher proportion of young labour force seem to have been positively associated with sensitivity to health issues on the community level. Overall relationships between various community variables and morbidity are presented in Table IX-2.

Although the reporting of morbidity is of questionable quality, the major patterns of illness still stand out, and the pattern of each study community was largely accounted for by the sanitary problems observed in the village. Also, occupational diseases were widely noticed. In all research communities, diverse medical and health services are adopted for the cure of ailment. But, the pattern of reliance on varying medical and health services differs considerably from one community to another depending on the average standard of living, the accessibility to various services, people's perception of health and the social characteristics of its population.

6. *Water Source and Health*

According to the laboratory test of water samples, water-borne or related diseases were not likely to be observed to a significant degree except in Sam-pyung, and no difference in morbidity could be expected as a result of water source in all the study communities. The results do not support what has been discerned from the anthropological fieldwork. But, an additional analysis based on the base-line survey suggests significant differences in morbidity by water source in all the study communities except Kuro. The analysis, though problematic in many ways, is also found to be useful in generating some important hypotheses on the relationship between the perception of water quality and water use behaviour in current community settings in Korea.

Table IX-2 : **Summary of community variables**

Community :	Kuro	Tong-jom	Myung-ji	Sam-pyung	Tosan
Relative morbidity	high	middle	high	low	middle
Chronic conditions	middle	high	low	low	low
Most important primary health care institution	pharmacy	clinic & hospital	pharmacy	nothing dominant	clinic & hospital
Major health institution	clinic & hospital	clinic & hospital	clinic & hospital	clinic & hospital	clinic & hospital
Reliance on herb medicine or shaman practice	negligible	negligible	prevalent	extensive	prevalent
Major occupational activities	blue collar & low income service work	mining & up-land farming	green-house & rice farming	traditional rice farming	sea diving, fishing & farming
Medical insurance	Some are in medical aid programme	miners are medically insured	almost none	almost none	almost none
Relative living standard	middle	low	high	high	low
% aged 15-34	40.1	33.7	37.5	40.0	32.1
% aged 50+	10.9	12.9	16.0	23.7	10.6
Major potable water sources	city water & simple pipe	simple pipe & well	simple pipe	well & simple pipe	simple pipe

C. Policy Recommendations

It is obvious now that Korean communities possess diverse problems in environmental

and water sanitation. The major aspects of the problems can be roughly grouped into three categories ; environmental contamination by external forces, sanitary problems due to community factors, and problems in individual perceptions and behaviour. In the following, recommendations based on the findings of this research are presented to upgrade government policies toward environmental improvement and water sanitation on the community level.

1. ***External Forces*** :

– The sanitary environment of the survey communities has been seriously affected by the major processes of societal transformation since the early 1960 s which were characterized by urbanization, industrialization and economic development. Particularly, environmental sanitation has deteriorated greatly as a result of government initiated or government supported industrial development programmes.

It is, therefore, advised that the government incorporate environmental sanitation aspects into various national and local development programmes such as industrial zoning, housing development for the poor, population displacement and regional development. For this, the concept of equitable living environments should be adopted and its indicators developed. Further, the evaluation of a programme's effect on environmental sanitation is requested to be conducted in all the affected areas based on these indicators.

– Although Saemaul Undong includes a programme to improve the sanitary environment of the village, it has partially contributed to creating many new sanitary problems by disrupting the traditional ecological system. Also, poor integration of various programme items has produced unexpected ill effects.

Accordingly, it is advised that the government change the current regional development (Saemaul Undong) strategies which emphasize visible effects, an isolated programme –by–programme approach, and government centred administration and management. The new orientation needs to include consideration of ecological perspectives, life styles of the people and integrated development perspectives. Participation of the resident population in the formulation and implementation of various programmes is of particular importance because of its educational as well as practical functions. Through this, the government would be able to develop many alternative programmes which can be selected by the given village in view of their particular needs. Also, the villagers would become aware of the sanitary implications of various programmes in the process. To develop an integrated synthetic approach, critical evaluations of the current regional development programmes from socio–cultural perspectives are recommended.

– The role of the government in environmental sanitation is negatively perceived in the research communities. Most people believe that the government tries to conceal the seriousness of environmental pollution in their respective villages to protect pollution industries or the interests of captalists.

To repeal such a negative perception of the ordinary people toward the government's role in environmental health and sanitation, it is recommended that the government set up an independent investigation organization which guarantees the participation of a representative from the allegedly affected area in a given investigation and their right to collect evidence and to request the nomination of trusted investigators.

2. ***Community Factors*** :

– The installation of simple piped water supply systems was evaluated as being successful in providing safe water in a larger quantity to the resident population. But most systems installed in the research communities are not considered to be well protected from external contamination since these were not constructed strictly following the government instructions. Also, the management of the systems is either nominal or totally improper.

Therefore, more positive government roles and involvement are needed in the dissemination or installation of simple piped water supply systems. This would include rigorous supervision of the system installation and the provision of all logistic support for management of the system. (There is no need to mention technical problems in the management of simple piped systems in rural Korea since it was already discussed extensively in other studies.)

– Insufficient water supply is a chronic problem in all the study communities and this acts as a major factor constraining sanitary considerations in water use. Although the amount of water supplied has been increased to a significant degree with the replacement of old water sources by new simple piped systems, this increase is not enough to meet coped the increasing demand for water that has accompanied the rising standard of living. To save water, there has developed a stepwise water use behaviour. People use once used water for washing kitchen towels, chopping boards and dishes.

This observation leads us to a recommendation that the government's policy on safe water supply to the entire population should divert its attention from the number of piped water supply system installations to increasing the volume of safe water supply in order to cope with an increasing demand for water as a result of the betterment of living conditions and changing life styles.

– The rising standard of living, the introduction of so-called new sanitary toilets and the increased use of water in the research communities have not been accompanied by the concomitant development of the necessary infrastructure to deal with various resultant conflicts and ill effects. Accordingly, many new, sometimes very serious, sanitary problems have been created with this line of development. For example, the increasing consumption of water necessitates the construction of a new sanitary drainage system.

In other words, there is a need to develop an infrastructure to deal with the emerging sanitary problems of a community created by social change. More specifically, it is suggested that water supply, drainage systems, waste disposal and night-soil disposal be dealt with as essential, inter-related, components of a community sanitary system.

– Sanitary and health problems differ greatly from one survey community to another. The type of major economic activity, the geographical location, the accessibility to and availability of various medical and health services, the population composition, the standard of living, and the degree of air or water pollution due to industrial discharge are listed as the major factors explaining the differentials.

The observation confirms the usefulness of adopting a community as a unit of health delivery and management. It would be of great help if the government were to identify the major patterns of community health problems to develop diverse alternative health and sanitary programmes, anyone of which could be adopted by individual communities based on their specific experiences and problems.

3. ***Behavioural Factors*** :

– In some research communities, there is often a shortage of water supply in a part of the community through the unconstrained use of water by the households located near the water source. For example, water is running all day in some houses, while others have none. The major reason for this lack of self control in water use is rooted in the traditional idea of water and its use. Also, few care what the problem is, even if in–house stand–pipes are out of order and water flow can not be stopped.

A programme is, therefore, necessary to propagate a new conception of water and its use which would be appropriate for the use of piped water supply systems. It should emphasize public mindedness in water use.

– Although people worry a great deal about the deterioration of the sanitary environment, they do not appear to have sufficient knowledge of the causes and effects of environmental deterioration. Little sanitary concern is found among the villagers in their everyday life including kitchen work, toilet behaviour, food preparation and water use. Also, inaccurate perceptions of the nature of diseases and disease treatment was widely observed.

It is, thus, recommended that educational programmes on environmental sanitation including water sanitation be developed as an integral part of Saemaul Undong. The mobilization of the mass media for sanitary education is expected to contribute greatly to changing the sanitary behaviour of individuals. The family planning education model can be applied without much revision to this proposed sanitary education. The contents of the educational programme should be based on the findings from community level studies on the sanitary and water use behaviours of individuals.

– The use of water containers in the kitchen to store potable water is found to have been an important cause of biological contamination of drinking water in Korean communities. In addition, there is a tendency in some communities, even when water endency in some communities, even when water safety is highly questioned, for people to judge the quality of water by its taste only and the prefer natural well or pump water to treated simple piped water.

The proposed sanitary education programme should have it an important aim to teach implications of everyday water use behaviour for health and the proper ways judge the qual of water.

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