EVALUATION REPORT
of the
KOREA POTABLE WATER SYSTEM PROJECT

CARE

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USAID

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CHAPTER I

INTRODUCTION

Program Goals and Objectives

The primary goal of the Korea Potable Water systems program was to reduce the incidence of water-borne diseases in participating villages by:

1) Providing an adequate supply of potable water accessible to the majority of the local population.
2). Establishing an effective local system of maintenance and monitoring of the potable water system.
3) Improving the Knowledge, Attitude and Practice of residents of the participating villages concerning the use of potable water.

The purpose of this study will be to assess the effectiveness of the program according to these three criteria.

Description of the Program

The Korea Potable Water Systems Program is a two part program in which one project (OPG #AID/ASIA-G-1198) is a jointly funded project of AID and CARE initiated in 1976, and the second project is a wholly funded CARE project.

The construction of 14 sophisticated potable water systems in towns with lower income populations of 5,000 to 10,000 people was accomplished by the Program. Previously households in these towns were forced to rely on primitive private wells, community wells, or water from nearby streams or rivers.

These sources are often contaminated and are a primary cause of minor as well as major health problems.

CARE, in conjunction with County and Provincial government personnel, selected six sites per year in 1977 and 1978 and one each in 1975 and 1976.

Construction materials and water system equipment for six project sites were purchased with funds provided by CARE and AID, while materials and equipment for the other six sites were purchased by CARE funds. Participating County governments were responsible for all labor costs involved in the construction of each project. All construction material and system equipment was examined by CARE engineers to insure that it met approved specifications.

To assist the County in recruiting unskilled labor needed to construct the system and in collecting installation fees for individual house connections, a steering committee of elected local representatives was formed. In some communities this committee was disbanded after the system was completed. In other towns it continued to function, assisting in management of the system.

Households that elected to be connected to the system did so at their own cost. The systems were constructed so as to insure that any household in the area encompassed by the system could be provided with potable water.

Each household which subscribes to the system should pay a monthly fee determined by a water meter which they also pay for. Money collected from these fees is used to offset monthly

charges for fuel, maintenance, and administrative personnel for the system.

To insure that once potable water is piped into the house it remains pure until it is consumed, CARE also provided for education classes on the value of potable water and proper household and environmental sanitation at all but the first two sophisticated water project sites.

A series of six meetings were conducted at several locations in each town so as to be accessible to all potential subscribers to the system. These education meetings were begun as soon as an agreement to construct a system was finalized and were conducted over a span of approximately six months to one year. An appropriate education booklet was prepared, printed and distributed by CARE to participants at education meetings. Towels and wrapping cloths were also distributed to participants as attendance incentives.

Each water system constructed under this program is composed of a pumping station, a filtration unit, a chlorination unit, holding tank, and a distribution system.

After each system was completed, it was officially transferred to the County governments whose responsibility it is to insure proper maintenance and operation.

CHAPTER II

EVALUATION METHODOLOGY

The two main foci of analysis in this study are (1) the water plant operators and other system administrative personnel and (2) the water users.

To assess the quality and reliability of water service and the adequacy of administrative controls, CARE collected and analyzed monthly maintenance reporting sheets prepared by water operators. After each water system was completed, CARE gave a year's supply of the report forms to the water operator who, at the end of the month, filled them out and sent them to the CARE office. These reports contain information on hours of daily operation, fuel consumption, water treatment, system maintenance, frequency and type of breakdowns, and fees collected as well as operating expenses. (See Appendix 'C' for copies of the report forms.)

A total of 36 monthly reports were collected from five different project sites selected for analysis in this study. The names of these projects as well as the number of reports submitted and the project completion date are listed below.

Project Name	Number of Reports Submitted	Project Completion Date
Weolchon	12	12/76
Daekwangri	9	8/77
Jindong	7	5/78
Naesu	3	9/78
Danyang	5	12/78

Two of these five projects, Danyang and Naesu, were among the six projects funded jointly by CARE and AID. Daekwangri, Jindong and Weolchon were funded by CARE alone. All five projects follow the same general arrangement and were constructed with the County governments and local populace under the same conditions.

To assess changes in the sanitary habits of the affected population concerning the use of water, initial and evaluative surveys were conducted in selected participating towns. The initial surveys were conducted before either the CARE education program or water service began. The evaluative surveys were conducted following the completion of the education program and after two or more months of regular piped water service.

According to the original evaluation design, evaluative surveys were to have been conducted in the same towns where an initial survey had been accomplished earlier. However, due to unexpected delays in construction and the exigencies of the evaluation schedule this matching was not always possible. This discrepancy from the original plan should not significantly detract from the validity of conclusions drawn from comparisons of initial and final data from different towns. Because of the identical cultural tradition and homogonous nature of the Korean people, rural houses are remarkably similar in design and household patterns and customs are essentially the same throughout the country. Therefore, we believe that the Knowledge, Attitude and Practice (KAP) of the people can be generalized from one area to the next.

Initial surveys were conducted at five project sites. The names of these sites and the months in which the surveys were conducted are as follows:

Initial Survey Sites	Initial Survey Dates
** Daekwangri	11/76
** Jindong	11/76
+ Eumsong	1/78
+ Danyang	1/78
Shindeung	1/78

Evaluative surveys were also conducted at five sites, as follows:

Evaluative Survey Sites	Evaluative Survey Dates	
Daekwangri	4/78(A)	2/79(B)
Jindong	7/78(A)	2/79(B)
+ Naesu	2/79	
+ Danyang	1/79	
Weolchon	1/79	

As indicated above, evaluative surveys were conducted twice at Daekwangri and Jindong. The evaluative survey conducted in April 1978 in Daekwangri and in July 1978 in Jundong will hereafter be referred to as survey (A). The second evaluative

** Following the 1976 initial surveys conducted in Daekwangri and Jindong the survey questionnaire design was changed significantly. Consequently, the number of comparisons that can be made between initial survey data from Daekwangri and Jindong and initial and final data from the other evaluation sites are limited.

+ OPG funded projects/An evaluative survey in Naesu was substituted for one at Eumsong because of delays in the start of operations at the latter site.

surveys were done to obtain some measure of the effect of maturation on the water use habits of a population that had been exposed to the CARE sanitary education program. These second surveys conducted in February 1979 in both Daekwangri and Jindong will be referred to as survey (B).

An evaluative survey was also conducted in the town of Weolchon where there was no education program in order to judge the effect on water use habits of maturation alone. Weolchon is the control group for this study. It resembles the test sites in every respect except that there were no sanitary education classes conducted there.

Closed-end questionnaires were used in the construction of the survey questionnaire. (See Appendix B for English Translation of the questionnaires.)

The survey was conducted by trained interviewers hired on a part-time basis from the Planned Parenthood Federation of Korea. The survey interviews were done at individual households. Care was taken to preserve the anonymity of the respondents.

Initial survey interviews were conducted on a random basis with surveyors stopping at every fourth house. In the evaluative survey interviews were conducted only at households connected to the system.

The size of the samples taken in all initial and evalautive surveys are listed below:

Initial Survey Site	Sample Size
Daekwangri	133
Jindong	105
Eumsong	219
Danyang	260
Shindeung	201
	918

Evaluative Survey Sites	Sample Size
Daekwangri(A)	130
Jindong(A)	160
Danyang	144
Naesu	140
Daekwangri(B)	93
Jindong(B)	106
Weolchon(Control)	140
	913

Total Sample Size Initial and Evaluative Combined ... 1831

CHAPTER III

RELIABILITY OF THE SYSTEM

Supply

Hours of Daily Plant Operation:

In the agreements between the County governments and CARE, it was planned that the systems would be operated 24 hours per day.

Of the five systems evaluated here, three are operated on a 24 hour a day basis.

Project Name	Average Hours of Daily Operation
Daekwangri	24
Jindong	6
Weolchon	12
Naesu	24
Danyang	24

In Jindong the system is operated from approximately 7 a.m. to 10 a.m. and 3 p.m. to 6 p.m. Jindong township officials maintain that the limited daily service is a result of problems in collecting sufficient operating funds since not all homes have meters yet. Suscribers are charged for a minimum volume of assumed water use. It is difficult to persuade the people to pay more than this minimum base because they fear that some people may be overcharged to compensate for excessive water use by others. The financial situation of the water system in Jindong will be discussed in greater detail in Chapter IV.

In Weolchon water is supplied from approximately 6 a.m. to 6 p.m. Here the operator claims that the pump is not strong enough to deliver enough water to meet the demand of subscribers

on a 24 hour a day basis. If this were entirely the case, one would expect the operator to keep the pumps running on a continuous basis to provide as many hours of water service as possible. However this plant averages only 15 pumping hours per day. We suspect that the fact the back-up pump has been out of order for eight months and the fear of the operator of overtaxing the single remaining pump is another unmentioned reason for limited daily service. Also, full 24 hour service would probably require another full-time operator and the concomitant expenses for salary which would raise water rates.

Frequency and Type of Major Breakdowns

In the 36 months of operation at the five systems evaluated there was a total of 17 days without water according to monthly reports. An average of slightly less than one day's plant down time for every two months. Additionally there were major repairs that did not necessitate an interruption of water service. Table '1' in Appendix 'A' gives a detailed listing of the type, frequency and duration of major repairs by month, for each system.

A composite list for all five systems of the type and frequency of major repairs is given below.

Repair Service Required	Number of Times Service Required
Pump Motor Repair	6
Pump Repair	5
Filter Unit Servicing	3
Valve Repair	6
Chlorinator Repair	1
Pipe or Tank Leak Repair	3

Problems with the pump or its associated motor were the most frequent incidents and were experienced by every system. More detailed data on the type of pumping problem, i.e. on the make of motor and pump, part broken and type of repair required were not available. These data would be useful in developing pump specifications, an inventory list of spare parts required, and in knowing the kind of maintenance training operators requi Nevertheless, the findings do underline the importance of the back-up pump provided by CARE.

The list of breakdowns recorded by the operators is not al inclusive. In personal interviews with operators it was reveal that not all system malfunctions are reported.

In Daekwangri for example operators disclosed that about 10% of the water pumped through the system has been lost throug leakage, thought to be in the water mains running to the individual houses. They also acknowledged that the master mete has been out of order for a year. This does not lessen the ability of the system to supply water but does impede the monitoring function. In Weolchon the back-up pump has been out of order for eight months but its breakdown was not entered in the monthly reports.

There seems to have been a tendency among some operators to leave unreported those problems which they could not handle yet which did not interrupt the daily delivery of water to subscribers.

Water Quality

Regularity of Chlorine Treatment:

All five of the evaluation sites report regular use of chlorine in piped water treatment. However, only three of these five sites regularly test the residual chlorine level of the water to check whether the amount of chlorine they are using is sufficient to maintain the government standard level of water quality. According to ROK government regulations, there must be a residual chlorine level in the whole of the water distribution system of about 0.2 ppm (parts per million).

At the two sites where residual chlorine tests are not conducted, Weolchon and Jindong, independent tests conducted by CARE revealed that at the time of the test the chlorine level was insufficient to maintain government water quality standards.

In Jindong there are at least two reasons contributing to the failure to maintain an adequate chlorine level. First, the operator deliberately keeps the chlorine dosage low because of complaints from local residents of the chlorine smell in the water. Also, the water is chlorinated in Jindong at the pump house before it is pumped up to the filtration unit and storage tank. In other systems the water is chlorinated after it passes through the filtration unit. Thus the chlorine in the Jindong water is already considerably dissipated by the time it reaches the storage tank.

Neither the Jindong nor the Weolchon operator have a residual chlorine test kit.

The remaining three sites report that they maintain a

residual chlorine level of between 0.2 ppm and 0.5 ppm. These reports were confirmed in Daekwangri and Naesu by spot tests conducted by CARE. However in a test conducted in Danyang CARE found a residual chlorine level of 0.1 ppm. In contrast to Jindong, several residents here complained to a CARE field worker that they could not smell chlorine in the water and were worried about its potability.

In Daekwangri the residual chlorine test is done approximate once a week. In Naesu and Danyang operators report that they do the test daily.

Results of Chemical and Biological Tests

Chemical or biological tests performed by the county are rare in the projects evaluated. In Danyang and Weolchon no such tests have been conducted by the county after the systems began operation. One test has been conducted in Naesu and Jindong and two in Daekwangri since their respective opening dates.

Project	Length of Operation	Number of Tests by the County
Weolchon	29 months	none
Daekwangri	21 months	two
Jindong	12 months	one
Danyang	5 months	none
Naesu	8 months	one

A number of independent tests have been conducted by CARE on the tap water, raw water, filtered water, and water in the storage tank. A summary of the results of these tests can be found in Table '2' of Appendix 'A'. A summary of the tap water tests results are listed below.

Project	Tap Water Tests Results	
	Adequate	Inadequate
Weolchon	2	1 (most recent)
Jindong		1
Daekwangri	1	
Danyang		1
Naesu	1	

In Weolchon and Jindong the tap water was found to be substandard because of positive coliform traces. In Danyang the negative finding was due to detection of nitrite nitrogen in the water. CARE believes that the source of this pollution in Danyang may be a privy located not far from one of the well boreholes. CARE recommended that this privy be removed.

The fact that the tap water at these three sites was found to be substandard, underlines the importance of maintaining adequate residual chlorine levels. In Daekwangri where chlorine treatment was properly administered, the tap water was found safe for drinking even though the tests showed raw and filtered water unfit for consumption.

CHAPTER IV

ADMINISTRATION

Operation and Maintenance

Operation and maintenance of the potable water system is primarily the responsibility of the treatment plant operators. The operators responsibilities usually include opening and shutting of valves, chlorination, routine maintenance of plant buildings and equipment, most repairs of the system and procurement of repair items.

In Daekwangri, Naesu and Danyang where there is a 24 hour water service there are two operators. As a rule, there is one person in the pump house at all times. In Woolchon and Jindong where there is limited daily water service there is only one operator.

Of the eight operators maintained by the five systems under consideration here, one had previous experience as a water treatment plant operator. That man, an operator from Daekwangri, worked for eight years at an American army water treatment plant in Seoul.

Seven of the eight operators reported receiving some training for their jobs. The degree of training varied considerably from one town to another. Below is a brief description of the extent of training received by the operators in each locale.

Naesu: The senior operator spent approximately one week in the provincial capital observing the operation of the water treatment plant there. The assistant operator in Naesu is being trained by the senior operator.

Danyang: Both operators received 15 days of on the job training by experienced water operators from a nearby town.

Daekwangri: The two operators received an orientation of several hours at the county office regarding government rules and regulations relating to piped water systems.

Weolchon: The single operator in this town received 40 days training from the contractor for the project.

Jindong: The operator here received no training per se in the operation and maintenance of the system. However, he did have experience operating irrigation pumps for his village and was a foreman in the construction of the potable water system.

The average salary per operator is approximately $153.00 per month, ranging from a high of $186.00 per month to a low of $124.00 per month.

In addition to the operators, each system employs other personnel to round out its administrative staff. Below is a list of all administrative personnel employed to operate the water system in each town as of April 1, 1979.

Project Name	Total Number of Staff	Descriptive Job Titles
Naesu	3	1 system operator 1 assistant system operator 1 bill collector
Danyang	5	2 system operators 2 pipe repairmen/bill collectors 1 electrician
Jindong	2	1 system operator 1 bill collector
Daekwangri	4	2 system operators 2. pipe repairmen/bill collectors
Weolchon	3	1 system operator 1 pipe repairman/bill collector 1 bookkeeper

In Daekwangri, Danyang, and Weolchon, pipe repair in the distribution system is not the responsibility of the operators but of plumbing assistants who double as water bill collectors. In Danyang the two men employed for this function have plumbing experience. Their counterparts in Daekwangri and Weolchon have no experience in this field and are receiving on the job training from the system operators.

If a breakdown occurs that cannot be serviced by the operators or their plumbing assistants, help can be requested from the County governments. However, there is a general reluctance among operators to contact the County. In some cases the contractor can be called on for assistance. As the contractors are usually based in larger cities away from the project this can involve considerable delays as demonstrated by the experience of Danyang, where it took over two months for a pump motor to be serviced and returned. As a result, most all repairs are attempted by water system personnel in the town.

Billing and Collection

In four of the five evaluated sites, billing for water use is based on individual house meters. The one exception is Jindong where only 250 out of 435 households have a meter. Here billing is based on a flat rate.

All homes do not have a meter in Jindong due to a dispute that arose between the contractor and local residents over an unexpected rise in the price of meters. The contractor originally agreed to provide meters for $15.00 each. However, after 150 meters had been installed inflation and new taxes raised

the price approximately $2.00. One hundred more residents purchased a meter at this price but the remainder refused to do so claiming that it was a violation of the original contract. County officials report that the dispute has been resolved and the remaining meters will be installed during 1979.

In Jindong, Weolchon, and Naesu water rates were set by the local water committees. In Danyang and Daekwangri the rates were set by the County governments.

Table 3 in Appendix 'A' lists the average monthly water bill per town for the months covered in this evaluation. To give some indication of the variation in water costs between towns, the base water rate for households in each site is listed below:

Project Name	Base Water Rate
Danyang	$0.60 for first 10$m^3$ of water
Naesu	$2.00 for first 10$m^3$ of water
Weolchon	$1.00 for first 5$m^3$ of water
Daekwangri	$1.40 for first 10$m^3$ of water
Jindong	$1.25 flat monthly rate charged to all households

Fees are collected monthly in all five towns by a paid member of the piped water system administrative staff.

Only Daekwangri reported any problem in collecting water fees from system subscribers. In January through March 1979, Daekwangri collected only 74% of the fees due them. Local officials say that this is an abnormal situation due to a short hiatus in bill collecting that occurred between the termination of one bill collector and the hiring of another. They expect to catch up in the bill collections within a month or two.

Financial Management

Although bill collection is handled uniformly by the local water system staff, in the towns of Daekwangri, Danyang and Jindong all collected funds are disbursed by the County governments. In the two remaining sites of Weolchon and Naesu, disbursement of funds is the responsibility of the local water committee.

Fees Collected versus Operating Expenses

According to monthly operational reports and personal interviews with operators and town and county officials, Daekwangri, Danyang, and Jindong are operating at a regular monthly deficit. Only in Weolchon and Naesu do water fees collected meet or exceed operational expenses.

In the case of Jindong, a county official estimated that the monthly deficit runs to about $124.00 per month. In Daekwangri, if 100% of water fees are collected, income covers or comes very close to covering expenses in the summer when water consumption is high but runs in the red the rest of the year. One of the bill collectors from Daekwangri said that the deficit in the non-summer months averages $80.00 per month. By far the largest regular deficit occurs in Danyang. Since this system began operation in December of 1978 expenses have exceeded income by an average figure of $700.00 per month.

On the plus side, the largest surpluses have been recorded by Weolchon. They have reported an average monthly surplus of approximately $200.00 in eleven out of the past twelve months. In Naesu income is roughly equalling expenses.

In Naesu and Weolchon surplus money is kept by the local

water committees in a contingency fund for the water system. The Weolchon water committee is planning to purchase a new and larger pump motor with their extra money. In those towns where there is a deficit, the deficit is covered by funds taken from the county government's "General account".

Table 4 of Appendix 'A' provides a breakdown of monthly expenses as recorded in the montnly reports of each town.

There is an inverse relationship that exists between water system fees and water system costs. The towns with the highest system costs are charging the lowest fees for their water. Although the situation in Jindong is unique because of the absence of individual house meters, it appears that in Danyang and Daekwangri water rates are being kept at artificially low levels. In Danyang this was acknowledged by the township chief who said that the town and county officials regard the water system as a "welfare project" for local residents.

The extremely high deficit in Danyang is further aggravated by the unusually high labor costs in that town. Five men are employed there to do the same job that four men do in Daekwangri and only three men do in Naesu.

CHAPTER V

ACCESS TO WATER AND VOLUME OF WATER USE

The majority of the populations in each of the evaluation sites participates in the piped water system. The table below lists the percent of the eligible population in each town that was connected to the system as of May 1, 1979 and the official opening date for each system.

Project Name	Percent of Eligible Subscribers Connected	System Opening Date
Weolchon	75%	12/76
Daekwangri	65%	10/77
Jindong	74%	5/78
Naesu	60%	9/78
Danyang	61%	12/78

Over 92% of the interviewed population in the evaluative survey conducted by CARE said they always get all the water they need from the piped source. This is a considerable improvement over the results from baseline surveys when only 71.7% of the respondents said their main water source was sufficient all the time. In initial surveys conducted in Jindong and Daekwangri, a full 33% of the population said their water source had dried up at least once in the past two years.

Even though the supply of water is much more dependable with the piped system than previous water sources, consumption of water has not greatly increased with the advent of the piped system. Average per capita water use before installation of the system in evaluated sites was 36.8 liters per day, excluding use

for laundry. Following installation of the system, the results from evaluative surveys show per capita consumption increased to only 40.9 liters per day. The increase per person being so small it was difficult to attribute the additional water consumption to any particular category of water use.

For the purpose of this study, water consumption is divided into five categories: water used for drinking, washing food, doing laundry, washing one's body and doing dishes. The extent of reliance on piped water in each of these categories will be discussed more fully in Chapter VII, Section B.

CHAPTER VI

ATTENDANCE AT CARE SANITARY EDUCATION MEETINGS

Since the following sections will discuss the impact of the CARE Sanitary Education Program on the KAP of water users, it is important to note the number of interviewees in each town who attended the education meetings. The table below lists the number and percent of those who attended at least one meeting and the number and percent of those who attended three or more meetings. A more detailed listing of the frequency of attendance at these meetings can be found in Table 5 of Appendix 'A'.

Survey Site	Total No. Surveyed	Attended at least One meeting	Attended three or more meetings
Daekwangri (A)	130	29 (22%)	15 (12%)
Jindong (A)	160	63 (39%)	22 (14%)
Daekwangri (B)	93	61 (66%)	2 (2%)
Jindong (B)	106	94 (89%)	12 (11%)
Danyang	144	134 (93%)	74 (51%)
Naesu	140	73 (52%)	47 (34%)

A total of six meetings were held in each town

The best overall attendance occurred in Danyang. In the two sets of evaluative surveys conducted in Daekwangri and Jindong a greater percent of the interviewed population had at least <u>some</u> exposure to the education program in the second survey. However, very few persons in either locale in the second survey attended more than two meetings.

The considerably higher attendance rates in Danyang and Naesu over Jindong and Daekwangri are a reflection of improve-

ments instituted in the education meetings during the life of the program.

Daekwangri and Jindong were among the very first sites where CARE Sanitary Education meetings were held. Based on this early experience, CARE initiated a number of changes in the program to increase the number of returning participants. Color slides were shown to make the meetings more interesting. Also wrapping cloths and towels were distributed at the meetings to returning participants as incentives to regular attendance. Attendance cards were also used in later meetings to insure that incentives were distributed only to those who had earned them through participation.

CHAPTER VII

KNOWLEDGE, ATTITUDE AND PRACTICE OF BENEFICIARIES REGARDING SANITARY WATER USE

When a water supply system is introduced into a town, the water-use habits of the system beneficiaries can be expected to undergo change brought about by the more accessible and dependable source of water. Any educational programs undertaken to instruct the people on proper sanitation and water use can also be expected to have an effect. This portion of the evaluation will measure the extent of change that occurs in water-use habits and will attempt to judge which habits change as a natural development of the installation of the system and which ones require education to develop.

The KAP (Knowledge, Attitude and Practice) surveys conducted by CARE were directed toward water-use habits that through tradition, culture, and expediency have become common and accepted in the Republic of Korea. The following sections will focus on sanitary conditions in the tap water area, water storage, water treatment, dishwashing habits, and the extent of piped water use.

For reasons of clarity, completeness, and visual presentation of data as well as ease in reading the text, most statistical tables are place in Appendices at the rear of the text. Summaries of the data highlighting significant findings are presented in the narrative portion of the report.

A. Improvements in the Tap Water Area

Water taps, pumps, and wells in Korean households are usually located in small courtyards outside the house proper.

In some homes the area surrounding the pump, tap, or well may be covered by cement and there may be either a cement or pipe drain. In other homes, the cement area surrounding the water source may be cracked creating potential collection spots for bacteria and there may be no drainage system at all - merely mud.

Installation of piped water connections to participating homes brought some concomitant improvements to the tap water areas but the number of improvements was not dramatic. (See Table 6, Appendix 'A'.)

The most significant number of improvements were made in the drainage systems. Approximately 10% more households had adequate pipe or cement drainage in the evaluative survey than they did in the initial survey.

When it comes to "planned improvements" in the tap water area after having been connected to the system, 12.7% of the households in the evaluative survey expressed an intention to improve both drainage and the cement area around the tap. (See Table 7, Appendix 'A'.) There were a lesser number of people who planned to install kitchen or shower taps in their homes.

In both accomplished and planned improvements in the tap water area it is interesting to note that Weolchon, the education control group, registered as many if not more improvements than towns that had received sanitary education and had been encouraged to make these changes. Whether residents of Weolchon made these improvements for sanitation

reasons or simply to improve the appearance of their courtyards, kitchens, etc., was not investigated in this study. In any event education seems to have had a marginal effect in prompting change in this area.

B. Extent of Piped Water Use

For consideration in this study, water use was divided into five categories: water used for drinking, washing food, doing laundry, washing ones' body, and doing dishes. After connecting to the piped water system, over 90% of the survey population in each town used piped water as their primary or only source in four out of the five categories. The one exception to this otherwise heavy dependence on piped water was in doing laundry. Only 50.0% of the survey population used piped water for washing laundry. The remainder of the interviewed housewives still follow the traditional Korean custom of going down to the river to do their wash.

In Table 8 of Appendix 'A' the individual town tabulations for each of the five categories are listed. Judging from these figures, participation in the sanitary education program does not seem to have influenced the extent of piped water use by the affected population. In each of the five categories the degree of piped water use by Weolchon residents (Control group) was comparable to water use in towns where the education program was implemented. In the case of Daekwangri and Jindong it is notable that

the use of piped water increased significantly in the time between the first and second evaluative surveys. The categories in which those increases occurred and the corresponding percent of increase in each case are listed below.

Evaluation Site	Water-Use Category	Percentage of Increased Use Between Initial & Final Survey
Daekwangri	Washing Food	16%
	Doing laundry	75%
	Dishwashing	22%
Jindong	Drinking	22%
	Washing body	32%

The above figures indicate a tendency on the part of the system beneficiaries to increase their dependency on piped water as time goes on.

C. Water Storage

Having been dependent on pump or well water in the past, Korean housewives have traditionally, as a matter of convenience, collected and stored water for household use rather than draw and use the water as they need it. The water containers sometimes hold as much as 400 liters of water each. In the series of initial surveys conducted in 1978, 86.6% of the households reported that they stored water for daily use.

With the introduction of the piped water system, continuation of this traditional custom becomes counter-productive to one of the main purposes of the potable water system. Because

chlorine loses 30% of its disinfection effect after 24 hours and 70% after 48 hours, the long storage times accompanying the use of large containers renders the chlorination of the water useless. In addition, the storage containers are often left uncovered and are not properly disinfected making the water susceptible to recontamination.

Among the homes at the test sites in the evaluative survey, 73.3% of the respondents reported storing piped water. Thus in the time between the initial and evaluative surveys there was an increase of 13.3% of the interviewed population who said they use water directly from the tap without storage ("draw and use"). A close look at the statistics in Table 9 of Appendix 'A' shows that the percentage of increase in this category was greatly deflated by the responses from Jindong. In both the first and second evaluative surveys conducted in Jindong only 1.9% of the population said they "draw and use" water. The unusually high rate of water storage in this town is no doubt a result of the limited, daily water service there. The same is true of Weolchon where an unusually high percentage of the population (98.6%) also said they regularly store water. If we eliminate the Jindong figures from consideration with the other test sites, the percentage of those who "draw and use" piped water rises dramatically from 26.9% to 40%. Isolating the statistics from Danyang alone, the site with the most education participants, there is an increase in the "draw and use" category from 13.9% in the initial survey to 44.1% in the evaluative survey. Thus, in the three sites where 24 hour

service is available, education did have some impact on this habit.

In the homes from the test sites of the evaluative surveys that do store water, 43.3% put covers on the storage containers. This rate is better than that of the control group, Weolchon, where only 26.3% cover their water, but, not as good as the findings from the initial survey when 64.5% said they used covers on their water. There is no readily apparent reason for this discrepancy between the initial and evaluative surveys. The average amount of water stored in all types of receptacles was 56.5 liters in the initial survey and 89.7 liters among the test sites in the evaluative survey. The apparent increase in the amount of water stored at the time of the evaluative survey is largely a reflection of the heavy storage habits in Jindong.

If we again factor out Jindong, the average amount of water stored at test sites is only 62.2 liters. As might be expected, the amount of water stored is much greater in Jindong and Weolchon, the two sites where there is not 24 hour a day service. In Jindong the average amount of water stored is 144.8 liters, in Weolchon it is 217.1 liters. The greater amount of water storage in Weolchon can probably be explained by the fact that in addition to the limited daily availability of the water, the water there also becomes cloudy for one or two days after heavy rains during which time local residents are hesitant to use it for drinking. Weolchon draws its water from a nearby river. When it rains heavily, the river rises over its usual branks and the river becomes muddied. This muddied water overloads the filter unit in Weolchon and the water comes through to the faucet cloudy.

Therefore, in anticipation of bad weather, residents keep an extra large volume of water on hand.

The most popular mehtod of cleaning storage containers in initial and evaluative surveys was to use cold water with sand or a rough cloth. Over 59% of the respondents used this method in the initial evaluation and 51.3% of the test site population in the evaluative survey reported using the same method (See Table 10, Appendix 'A'). The two preferred methods suggested in the CARE education meetings gained no new adherents in the time between surveys. In both the initial and evaluative surveys only about 2% of the interviewed populations reported using either of the CARE recommended methods: 1) pour in some boiling water and shake around the container once a week or more: 2) clean with hot water and an accepted detergent (Trio or Pong Pong).

D. <u>Water Storage/Faucet Tubes</u>

A habit related to water storage that CARE field workers sought to discourage was the use of long plastic or rubber tubes that often run from the mouth of the tap faucet to the brim of the storage container. When the container is filled, the end of the tube is allowed to touch the water surface creating a possible source of water contamination. As this habit is created with the introduction of faucets, data on this situation was collected only in the evaluative surveys. As the table below shows, 52.4% of the interviewed population at test sites follow this practice.

Evaluation Site	Tube Touches Water Surface	Tube Does Not Touch Water Surface	Total
Daekwangri (A)	22 (18.3%)	98 (81.7%)	120 (100%)
Jindong (A)	122 (78.2%)	34 (21.8%)	156 (100%)
Danyang	48 (35%)	89 (65%)	137 (100%)
Naesu	73 (43%)	55 (43%)	128 (100%)
Daekwangri (B)	52 (55.9%)	41 (44.1%)	93 (100%)
Jindong (B)	69 (67%)	34 (33%)	103 (100%)
Total	386 (52.4%)	351 (47.6%)	737 (100%)
Woolchon (Control)	92 (66.7%)	46 (33.3%)	138 (100%)

Although the rates of correct responses from the test sites are mixed, the overall average of correct responses from these towns is 14.3% greater than that of the control site Woolchon, seeming to indicate that the education program did have some impact. This conclusion is reinforced by a comparison of Danyang, where education classes were best attended, and the control group Woolchon. The interviewed population in Danyang recorded over 31% more correct responses than did the Woolchon group.

E. Consumption of Untreated Well or Pump Water

As most of the piped water users maintain their old pumps or wells as a back-up or supplement water source, CARE asked respondents in the initial (1978 conducted) and evaluative surveys whether they would drink untreated well water straight from the well or pump.

The responses from the test sites in the evaluative survey shows a 23.3% increase over initial survey figures in the number of people who would "never" drink well or pump water without prior treatment. (See Table 11 Appendix 'A'.)

A uniform contrast between test and control sites in the

evaluative survey is upset by the atypical responses from the town of Naesu. In Naesu the percentage of people who say they would "never" drink untreated well water is more than 25% lower than the corresponding average of the other test sites combined. This aberration is most likely a reflection of the high opinion that many Naesu residents have of their local well water. At the time the evaulative survey interviews were conducted, a number of respondents as well as the water plant operator commented on the quality of well water in Naesu.

It is also interesting to note in the cases of Daekwangri and Jindong, the significant drop during the interval between the first and second evaluative surveys of the number of people who said they "always" drink untreated well water. In Daekwangri the percent of the population who said they "always" drink untreated well water dropped from 30.8% to 5.4%. The corresponding decrease in Jindong went from 18.6% to 1.9%. This change may be due to a greater percentage of education program participants that were interviewed in the second survey or may simply reflect a greater concern for the quality of water following the installation of a piped water connection. However, noting that maturation did not produce similar results in the control town of Weolchon (29.5% "always" drink untreated well water) the former rationale seems more plausible. Overall it is safe to assume that the education program did have some impact on this practice. A glance at the

significant changes in the statistics for Danyang (the only town for which a direct comparison can be made to the initial survey) are a positive illustration of this impact. For example, in the initial survey only 13.3% of the population said they would "never" drink untreated well water. In the evaluative survey over 48% answered thusly.

F. Treatment of Well or Pump Water

In a related question to the one discussed above, people who said they "never" or only "sometimes" drink untreated well water were then asked if they boiled the water before drinking it.

A distinction was made between summer and winter because Korean women as a rule boil more water for drinking in winter due to the ready availability of a heating source,[1] and because the hot liquid is a comfort in cold weather.

In comparing initial and evaluative survey results, the test sites in the evaluative survey recorded a 22.4% increase in the number of people who "always" boil their water in summer and a corresponding 12.2% increase for winter. (See Tables 12/13 Appendix 'A'.)

1. In the unique Korean "ondol" heating system, the same fire which is used for cooking in the kitchen is also used to heat the adjacent room(s) in traditional style homes, through a system of flues under the floor. In winter this fire is kept burning at all times for house warmth.

In Naesu the statistics for summer treatment of water are abnormal when compared to other education test sites. The percentage of people who say they "always" boil their water in summer is 25.6% lower than the corresponding average from remaining test sites combined. (Test sites, excluding Naesu report 54.8% always boil well water in summer - In Naesu 29.2% always boil well water in summer) As in the above section, we believe that the abnormal responses are more a testament to the quality of local well water than a reflection of the impact of the sanitary education program. Inspection of the results from Weolchon at first glance seem to indicate that maturation may be responsible for the improved statistics regarding water treatment. In both summer and winter the percentage of people who always boil their well water in Weolchon is comparable to similar percentages from the education test sites. However, in considering these statistics one must remember that the question under discussion here discounts people who don't treat well water at all. In Weolchon the number of people who treat their well water is smaller than most of the education test sites. (See Table below of the percentage of people in evaluative survey sites who "always or sometimes" treat well water.)

Evaluation Site	Percentage of people who always or sometimes treat well water
Daekwangri (A)	69%
Jindong (A)	81%
Danyang	94%
Naesu	64%
Daekwangri (B)	94%
Jindong (B)	98%
Weolchon	70%

Therefore, although the percentages of people who boil water in summer and winter are similar to some test sites they are generally not as significant since they represent a smaller portion of the total interviewed population in most towns. On balance, the education program does seem to have had a positive effect here.

G. Dishwashing/Use of Heated Water

In the 1978 initial surveys and the evaluative surevys, respondents were asked if they heated water to do their dishes, a habit CARE education meetings encouraged.
In both surveys, the responses remained fairly constant.
By far the most common response was "it depends on the season". Over 81% of the interviewees gave this answer in the initial survey and 76.1% of the population in the test sites answered the same in the evaluative surveys. (See Table 14 Appendix 'A'.) Most Korean housewives heat water for dishes in the winter and do not in the summer.
There was no appreciable difference between the test villages and the Weolchon control group on this question.
The only notable difference that did occur was between the first and second evaluative surveys done in Daekwangri and Jindong. In each locale there was over a 30% increase in the second survey in the number of people who "sometimes" heat water to do their dishes.

H. Dishwashing/Kind of Detergent Used

CARE education field workers tried to discourage the use of body soap and the popular local detergent Hie Tie when doing dishes and encourage the use of other more acceptable detergents. Hie Tie contains the chemical compound Akylbenzoic sulfate which does not dissolve in water. It is potentially harmful to the body as it accumulates. Tabel 15 in Appendix 'A' shows that the CARE education program did have some impact in this area. In the initial survey, 36.2% of the population used no soap, body soap or Hie Tie to do dishes all or some of the time. By the time of the evaluative survey only 19.5% of the test site respondents fit into one of these three categories, while 41% of the control population used one of the three undesirable methods. The percent of people who reported regularly using the detergents Trio or Pong Pong (practices recommended by CARE) increased by only 7.2% from 4.1% in the initial survey, to 11.3% in the evaluative survey.

By far thy most common response in both initial and evaluative surveys was "use Trio or Pong Pong only when oil has been used". Over 60 of the interviewees gave this response in both surveys.

It is interesting to note again the uniform pattern of change that occurred between the first and second evaluative surveys in Daekwangri and Jindong. In both locales there were decreases of approximately 12% in the number of people who use Hie Tie and almost as large a decrease in the number of people who regularly use Trio or Pong Pong. The decreases in both

cases were balanced by an increase in the number of people who use an acceptable detergent only when oil is used.
In the case of Hie Tie use at these two sites, it seems that most housewives were sufficiently impressed with the danger of that detergent to discontinue its use permanently. The improvement in this column in the second evaluative survey is most likely a reflection of the greater amount of education participants reached in the second survey.
In the latter case, the drop in the percentage of people always using an acceptable detergent and the corresponding increase in the people who use detergent only when dishes are greasy appears to indicate a return to pre-education practices. The percentage of the population in the second evaluative surveys who report always using detergents dropped to a level similar to that recorded in the initial surveys. The temporary bulge in the "always" use category of the first evaluative survey shows that housewives for a time followed the recommendations of CARE field workers and then lapsed back into the more popular practice of using detergent only when oil was used. Whether this relapse was due to an inadequate appreciation of the importance of regular detergent use, a lack of money to buy detergent for regular use, or simply a lazy indisposition toward using detergent all the time was not investigated here.
An interesting follow-up on this issue would be to conduct a similar second evaluative study in towns where education

was well-attended and see if the same situation evolved.

In summary, CARE field workers were successful in discouraging some harmful practices but had a less impressive record in converting housewives to the most preferred methods.

CHAPTER VIII

OCCURANCE OF SICKNESS AMONG PIPED WATER USERS AND NON-PIPED WATER USERS

Both in the initial 1978 surveys and the evaluative survey respondents were asked how many times in the past two weeks the had been occurances in their households of four common illnesse that can be caused by water-borne bacteria. The four illnesses investigated were diarrhea, fever, stomachache, and stomachache with vomiting.

Table 16 of Appendix 'A' indicates that overall there were no significant changes in the trends of sickness in the initial and final surveys.

Given the relatively small size of the sample and the difficulty in controlling the many variables that can affect a person's health, it is not possible to draw any conclusions from this data.

CHAPTER IX

CONCLUSIONS, SUMMARY, RECOMMENDATIONS

CONCLUSIONS

In judging the effectiveness of the Korea Potable Water Program we should look back for a moment at the three program objectives:

1. An adequate supply of potable water accessible to the majority of the people
2. An effective local system of maintenance and monitoring of the system
3. Improved KAP of the affected population regarding the use of potable water.

In meeting the first objective the program has been largely successful. In each of the towns evaluated, 60% or more of the local population is connected to the system and there is a pattern of increase in the number of subscribers as time goes on. Even though a 24 hour system does not exist in every town, nearly 100% of the survey respondents report that the water service is adequate to meet their needs always or most of the time. Further, maintenance reports show that the supply of water is dependable. Repairs of the system requiring interruption of service are few. However, turning to the quality of water provided, indicators are not as positive. In three of the five sites evaluated, spot tests found that chlorine treatment was inadequate and the quality of water substandard. This brings us to the second objective: maintenance and monitoring of the system. Although operators have a fair record in keeping the

system in operation (i.e. keeping water running at the taps), there is either a lack of concern about the quality of water or an inability to maintain water quality through proper chlorine dosage. Likewise the County governments do not appear to have a priority concern towards water quality. Few if any water quality tests were conducted by the Counties once the system was put into operation. The primary concern of the County officials and local operators alike seems to be the availability of water.

Funding for operation and maintenance of the system is not a problem since the systems are backed by the County governments. However, the subsidy of the systems that occurs in Daekwangri, Danyang, and Jindong may be creating an unnecessary strain on the County budgets. The experience of Naesu and Weolchon shows that the systems can be self-supporting. Further it doesn't appear that the fees charged by Naesu and Weolchon are a burden to local residents as neither system reports any difficulty in collecting these fees.

Regarding changes in the KAP of the system beneficiaries, sanitary conditions and health habits relating to the use of potable water have improved since the water systems have been installed.

Physical improvements in the drainage and the tap water area seem to be developments prompted by installation of house connections. Installation of the faucet connection provides an opportunity and incentive to make other improvements.

Some changes are a direct result of education. It is safe to conclude that exposure to the CARE education meetings

led to a greater awareness of the dangers of untreated water and certain cleansing detergents, improved treatment of non-potable water, some improved storage practices, and increased direct use of tap water rather than storing before use.

The study also indicates that the more education meetings are attended the more improvements in KAP are observed. It is no coincidence that Danyang which had the best attendance record at education also consistently recorded a higher percentage of the local population practicing correct water-use habits.

It is difficult to draw any firm conclusions about the effect of maturation on the water habits of participants because of the relatively poor attendance rates at the two sets of evaluative surveys in Daekwangri and Jindong. Nevertheless, the findings from these two sites do exhibit some interesting trends. The second evaluative survey responses show marked improvements on several occasions, indicating that perhaps the higher percentage of education participants reached in the second survey did remember part of their lessons from the year before. Most of the improvements noted however, were qualified improvements. For example, the percent of the population that "always" drinks untreated well water declined but the balancing increase did not accrue to the "never" drink untreated water category but rather to the sometimes" drink it column. Perhaps if education classes had been better attended, properly understood ,correct practices would have been more firmly embedded in water-use habits.

The extent of piped water use seems to develop independently

of education. Except in the case of doing laundry, the survey data revealed that if piped water is available, people will use it to the exclusion of less convenient water sources.

SUMMARY

This study shows that a sanitary education program can have a signficant effect on the KAP of system beneficiaries regarding the use of potable water and that the longer the exposure to the education the greater the change. The report also clearly demonstrated that it is necessary to take steps to insure the competency of those who operate the system so as to guarantee that the water provided will indeed be potable.

RECOMMENDATIONS

1. While recognizing the value of education to proper water-use habits, emphasis must be placed on the necessity of regular attendance at education meetings for the education to have any effectiveness. In any future projects of this type, education meeting attendance should be encouraged by incentives, such as were distributed in the latter stages of this program, and a lively, colorful presentation.

To insure that incentives are awarded only to those who have earned them by participation, the attendance card system used in this program was effective. In this system, participants were given an attendance card at the first of the meetings they attended. At the end of every education meeting, the CARE field worker entered the date of that meeting on the card of everyone

present. Incentives were distributed on the basis of the number of meetings entered on each person's card.

As the content of the material presented is elementary, strong communication skills should be considered more important for field workers than an extensive formal education.

Heavy use should also be made of slides and other visual aids.

2. It can be seen from the present study that a comprehensive operator-training program should be instituted. This program should not only teach operators the mechanics of plant operation but also the importance of delivering potable water to the water users.

3. Water quality tests should be conducted on a much more regular basis to check on plant performance and stress the importance of water quality. The water operators should be trained to collect water samples and be required to deliver these samples to County or Provincial analysis centers every two months.

APPENDIX 'A'

TABLE 1

FREQUENCY & DURATION OF PLANT BREAKDOWNS

Project Name	Months Under Consideration	Date of Breakdowns	Days of Downtime	Reason for Plant Shutdown	Repairs Not Requiring Plant Shutdown	Time Required for Repairs Not Causing Plant Shutdown
Daekwangri	Aug.77-Jan.78 Jan.79-Mar.79	Mar.1979	2	Water main leak	---	---
		Dec.1977	2	Bearing replacement-pump motor	---	---
		Nov.1977	-	---	Pump motor repair	5 days
		Oct.1977	-	---	Bearing repair-pump motor	2 days
		Sept.1977	-	---	Foot valve repair	1 day
		Aug.1977	-	---	Filter unit repair	not reported
		Aug.1977	-	---	Pump motor repair	3 days
		Aug.1977	-	---	Bearing repair-pump motor	1 day
Woolchon	Mar.78-Mar.79	Dec.1978	1	Valve repair	---	---
		Oct.1978	-	---	Pump motor repair	not repaired after 6 months
		Aug.1978	6	Filter unit repair	---	---
		June 1978	2	Electricity failure	---	---
		June 1978	2	Tank & filter cleaning	---	---
Jindong	Aug.78-Oct.78 Dec.78-Mar.79	Mar.1979	-	---	Chlorinator repair	1 day
		Feb.1979	-	---	Foot valve repair	1 day
		Jan.1979	-	---	Foot valve repair	2 days
		Sept.1978	-	---	Pump repair	5 days
		Aug.1978	-	---	Pump repair	not reported
		Aug.1978	-	---	Foot valve repair	not reported
Daeyang	Dec.78-April.79	Feb.1979	-	---	Water main leakage	2 days
		Jan.1979	2	Pump repair Foot valve repair	---	---
		Dec.1978	-	---	Pump motor repair	2½ months
Haesu	Feb.79-April 79	Feb.1979	-	---	Pump bearing replacement	not reported
		Feb.1979	-	---	Storage tank leakage	not repaired after 3 months

APPENDIX 'A'

TABLE 2

SUMMARY OF WATER QUALITY TEST RESULTS

Project Name and Date of Water Sample	Water Sample Source	Chemical Items		Biological Items	
		Adequate	Inadequate	Adequate	Inadequate
Mr[illegible]chon					
March 7, 1979	Raw Water	X			X
	Tap Water		X		X
August 7, 1978					
August 7, 1978	Filtered Water		X		X
	Storage tank Water (Chlorinated)	X		X	
	Tap Water	X		X	
May 4, 1977	Storage tank water		X		X
	Tap Water	X		X	
March 16, 1977	Raw Water		X		X
Jindong					
January 9, 1979	Tap Water	Not Tested	Not Tested		X
	Raw Water	Not Tested	Not Tested	X	
August 11, 1978	Filtered Water		X		X
	Raw Water (Chlorinated)	X		X	
July 14, 1977	Raw Water		X		X
Daekwangri					
July 6, 1978	Filtered Water		X		X
	Raw Water		X		X
	Tap Water	X		X	

Cont.../...2.

APPENDIX 'A' - TABLE 2 - Continued

Project Name and Date of Water Sample	Water Sample Source	Chemical Items		Biological Items	
		Adequate	Inadequate	Adequate	Inadequate
Danyang					
April 28, 1979	Tap Water		X	X	
October 13, 1978	Raw Water	Not Tested	Not Tested		X
Haesu					
April 28, 1979	Tap Water	X		X	

APPENDIX 'A'

TABLE 3

AVERAGE MONTHLY WATER FEES COLLECTED (HOUSEHOLDS)

Project Name	Month-Year	Number Hours Daily Water Delivery	Average Monthly Household Bills
Daekwangri	Jan. 1978	24 hours	$2.25
	Dec. 1977	24 hours	$1.88
	Nov. 1977	24 hours	$2.26
	Oct. 1977	24 hours	$2.38
	Sept.1977	24 hours	$2.30
	Aug. 1977	24 hours	$2.30
Woolchon	Mar. 1979	12 hours	$1.66
	Feb. 1979	12 hours	$1.66
	Jan. 1979	12 hours	$1.45
	Dec. 1978	12 hours	$2.38
	Nov. 1978	12 hours	$2.15
	Oct. 1978	12 hours	$2.15
	Sept.1978	12 hours	$1.66
	Aug. 1978	12 hours	$1.35
	July 1978	12 hours	$1.66
	June 1978	12 hours	$1.55
	May 1978	12 hours	$1.66
	April 1978	12 hours	$1.45
	Mar. 1978	12 hours	$1.45

Project Name	Month-Year	Number Hours Daily Water Delivery	Average Monthly Household Bills
Jindong	Mar. 1979	6 hours	$1.24
	Feb. 1979	6 hours	$1.24
	Jan. 1979	6 hours	$1.24
	Dec. 1978	6 hours	$1.24
	Oct. 1978	6 hours	$1.24
	Sept.1978	6 hours	$1.24
	Aug. 1978	6 hours	$1.24
Danyang	April 1979	24 hours	$1.56
	Mar. 1979	24 hours	$1.52
	Feb. 1979	24 hours	$1.20
	Jan. 1979	24 hours	$1.06
	Dec. 1978	24 hours	$1.02
Naesu	April 1979	24 hours	$2.07
	Mar. 1979	24 hours	$2.07
	Feb. 1979	24 hours	$2.07

APPENDIX 'A'

TABLE 4

MONTHLY OPERATION COSTS

Project Name	Average Hours of Daily Water Service	Date	Chemical Costs	Fuel Costs	Labor Costs	Repair Costs	Total Monthly Cost
Daekwangri	24	Mar. 1979	$103.00	$193.00	$1,060.00*	$322.00	$1,678.00
	24	Feb. 1979	$ 82.00	$175.00	$ 493.00	$236.00	$ 986.00
	24	Jan. 1979	$ 91.00	$251.00	$ 520.00	---	$ 862.00
	24	Jan. 1978	not reported	$273.00	$ 372.00	---	$ 645.00
	24	Dec. 1977	not reported	$321.00	$ 372.00	$107.00	$ 800.00
	24	Nov. 1977	$ 78.00	$229.00	$ 372.00+	$ 58.00	$ 737.00
	24	Oct. 1977	$ 86.00	$197.00	$ 279.00	$ 35.00	$ 597.00
	24	Sept.1977	$180.00	$349.00	$ 252.00	$ 86.00	$ 867.00
Weolchon	15	Mar. 1979	$ 20.00	$240.00	$ 383.00	---	$ 643.00
	15	Feb. 1979	$ 20.00	$233.00	$ 351.00	---	$ 604.00
	15	Jan. 1979	$ 20.00	$240.00	$ 351.00	---	$ 611.00
	15	Dec. 1978	$ 20.00	$254.00	$ 351.00	$ 41.00	$ 666.00
	15	Nov. 1978	$ 20.00	$175.00	$ 372.00	$ 12.00	$ 579.00
	13	Oct. 1978	$ 20.00	$217.00	$ 269.00	---	$ 506.00
	12	Sept.1978	$ 20.00	$193.00	$ 269.00	---	$ 482.00
	9	Aug. 1978	$ 35.00	$130.00	$ 269.00	$369.00	$ 803.00
	12	July 1978	$ 35.00	$218.00	$ 269.00	---	$ 522.00
	8	June 1978	$ 35.00	$161.00	$ 269.00	$ 24.00	$ 489.00
	10	May 1978	$ 35.00	$182.00	$ 269.00	---	$ 486.00
	8	April 1978	$ 20.00	$217.00	$ 269.00	---	$ 506.00
Jindong	6	Dec. 1978	$ 10.00	$233.00	$ 225.00	$ 8.00	$ 476.00
	6	Oct. 1978	$ 10.00	$233.00	$ 225.00	---	$ 468.00
	6	Sept.1978	$ 10.00	$317.00	$ 225.00	$ 8.00	$ 560.00
	6	Aug. 1978	$ 10.00	$285.00	$ 225.00	$ 8.00	$ 528.00

* Reflects pay for added personnel needed to repair water main break

\+ Man added to payroll

Cont.../...2.

APPENDIX 'A' - Table 4 - Continued

Project Name	Average Hours of Daily Water Service	Date	Chemical Costs	Fuel Costs	Labor Costs	Repair Costs	Total Monthly Cost
Danyang	24	April 1979	$ 20.00	$455.00	$ 819.00	$ 48.00	$1,342.00
	24	Mar. 1979	$ 20.00	$337.00	$ 819.00	---	$1,176.00
	24	Feb. 1979	$ 20.00	$ 61.00*	$ 819.00	---	$ 900.00
	24	Jan. 1979	$ 20.00	$ 57.00*	$ 819.00	---	$ 896.00
	24	Dec. 1978	$ 20.00	$ 74.00*	$ 819.00	$451.00	$1,364.00
Maesu	24	April 1979	--- **	$231.00	$ 414.00+	$ 8.00	$ 753.00
	24	Mar. 1979	--- **	$270.00	$ 186.00	---	$ 456.00
	24	Feb. 1979	--- **	$270.00	$ 186.00	$103.00	$ 559.00

* These figures do not include electricity costs

** Chlorine was bought in bulk when system was opened

\+ Man added to payroll

APPENDIX 'A'

TABLE 5

FREQUENCY OF ATTENDANCE AT SANITARY EDUCATION MEETINGS

		Number of Meetings Attended								
		Never, but heard of meetings	1	2	3	4	5	6	Never heard of meetings	Total #/%
Number	Daekwangri(A)	22(16.9%)	10(7.7%)	4(3.1%)	5 (3.8%)	2(1.5%)	2(1.5%)	6(4.6%)	79(60.8%)	130/100%
and	Jindong(A)	47(29.4%)	27(16.9%)	15(9.4%)	8 (5.0%)	3(1.9%)	4(2.5%)	7(4.4%)	50(31.3%)	161/100%
%	Danyang	9(6.3%)	27(18.8%)	33(22.9%)	28(19.4%)	13(9.0%)	13(9.0%)	20(13.9%)	1(0.7%)	144/100%
of	Maegu	25(17.9%)	11(7.9%)	15(10.7%)	15(10.7%)	9(6.4%)	6(4.3%)	17(12.1%)	42(30.0%)	140/100%
Respondents	Daekwangri(B)	15(16.1%)	27(29.0%)	32(34.4%)	2(2.2%)	0(0.0%)	0(0.0%)	0(0.0%)	17(18.3%)	93/100%
	Jindong(B)	8(7.5%)	49(46.2%)	33(31.1%)	9(8.5%)	3(2.8%)	0(0.0%)	0(0.0%)	4(3.8%)	106/100%
	TOTAL #/%	126(16.3%)	151(19.5%)	132(17.0%)	67(8.7%)	30(3.9%)	25(3.2%)	50(6.5%)	193(24.9%)	774/100%

APPENDIX 'A'

TABLE 6

CONDITIONS IN THE TAP WATER AREA

Category of Response (1)		A	B	C	D	A,B	A,B.C	A.C	B,C	E	Total Responding
% of Respondents	Initial Survey	44.0%	63.7%	0.7%	0.3%	37.9%	0.4%	0.4%	0.4%	27.8%	680
	Evaluative Survey (Test Sites)	54.6%	62.6%	11.3%	0.0%	37.8%	9.4%	0.7%	1.0%	29.5%	764
	Evaluative Survey (Wool-Chon Control)	56.5%	63.7%	5.7%	0.0%	47.1%	4.3%	0.7%	0.7%	30.4%	138

Category of Response (1)

A = Drainage system that is not cracked
B = Cement area around the tap that is not cracked
C = A tap in the kitchen
D = A tap in the shower room
E = None of the above

APPENDIX 'A'

TABLE 7

PLANNED IMPROVEMENTS IN THE TAP WATER AREA AFTER INSTALLATION OF PIPED WATER CONNECTIONS

Category of Response(1)		Only A	Only B	Only C	Only D	A,B	A,B,C	A,C	B,C	E	F	Total Responding
% of Respondents	Evaluative Survey Test Sites	4.8%	2.8%	1.2%	0.4%	12.7%	0.5%	0.1%	0.0%	64.9%	9.6%	772
	Evaluative Survey Weolchon Control	2.1%	2.1%	0.0%	0.0%	17.1%	0.0%	0.7%	0.0%	70.7%	6.4%	140

Category of Response (1)

A = Cement drainage system
B = Cement area around the tap
C = A tap in the kitchen
D = A tap in the shower room
E = None of the above
F = Want to make 1 or more of the above improvements, but can't due to lack of money

APPENDIX 'A'

TABLE 8

EXTENT OF PIPED WATER USE

% of Respondents		For Drinking	For Washing Food	For Laundry	For Washing the body	For Dish-washing	Total Responding
	Daekwangri (A)	99.2%	77.5%	17.5%	91.7%	75.8%	120
	Jindong (A)	78.8%	94.2%	48.7%	67.3%	94.9%	156
	Danyang	99.3%	90.7%	19.3%	95.0%	93.6%	140
	Naesu	91.3%	91.3%	74.6%	97.8%	94.2%	138
	Daekwangri (B)	100%	93.5%	92.5%	100%	97.8%	93
	Jindong (B)	100%	93.5%	47.6%	99.0%	97.1%	105
	TEST SITES AVERAGE	94.8%	90.1%	50.0%	90.4%	92.2%	752
	Weoichon (Contol)	95.0%	98.6%	22.3%	99.3%	99.3%	139

APPENDIX 'A'

TABLE 9

WATER STORAGE

Initial Survey

Category of Response (1)		1	2	3	4	5	6	7	Total Responding
% of Respondents	Eumsong	7.3%	19.6%	17.4%	0.0%	0.9%	14.2%	40.6%	219/100%
	Danyang	13.9%	22.5%	18.9%	0.0%	7.3%	8.8%	28.6%	259/100%
	Shindeung	18.9%	32.8%	20.9%	3.5%	13.4%	3.0%	7.5%	201/100%
	AVERAGE	13.4%	24.9%	19.1%	1.1%	7.2%	8.7%	25.6%	679/100%

Evaluative Survey

Category of Response (2)		1	2	3	4	5	6	7	8	Total Responding
% of Respondents	Daekwangri (A)	40.0%	23.1%	14.6%	0.8%	0.0%	10.0%	11.5%	0.0%	130/100%
	Jindong (A)	1.9%	90.0%	1.9%	2.5%	1.3%	0.6%	0.6%	1.3%	160/100%
	Danyang	44.1%	24.5%	21.7%	0.0%	4.9%	0.7%	4.2%	0.0%	143/100%
	Naesu	43.2%	33.1%	7.9%	0.0%	2.9%	0.0%	13.0%	0.0%	139/100%
	Daekwangri (B)	29.3%	19.6%	41.3%	0.0%	2.2%	3.3%	4.3%	0.0%	92/100%
	Jindong (B)	1.9%	75.2%	8.6%	3.8%	6.7%	0.0%	3.8%	0.0%	105/100%
	Test Site AVERAGE	26.7%	44.3%	16.0%	1.2%	3.0%	2.4%	6.2%	0.2%	769/100%
	Woolchon (Control)	1.4%	32.0%	1.4%	7.9%	5.8%	0.0%	1.4%	0.0%	139/100%

Category (1)
1 = Draw and use it
2 = Store it in a plastic tank
3 = Store it in a bucket
4 = Store it in a concrete tank
5 = Store it in an earthen jar
6 = Store it in a metal jar
7 = Other

Category (2)
1 = Draw and use it
2 = Store it in a plastic tank
3 = Store it in a bucket
4 = Store it in a concrete tank
5 = Store it in an earthenjar
6 = Store it in a metal cauldron
7 = Store it in iron cauldron
8 = Other

APPENDIX 'A'

TABLE 10

STORAGE CONTAINER DISINFECTION

Category of Response		1	2	3	4	5	6	7	8	9	10	11	Total Responding
% of Respondents	Initial Survey	2.4%	6.4%	0.2%	0.0%	11.6%	1.7%	59.3%	6.6%	11.5%	0.3%	0.0%	653/100%
	Evaluative Survey (Test Sites)	1.2%	7.8%	0.1%	0.1%	14.6%	1.3%	51.3%	1.2%	22.2%	0.1%	0.1%	752/100%
	Evaluative Survey (Weol-chon Control)	0.0%	1.4%	0.0%	0.0%	5.0%	0.0%	92.1%	0.0%	1.4%	0.0%	0.0%	139/100%

Category of Response:
1 = Never disinfect
2 = Clean with Hie Tie detergent, laundry or body soap
3 = Pour in some boiling water and shake around container once a week or more often
4 = Pour in some boiling water and shake around container less than once a week
5 = Clean with cold water and Trio (liquid detergent) or Pong Pong (liquid detergent)
6 = Clean with hot water and Trio or Pong Pong
7 = Clean with cold water and sand or rough cloth
8 = Clean with hot water and sand or rough cloth
9 = Not applicable - No storage container
10 = Other method
11 = Don't know/No response

APPENDIX 'A'

TABLE 11

CONSUMPTION OF UNTREATED WELL/PUMP WATER

Initial Survey

		Never	Always	Sometimes	No Response	Total Responding
% of Respondents	Eumsong	9.9%	48.7%	41.4%	0.0%	203/100%
	Danyang	13.3%	28.1%	58.6%	0.0%	256/100%
	Shindeung	31.3%	24.6%	44.1%	0.0%	195/100%
	TOTAL	18.2%	33.8%	48.0%	0.0%	654/100%

Evaluative Survey

		Never	Always	Sometimes	No Response	Total Responding
% of Respondents	Daekwangri (A)	38.3%	30.8%	30.8%	0.0%	120/100%
	Jindong (A)	48.1%	18.6%	33.3%	0.0%	156/100%
	Danyang	48.6%	5.7%	45.7%	0.0%	140/100%
	Naesu	20.3%	35.5%	44.2%	0.0%	138/100%
	Daekwangri (B)	38.7%	5.4%	55.9%	0.0%	93/100%
	Jindong (B)	54.3%	1.9%	43.8%	0.0%	105/100%
	TOTAL	41.4%	16.3%	42.3%	0.0%	752/100%
	Weolchon (Control)	32.4%	29.5%	38.1%	0.0%	139.100%

APPENDIX 'A'

TABLE 12

TREATMENT OF WELL/PUMP WATER (SUMMER)

Initial Survey

		Heat It	Always Boil	Sometimes Boil	Treat with Chemicals	Other	Not Sure	Total Responding
% of Respondents	Eumsong	63.5%	15.4%	14.4%	6.7%	0.0%	0.0%	104/100%
	Danyang	60.9%	19.6%	18.5%	1.0%	0.0%	0.0%	184/100%
	Shindeung	26.5%	51.0%	21.8%	0.7%	0.0%	0.0%	147/100%
	TOTAL	50.3%	28.7%	18.2%	2.8%	0.0%	0.0%	435/100%

Evaluative Survey

		Heat It	Always Boil	Sometimes Boil	Treat with Chemicals	Other	Not Sure	Total Responding
% of Respondents	Daekwangri(A)	16.9%	56.6%	21.7%	4.8%	0.0%	0.0%	83/100%
	Jindong (A)	4.7%	63.0%	32.3%	0.0%	0.0%	0.0%	127/100%
	Danyang	14.4%	51.5%	34.1%	0.0%	0.0%	0.0%	132/100%
	Naesu	40.4%	29.2%	29.2%	1.1%	0.0%	0.0%	89/100%
	Daekwangri(B)	15.9%	43.2%	40.9%	0.0%	0.0%	0.0%	88/100%
	Jindong(B)	8.7%	57.3%	34.0%	0.0%	0.0%	0.0%	103/100%
	TOTAL	15.8%	51.1%	32.3%	0.8%	0.0%	0.0%	622/100%
	Weolchon (Control)	17.3%	48.0%	34.7%	0.0%	0.0%	0.0%	98/100%

APPENDIX 'A'

TABLE 13

TREATMENT OF WELL/PUMP WATER (WINTER)

Initial Survey

		Heat It	Always Boil	Sometimes Boil	Treat with Chemicals	Other	Not Sure	Total Responding
% of Respondents	Eumsong	1.9%	38.5%	55.8%	3.8%	0.0%	0.0%	104/100%
	Danyang	1.6%	46.2%	51.6%	0.6%	0.0%	0.0%	184/100%
	Shindeung	3.4%	51.0%	45.6%	0.0%	0.0%	0.0%	147/100%
	TOTAL	2.3%	45.2%	51.0%	1.5%	0.0%	0.0%	435/100%

Evaluative Survey

		Heat It	Always Boil	Sometimes Boil	Treat with Chemicals	Other	Not Sure	Total Responding
% of Respondents	Daekwangri (A)	1.2%	54.2%	39.8%	4.8%	0.0%	0.0%	83/100%
	Jindong (A)	3.9%	63.0%	33.1%	0.0%	0.0%	0.0%	127/100%
	Danyang	0.0%	72.7%	27.3%	0.0%	0.0%	0.0%	132/100%
	Naesu	0.0%	47.2%	51.7%	1.1%	0.0%	0.0%	89/100%
	Daekwangri (B)	1.1%	45.5%	53.4%	0.0%	0.0%	0.0%	88/100%
	Jindong (B)	0.0%	62.1%	37.9%	0.0%	0.0%	0.0%	103/100%
	TOTAL	1.0%	57.4%	40.5%	1.1%	0.0%	0.0%	622/100%
	Weolchon (Control)	0.0%	52.0%	48.0%	0.0%	0.0%	0.0%	98/100%

APPENDIX 'A'

TABLE 14

DISHWASHING/USE OF HEATED WATER

Initial Survey

		No, Never	Yes, Always	Sometimes	Depends on Season Yes, in winter No, in summer	Don't know/NR	Total Responding
% of Respondents	Eumsong	6.9%	0.0%	9.8%	83.3%	0.0%	203/100%
	Danyang	12.1%	1.2%	12.1%	74.6%	0.0%	256/100%
	Shindeung	3.1%	0.0%	11.3%	85.6%	0.0%	195/100%
	TOTAL	7.4%	0.4%	11.0%	81.2%	0.0%	654/100%

Evaluative Survey

		No, Never	Yes, Always	Sometimes	Depends on Season Yes, in winter No, in summer	Don't know/NR	Total Responding
% of Respondents	Daekwangri (A)	3.3%	3.3%	3.3%	90.0%	0.0%	120/100%
	Jindong (A)	1.9%	0.0%	0.6%	97.4%	0.0%	156/100%
	Danyang	5.0%	0.7%	18.6%	75.7%	0.0%	140/100%
	Naesu	5.8%	1.4%	19.6%	73.2%	0.0%	138/100%
	Daekwangri (B)	2.2%	0.0%	34.4%	62.4%	1.1%	93/100%
	Jindong (B)	4.8%	0.0%	37.1%	58.1%	0.0%	105/100%
	TOTAL	3.8%	0.9%	19.0%	76.1%	0.2%	752/100%
	Meolchon (Control)	7.9%	0.0%	15.8%	76.3%	0.0%	139/100%

APPENDIX 'A'

TABLE 15

DISHWASHING/KIND OF DETERGENT USED

Initial Survey

Category of Response (1)		1	2	3	4	5	6	Total Responding
% of Respondents	Eumsong	4.4%	4.4%	30.5%	3.5%	57.2%	0.0%	203/100%
	Danyang	9.4%	4.3%	7.0%	6.3%	73.0%	0.0%	256/100%
	Shindeung	7.2%	8.7%	32.8%	2.6%	48.2%	0.5%	195/100%
	TOTAL	7.0%	5.8%	23.4%	4.1%	59.5%	0.2%	654/100%

Evaluative Survey

Category of Response (1)		1	2	3	4	5	6	Total Responding
% of Respondents	Daekwangri (A)	0.8%	5.0%	21.7%	13.3%	59.2%	0.0%	120/100%
	Jindong (A)	1.3%	4.5%	19.9%	12.2%	62.2%	0.0%	156/100%
	Danyang	0.0%	0.7%	3.6%	22.1%	72.9%	0.7%	140/100%
	Naesu	3.6%	0.7%	27.5%	13.9%	54.3%	0.0%	138/100%
	Daekwangri (B)	0.0%	4.3%	9.7%	4.3%	81.7%	0.0%	93/100%
	Jindong (B)	0.0%	7.6%	6.7%	1.9%	82.9%	1.0%	105/100%
	TOTAL	0.9%	3.8%	14.8%	11.3%	68.9%	0.3%	752/100%
	Woolchon (Control)	0.7%	5.8%	34.5%	5.8%	53.2%	0.0%	139/100%

Category (1): 1 = Don't use any detergent or soap
2 = Soap (laundry or body)
3 = Hie Tie (always or sometimes)
4 = Trio or Pong Pong (liquid detergent)
5 = Use Trio or Pong Pong only when oil has been used
6 = Don't know or no response

APPENDIX 'A'

TABLE 16

OCCURANCE OF WATER-RELATED ILLNESSES IN INITIAL & EVALUATIVE SURVEYS

		Diarrhea	Fever	Stomachache with Vomiting	Stomachache	Total Interviewed
% of Households with Illnesses	Initial	10.1%	17.5%	4.5%	13.4%	681
	Evaluative Survey (Test Sites)	11.2%	7.9%	2.5%	13.4%	913
	Evaluative Survey (Weolchon - Control)	4.3%	0.7%	6.7%	10.1%	139

APPENDIX 'B'

INITIAL EVALUATION - Translation

OBSERVATION QUESTIONS

1) How is the water drained from the house area?

(1) Dirt gutter
(2) Cement drain
(3) Cement drain, but it leaks
(4) Pipe drain
(5) Pipe drain, but it leaks
(6) Other

2) Do you draw water from your main source as you need it, or do you draw it and store some

(1)	Draw it and use it			
(2)	Store it in plastic tank	____mal	(1) uncovered	(2) covered
(3)	Store it in bucket	____mal	(1) uncovered	(2) covered
(4)	Store it in concrete tank	____mal	(1) uncovered	(2) covered
(5)	Store it in earthen jar	____mal	(1) uncovered	(2) covered
(6)	Store it in metal pan	____mal	(1) uncovered	(2) covered
(7)	Other storage method	____mal	(1) uncovered	(2) covered

3) Which of the below exist right now in the house area? (Record more than 1 choice, if applicable)

(a)	None of the below	(1) No	(2) Yes
(b)	Cement drainage system that is not cracked (@1 (2) or (4))	(1) No	(2) Yes
(c)	Cement area around the tap that is not cracked	(1) No	(2) Yes
(d)	A tap in the kitchen	(1) No	(2) Yes
(e)	A tap in the shower room	(1) No	(2) Yes

GENERAL QUESTIONS

4) Is there any restaurant or food-related business conducted at the house?

(1) No
(2) Yes

5) If Yes (2), how much water do you use daily for your business?

_____ mals

6) On the average, outside of business uses, how much well or pumped water do you, your family and others in the house area who use the main source, use per day?

_____ mals

7) Do you or the members of your family drink well or pump water straight rom the well or pump?

(1) Never (3) Sometimes
(2) Always (4) Not sure or no response

NOTE: 1 mal = 18.039 liters

8) If Never (1) or Sometimes (3), what do you do with the water before drinking it? Please make a seasonal distinction

(1) Heat it
(2) Always boil it
(3) Sometimes boil it
(4) Treat it with chemicals
(5) Other treatment
(6) Not sure or no response

SUMMER _____ WINTER _____

9) From where do you get the water that you:

(a) drink ___
(b) wash food ___
(c) do laundry ___
(d) wash hands, face or body ___
(e) do dishes ___

(1) Public or private pump
(2) River or water reservoir, pond
(3) Draw water from covered well by bucket
(4) Draw water from uncovered well by bucket
(5) Draw water from covered well by electric pump
(6) Draw water from uncovered well by electric pump
(7) Not sure or no response

10) Do you heat the water that you wash the dishes with?

(1) No, never
(2) Yes always
(3) Sometimes
(4) Depends on season - Yes in winter, No in summer
(5) Don't know or no response

11) When you wash the dishes, do you use detergent or soap? If so, what kind of detergent or soap do you use?

(1) Don't use any detergent or soap
(2) Soap (laundry or body)
(3) Hi Tie *
(4) Trio or Pong Pong **
(5) Use Trio or Pong Pong only when oil has been used
(6) Don't know or no response

12) Do you ever disinfect your storage container? If so, how?

(1) Never disinfect
(2) Clean with Hi Tie, laundry or body soap
(3) Pour in some boiling water and shake around container once a week or more often
(4) Pour in some boiling water and shake around container less than once a week
(5) Clean with cold water and/or Trio or Pong Pong
(6) Clean with hot water and/or Trio or Pong Pong
(7) Clean with cold water and sand or rough cloth
(8) Clean with hot water and sand or rough cloth
(9) Not applicable - No storage container (#2 and #3 (1)).
(10) Other method
(11) Don't know or no response

13) Do you always get all the water you need from your main source?

(1) Frequently
(2) Not sufficient occasionally
(3) Yes
(4) Don't know or no response

* This is a biosulphate
** This is what should be used

14) During the last 2 weeks, has anybody living in the household had:

(a)	Diarrhea (over 1 day)?	# sick persons _____
(b)	Fever?	# sick persons _____
(c)	Stomachache with vomiting?	# sick persons _____
(d)	Stomachache?	# sick persons _____

15) During the past 6 months, how many people who use the main source have been in your household (include children, boarders, other families etc)?

_____people

16) How many meters are between the well or pump and the nearest privy?

(INTERVIEWER: Please step out the measurements)

(1)	0-5 meters	(3)	11-14 meters
(2)	6-10 meters	(4)	15 meters or more

.....

APPENDIX 'B'

EVALUATIVE EVALUATION - Translation

OBSERVATION QUESTIONS

1) How is the water drained from the piped water area?

(1) Dirt gutter
(2) Cement drain
(3) Cement drain, but it's broken
(4) Pipe drain
(5) Pipe drain, but it leaks
(6) Public drain outside of the household wall
(7) Other

2) Do you draw water from your well or pump as you need it, or do you draw it and store some?

(1)	Draw it and use it			
(2)	Store in plastic tank	____(mal)	(1) uncovered	(2) covered
(3)	Store it in bucket	____(mal)	(1) uncovered	(2) covered
(4)	Store it in concrete tank	___(mal)	(1) uncovered	(2) covered
(5)	Store it in earthern jar	___(mal)	(1) uncovered	(2) covered
(6)	Store it in a metal cauldron	____(mal)	(1) uncovered	(2) covered
(7)	Store it in iron cauldron	____(mal)	(1) uncovered	(2) covered
(8)	Other storage method	____(mal)	(1) uncovered	(2) covered

3) Do you draw tap water as you need it, or do you draw it and store some?

(1)	Draw it and use it			
(2)	Store it in plastic tank	___(mal)	(1) uncovered	(2) covered
(3)	Store in bucket	___(mal)	(1) uncovered	(2) covered
(4)	Store in concrete tank	___(mal)	(1) uncovered	(2) covered
(5)	Store in earthen jar	___(mal)	(1) uncovered	(2) covered
(6)	Store in metal cauldron	___(mal)	(1) uncovered	(2) covered
(7)	Store in iron cauldron	___(mal)	(1) uncovered	(2) covered
(8)	Other storage method	___(mal)	(1) uncovered	(2) covered

4) Which of the below exist right now in the tap water area? (Record more than 1 choice if applicable)

(a)	None of the below	(1) No	(2) Yes
(b)	Drainage system that is not cracked ((1) (2) or (4)).	(1) No	(2) Yes
(c)	Cement area around the tap that is not cracked	(1) No	(2) Yes
(d)	A tap in the kitchen	(1) No	(2) Yes
(e)	A tap in the shower room	(1) No	(2) Yes

5) Is there a plastic or rubber tube running from the mouth of the tap faucet to the brim of the container to such a length as to permit the end of the tube to touch the water surface in the storage tank if the tank were filled to the brim with water?

(1) No
(2) Yes

NOTE: 1 mal = 18.039 liters

GENERAL QUESTIONS

6) Is there any restaurant or food-connected business conducted at the house?

(1) No
(2) Yes

7) If so (2), how much water do you use daily for your business?

(a) Piped water ____(mal)
(b) Well or other ____(mal)
(c) TOTAL (a+b) ____(mal)

8) On average, outside of business and laundry uses, how much water do you, the members of your family, and the other people who use your water source use per day? (Excluding laundry uses).

(a) Piped water ____(mal)
(b) well or other ____(mal)
(c) TOTAL (a+b) ____(mal)

9) If the piped water system breaks down or you don't get a sufficient amount of water from the tap, do you or the members of your family drink well water straight from the well or pump?

(1) Never
(2) Always
(3) Sometimes
(4) Not sure or No Response

10) If never (1) or sometimes (3), but you have to drink well or pump water, what would you do with it before drinking it? Make a seasonal distinction.

(1) Heat it or do nothing
(2) Always boil it
(3) Sometimes boil it
(4) Treat it with chemicals
(5) Other treatment
(6) Not sure or No Response

SUMMER _____ WINTER _____

11) From where do you get the water that you:

(a) drink _____
(b) wash food _____
(c) do laundry _____
(d) wash hands, face or body _____
(e) do dishes _____

(1) piped water
(2) public or private pump
(3) river or water reservoir, pond
(4) draw water from covered well by bucket
(5) draw water from uncovered well by bucket
(6) draw water from covered well by electric pump
(7) draw water from uncovered well by electric pump
(8) Not sure or No Response

12) Do you heat the water that you wash the dishes with?

(1) No, never
(2) Yes, always
(3) Sometimes
(4) Depends on season - Yes, in winter, no in summer
(5) Don't know or No response

13) When you wash the dishes, do you use detergent or soap? If so, what kind of detergent or soap do you use?

(1) Don't use any detergent or soap
(2) Soap (laundry or body)
(3) Hi Tie (Always or sometimes)*
(4) Trio or Pong Pong **
(5) Use Trio or Pong Pong only when oil has been used
(6) Don't know or no response

14) Do you ever disinfect your storage container? if so, how?

(1) Never disinfect
(2) Clean with Hi Tie,* laundry or body soap
(3) Pour in some boiling water and shake around container once a week or more often
(4) Pour in some boiling water and shake around container less than once a week.
(5) Clean with cold water and/or Trio or Pong Pong **
(6) Clean with hot water and/ or Trio or Pong Pong **
(7) Clean with cold water and sand or rough cloth
(8) Clean with hot water and sand or rough cloth
(9) Not applicable - No storage container (#2 & #3 (1)).
(10) Other method
(11) Don't know or no response

15) How many times have you or a member of your family attended the sanitary education meetings sponsored by CARE?

(1) Never, but have heard of them
(2) 1 time
(3) 2 times
(4) 3 times
(5) 4 times
(6) 6 times
(7) Never heard of meetings

16) Do you like the taste of the piped water?

(1) No, never
(2) Yes, always
(3) Occasionally, no
(4) Most of the time, no
(5) Don't know or no response

17) During the last complete month, how many entire days did you not receive water from the tap?

(1) Always received it
(2) 1 day
(3) 2 days
(4) 3 days
(5) 4 days
(6) 5 days or more
(7) More than 5 days mostly due to neighboring water-line construction
(8) Less than 5 days mostly due to neighboring water-line construction
(9) Don't know or no response

18) Do you always get all the water you need from the piped source?

(1) Frequently not sufficient
(2) Not sufficient occasionally
(3) Yes
(4) Don't know or no response

19) During the last two weeks, has anybody living in the household had:

(a) Diarrhea (over 1 day)? # sick persons ____
(b) Fever? # sick persons ____
(c) Stomachache with vomiting? # sick persons ____
(d) Stomachache? # sick persons ____

* This is a biosulphate
** This is what should be used

20) What improvements do you intend to construct in the near (8 months) future in connection with your potable water system? (Record more than one choice if applicable).

(a)	Don't intend to make any improvements in the near future.	(1) No (2) Yes (3) Already have
(b)	Cement drainage system	(1) No (2) Yes (3) Already have
(c)	Cement area around the tap	(1) No (2) Yes (3) Already have
(d)	Another tap in the kitchen	(1) No (2) Yes (3) Already have
(e)	Another tap in the shower room	(1) No (2) Yes (3) Already have
(f)	Want to make 1 or more of above improvements, but can't due to lack of money	(1) No (2) Yes
(g)	Don't know or no response	(1) No (2) Yes

21) During the past 6 months, how many people who use the tap water have been in your household (include children, boarders, other families, etc.)

_____ people

22) How many meters are between the well or pump and the nearest privy?

(INTERVIEWER: Please step out the measurements)

(1) 0-5 meters
(2) 6-10 meters
(3) 11-14 meters
(4) 15 meters or more

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APPENDIX C

Water System Monthly Report

_____ Month

_____ Village

_____ Myon (Township)

_____ Reporting Official's name

_____ Gun (County)

_____ Title

INCOME

Did you collect water fees this month? No Yes

1. How much collected?
   _____ Won
2. How many families paid?
   _____ No.
3. Average payment per family
   _____ Won

Did anyone join the water system this month? No Yes

4. No. of new connections
   _____ No.
5. How much collected from these sources?
   _____ Won

EXPENDITURES

Money spent for chemicals this month? Actual purchase/budgeted amount No Yes

6. _____ Won spent
7. _____ Won budgeted

Money spent for fuel this month

8. _____ Won electric
9. _____ Won gas
10. _____ Total Won

- Cont'd -

Money spent on salaries for water system personnel?

11. _____ Salary
_____ No. of people on salary

Remittances for maintenance, repairs

12. _____ Won
_____ Repairs
_____ Repairs
_____ Total Won

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13. Total income for this month _____ Won
14. Total expenditures of this month _____ Won
15. Balance or deficit this month _____ Won
16. Total water system funds on hand at end of month _____ Won
17. As of this month the total No. of faucet connections? _____ Connections
18. Total No. of homes that did not pay water bill this month? (Subtract answer #2 from #17 above for answer) _____ No. of homes
19. Total No. of people served directly by the system? _____ People
20. Currently, the % of area population connected to system? _____
21. Water quality exam completed this month? _____ No _____ Yes
22. Test results sent to county health office of CARE office? _____ No _____ Yes

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INCIDENT REPORT

1. Any fires combatted with water from the piped system this month? _____ No
If 'Yes' how many fires this month? _____ No. of fires
2. Any reports of leakage or indicators of water loss this month? _____ No
If 'Yes' please explain in detail. _____ Yes

17

3. Any damage reported this month? _____ No _____Yes

What was damaged? _____ Repair cost reported under question #12 of this survey?

4. Did you receive any complaints by the water customers this month? _____ No

If 'Yes' could you summarize those complaints below:

Yes, _____

_____

5. Please report any special audit, investigation, or special visitors this month at the water works: _____ No

_____ Yes, Visitor: _____ Purpose: _____ Date: _____

_____

_____

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DAILY REPORT FOR WATER SUPPLY SYSTEM

YEAR

MONTH

	PUMP												DISTRIBUTION							WATER QUALITY			MAINTENANCE				INCIDENCE REAPIR
	Pump 1					Pump 2							Supply time														
	from	to	from	to	Pump time	from	to	from	to	Pump time	Purpose	Discard	from	to	from	to	total	Master Meter	Chlorine added	Stock	Residual Chlorine	turbidity	odor	taste	tank cleaning			etc.	Leakage, Freezing, etc. Explanation, to.
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APPENDIX 'C'