WATER, SANITATION, HYGIENE & HEALTH STUDIES PROJECT

Aga Khan Health Service Northern Areas & Chitral

Third Progress Report

August 1993 to January 1994

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INTRODUCTION

Administrative matters

Since the previous progress report the Project has finalized recruitment of staff for all the professional positions. Besides the Project Director the composition of the team now includes one part-time and twelve full-time professionals, and five support staff. Three more support staff are expected to join the team. Two laboratories are functioning for backing up the field investigations in Chitral and Gilgit. It is planned to establish a third facility in Baltistan as part of a field office cum staff house. To help simplify financial procedures, the Project has been coordinating directly with the AKHSP PHC programme accountant in Chitral since the beginning of July. This has meant some additional responsibilities and work for the Project secretary and for the Director. A new budget plan was drawn up in early October for the period January 1994 to June 1995 on the assumption that the Project would continue to mid-1995. The final decision about this is expected in the next trimester. In September the ODA-CEC Pakistan monitoring mission team visited the Project. Both parties expressed general satisfaction with progress and the ODA representatives supported a request for consultancy and training inputs from the U.K. The decision about this has not yet been finalized. The continuing difficulty of obtaining Land Rover spare parts and communal tensions in August have impeded to some extent efficient and harmonious progress.

Collaboration with other institutions

During the period covered by this report the Project developed close working contact with AKHBP, AKRSP and AKHSP. The Project liaison and Advisory Committee met in November. At this meeting all the local AKDN institutions were represented and membership was formally extended to include the Deputy Director of the Local Bodies & Rural Development Department. The LB&RDD is the Government line department that is responsible for rural water supply and sanitation. The LB&RDD Director expressed particular interest in the work on water quality testing, and the Project has subsequently tried to include as many LB&RDD schemes as possible. Collaboration with AKHBP consisted of equipment sharing for field work and their assistance with the evaluation of the Musaffa water filter bags. For AKRSP, the Project is preparing a water and hygiene module for WO managers and is contributing a regular page of advice on water and sanitation matters to their new bi-monthly magazine "Dahi Tanzeem", circulated to over 12000 VO officials, specialists and activists. From August to October the Project continued to assist AKHSP in their efforts with the Government to control the outbreak of cholera mentioned in our last report. The contribution included testing the suspected water sources, experimentation to check the efficacy of the water disinfection strategy[1], and development of a set of health messages in poster and leaflet form. A beginning was made on developing other methods for communicating these messages such as radio and live drama, and plans have been made to do further work in spring in anticipation of a repeated outbreak.

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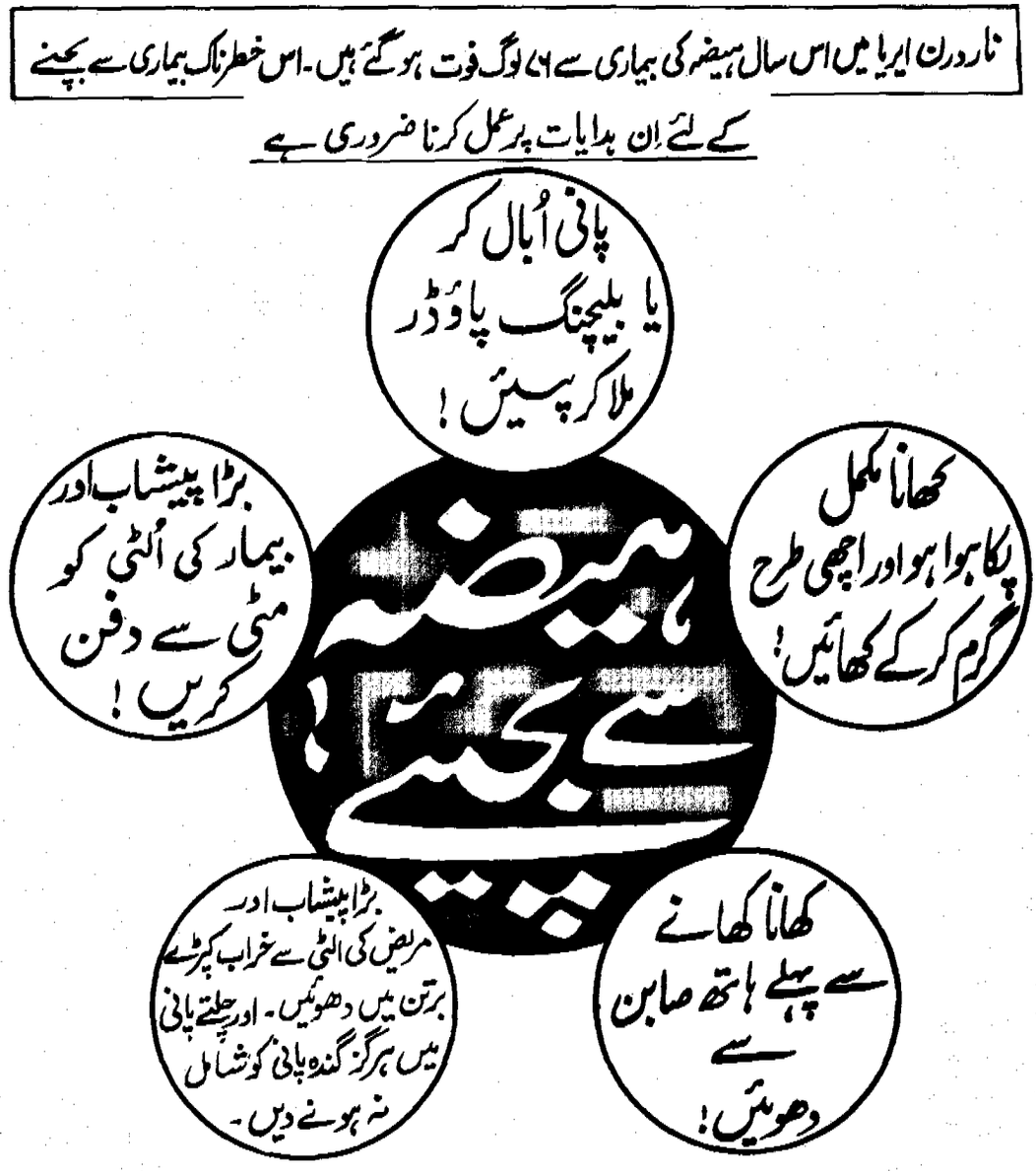
1. See Issue Paper 1: Chlorination campaign for cholera struck area and experiments to check residual chlorine levels and the efficiency of bleaching powder.

Other inputs to the cholera campaign included checking water quality at locations affected by cholera and in households using bleaching powder to disinfect their drinking water. On a broader front the Project has developed its contact with a number of other institutions. Noteworthy amongst these are the Health Education and Adult Literacy project of Adult Based Education Services in Lahore, UNICEF and the Pakistan Council for Research in Water Resources in Islamabad.



A set of simple health education messages to be used during the possible cholera campaign 1994

Towards policy development and an implementation proposal

Contact with the Planning and Development Department, the Ministry of Local Government and Rural Development and the World Bank in Islamabad, resulted in the Project assisting the Federal Support Unit for the Water and Sanitation Sector with the task of preparing the Northern Areas SAP Operational Plan 1993-98, Rural Water Supply and Sanitation Component. Essentially this is a revision of the proposed Rural Water Supply, Sanitation, Health and Hygiene Education Programme mentioned in our last report. In response to a request from the Government for support to the Northern Areas Local Bodies and Rural Development department in implementing the Programme, AKRSP and AKHSP have expressed their willingness to cooperate but the details still have to be worked out. Also related to the issue of policy development have been two workshops attended by staff, one in Chitral and the other in Muzzafarabad. These dealt with "Policy reformation to facilitate community participation in rural water supply projects" and "Collaboration and integration between agencies for hygiene education".

The plan to begin working on the development of a concept paper was brought forward to the beginning of January, prompted by a request from AKFP for a tentative outline of the future implementation proposal. A summary of the main issues and ideas likely to be addressed in this proposal has been prepared[2]. However, development into a draft has been temporarily postponed while discussions take place in Karachi that will probably affect the future course of the Project.

Progress in the field

During the period under review considerable effort has been put into field work and the writing up of results. Rapid reconnaissance studies have been carried out in the districts of Chitral, Gilgit, Ghizer, Skardu and Ganche. Based upon this work four position papers have been prepared[3]. Indepth studies commenced in Chitral in November on the themes of the pour flush and the pit latrine. The results of this work have been presented in two issue papers[4].
One interesting outcome has been an explanation for the general under-utilization of new pour flush latrines by the family members, especially by women and children. Additional field work has extended water quality analysis to over 100 villages, and inventories have been made in approximately 160 villages to define the status of their water supply and sanitation situation.
The picture beginning to emerge about water supplies, shows that most people use several systems which differ with the seasons, and that piped water rarely achieves significant improvement in terms of water quality. Results from storage tanks, communal and household alone

2. For more details see "Issues and ideas for the concept paper".

3. See the Position **Papers on water,** sanitation and health education: 1.Upper Chitral; 2.Lower Chitral; 3. Baltistan; and 4. Hunza and Nagar.

4. See Issue Paper 2: Pit latrines as a sanitation option in Chitral District; and Issue Paper 3: The pour flush latrine for guests only? A socio-cultural perspective on the pour flush latrine in Chitral.

taps are generally way outside the potable water standards suggested by WHO Guidelines. The traditional water pits, a very common household drinking source throughout the area, are consistently the most contaminated of all the sources. The only sources that can sometimes be considered potable are springs, especially during the winter. However, very few of these are properly protected and consequently they are vulnerable to contamination by human and animal activity. Although these findings are preliminary they support the idea that implementation of new schemes is inadvisable without proper integration of hygiene education and motivation of the users (effectively coordinated with the health and education sectors if possible), and the development of community management and sustainable maintenance strategies.

The experimental sanitation construction activities which were started in the Hunza valley in July have progressed slowly, and so far this work has been limited to three twin-pit compost latrines and one twin-pit pour flush latrine. As these were only put into use late in the year it is too early to draw any conclusions from the initial monitoring activities. As a sequel to the indepth sanitation studies in Chitral, it is planned to investigate the acceptability of an improved ventilated pit latrine for people living in congested areas and for places with water shortages or with freezing problems. Possibilities for upgrading the Chaksa are currently being considered in order to provide people in Baltistan, who wish to modernize, with an alternative to importing the (inappropriate) pour flush latrine. Also many people, at least in Chitral, hold the view that it is the Government who should provide sanitation facilities. Overcoming this will be a challenge for alternative sanitation implementation strategies in the future.

The results of the above mentioned field activities tend to support the conclusion that due to the variety of physical conditions and existing practices, and the different expectations of the beneficiaries, an innovative and versatile approach to technology choice and implementation will be a desirable feature of any future rural water and sanitation programme. For example, considering water supply, the extremely high turbidity characteristic of many surface water sources occurs only for a few months of the year. Special measures will need to be in operation during this period but for the remainder of the year it is conceivable that a conventional water treatment system, such as slow sand filtration, may be sufficient. The Musaffa water decontamination bags which are being evaluated by the Project, provide another example. If their application is limited to filtering low turbidity water (which is available in the majority of locations for at least half of the year), it appears they could be an effective method for improving drinking water quality; but for periods of high turbidity they may be inappropriate and additional measures or a more satisfactory alternative may be required. Considering a sanitation issue, the idea of female motivators working directly with women on planning and implementing sanitation and hygiene activities, could help to improve effective use of facilities and achieve greater impact. Although it has been observed that many women already possess basic knowledge about hygiene and health matters, a gap that still has to be bridged is the transformation of knowing into actually doing. Enabling people to do this will be another part of the challenge that lies ahead.

SOCIO-CULTURAL REPORT

During the period under review the anthropological staff commenced their field activities. First a rapid assessment of the water and sanitation situation was conducted. Secondly a start was made with indepth studies. In addition to these field investigations several activities related to health education commenced.

Rapid assessment of the water and sanitation situation

The reconnaissance visits to the five districts in the Project area provided an opportunity for staff to familiarize themselves with the field, to gain knowledge and to produce a set of preliminary data as a firm basis for the indepth studies. Besides some shorter visits, the rapid assessment was conducted during two to three week visits to Chitral in August, to Baltistan in October and to Ghizer and Gilgit in November and December. After a lengthy writing process four position papers have been prepared (see footnote 3 on page 3).

The methodology of the field investigations included indepth-interviewing, group discussions and observation during interviews, house visits and village walks. Two or three anthropologists, always male and female, worked together. The former focused on interviews with doctors, teachers, village elders and other male informants. The female anthropologists worked with LHVs and village women as well as interviewing men. After interviews walks were made through the villages and where possible questions were asked on the way.

One of the results of the assessment was the identification of a range of traditional sanitation systems. The management, local attitudes and beliefs about these systems were studied. Pour flush latrines are popular in Chitral and Gilgit, but not in Baltistan where people prefer to use their traditional composting system. In some parts of Gilgit also, the use of human faeces as manure is common. In these areas simple latrines such as the Chukan and simple shallow pits, are used to deal with human waste. In Baltistan, nearly every household has a Balti latrine (Chaksa). This is a compost latrine system with an upper floor with several holes for defaecation and a lower portion where human waste is accumulated. Traditionally women and children went together to the Balti latrine, though now this custom may be changing. In contrast the people in Ghizer and Chitral consider the use of human waste as a dirty custom and consequently composting latrines are not common. Few pit latrines were found in these two districts. After filling up they are abandoned and the contents are not used. Women often use the animal sheds called Shal, to relieve themselves, while men commonly use the open fields. Throughout the whole area defaecation in the open fields is very common. It has been confirmed by many people that animals like cows, sheep, chicken and dogs, but never goats, eat human faeces as they roam around the villages.

Another outcome of the assessment is a set of data collected on the knowledge, attitudes and practices of villagers concerning water. One interesting result was the stated preference of villagers in Chitral for cold drinking water. This concept was so strong that in villages with a piped water supply people often do not drink the luke-warm water from the tap but prefer the

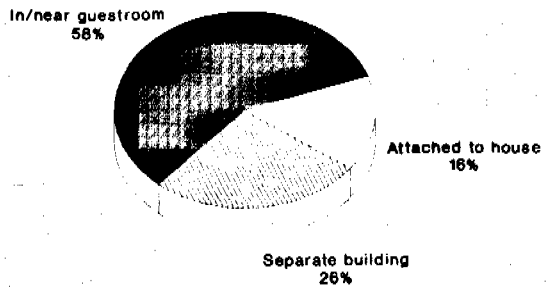
colder channel water. This means that unprotected sources are still used and the objective of a water supply scheme to improve health status, is largely negated. A start was also made with identifying and understanding the strengths and weaknesses of water supply implementation strategies. In Chitral an anthropologist and an engineer participated in a workshop on piped water schemes where all the major partners in the water sector were present. Arising from this, the Project is discussing collaboration with the Chitral Area Development Project in two participatory pilot projects. These and other results have helped to identify priority issues for incorporating into a future implementation project. Also the work has helped to formulate recommendations for engineers, microbiologists and social staff for the indepth studies.

Indepth studies

In November a start was made on the first indepth study with a three week field visit to Chitral to investigate pour flush and pit latrines. Use was made of questionnaires, open interviewing techniques and group discussions. For the initial days the senior engineer, and for all the rest of the time the field engineer worked together with the anthropologists. The reports on this work with recommendations were prepared in December (see footnote 4 on page 3). In the pour flush study a distinction was made between owners and non-owners. The data gathered included the actual and estimated cost of PF-latrines, construction details, date of installment, location, problems with the PF-latrine and other related topics. The fundamental limitation of PF-latrines is the fact that water is needed for flushing. One important conclusion from the study is that a pour flush seems to be related to status and that people generally consider that the latrine is for guests. In the majority of cases the location of the latrine is near the guest room.

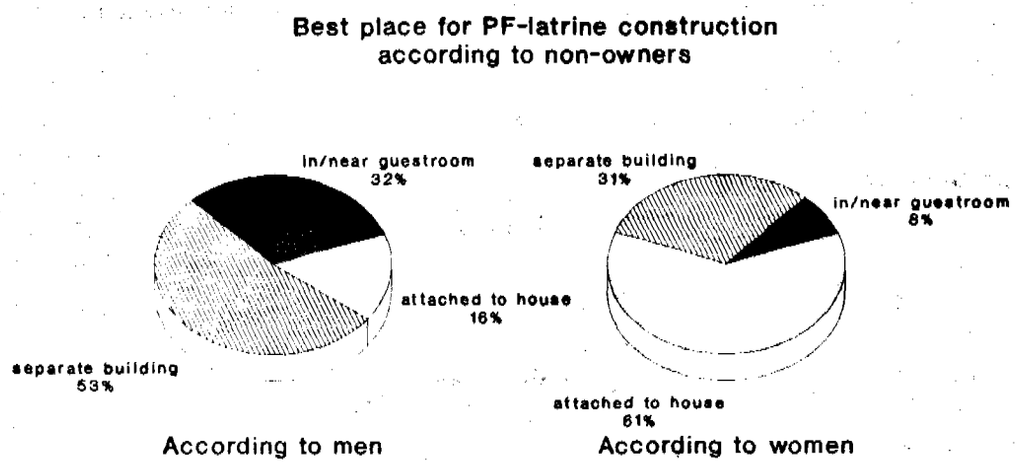
Some of Baluchistan

Actual location of the PF-latrine



It was found that a majority of household members either do not, or do not regularly, use their PF-latrine despite their awareness that a latrine is good for purdah, convenience and cleanliness. Therefore coverage alone is not a valid indicator to assess the actual use of PF-latrines. This under-utilization is a factor that has to be tackled in health education sessions at the time of implementation. Several other matters emerged from the research that will be considered in the

development of a sanitation strategy. One example is that women prefer the latrine to be situated attached to the house, because in this location it is more accessible for them. The men however, who normally decide about location, prefer the latrine in the guest room or away from the house. Therefore it seems that to achieve more effective utilization, women must be involved in decisions about latrine location.



In the study on pit latrines in Chitral, a limited number could be identified and their owners were interviewed. Although conventional pit latrines appear to be not very common, this option seems to merit further investigation as it has several advantages compared to the PF-latrine. For example; cheap construction, no need for water and no freezing problem. During some preliminary dialogues with villagers, the possibility of a ventilated improved pit latrine (VIP-latrine) was discussed. The initial response was encouraging but it is anticipated that this system will be acceptable to a limited number of people, such as those living in congested areas, those with a water shortage, and for villages at higher altitudes with low temperatures. In the whole area the Project is in the process of investigating a range of different sanitation options for different circumstances and with different costs. One example is the VIP-latrine that will be constructed on an experimental basis in Chitral. Another is a low cost trench latrine (see Annex A) which is proposed as a do-it-yourself minimal improvement option for low income groups and as an emergency measure for cholera outbreaks.

Other plans for indepth studies over the next six months include:

- A study on village involvement by looking at water committees, village organizations, collective work, and at water supply projects that are completed, in progress, functioning or failed. Besides interviewing, use will be made of a participatory exercise called village mapping. One anthropologist will take the main responsibility for these studies.

- Indepth domestic studies will be done by the two female anthropologists. A range of research methods will be applied to involve women. Beside interviewing and

observation, SARAR[5] and Participatory Rapid Appraisal methods including village mapping, needs assessments and three pile sorting cards will be used. In these studies, an attempt will be made to develop and test appropriate hygiene and health education messages and strategies, together with the women of the villages.

- Considering the importance of integrating hygiene education and motivation in water and sanitation projects to achieve greater sustainability and impact, a major part of the coming period will be devoted to the participatory research, development and testing of communication materials and methods.

Hygiene and health education activities

During the field investigations LHVs and doctors working in Government and NGO health facilities, were consulted about health education strategies and materials. These efforts to assess needs will continue, and new materials and methods will be pre-tested with the different target groups. The following activities have been undertaken in the period under review:

- **Health education for cholera control**

  The preparation of experimental health education materials commenced earlier than had been planned due to necessity caused by the outbreak of cholera in July. In close collaboration with AKHSP, posters and leaflets were produced for the orientation of health workers and the public. Government funds have been allocated for cholera control measures and if necessary, it is planned to spend a part of this on an education campaign in spring. A set of thirteen messages has been developed, and the five most important and practical will be highlighted in the campaign. A copy of the five simple messages has been shown on page 4.

- **Investigation of alternative strategies**

  Considering the limitations of the printed media for message communication, a start has been made on investigating alternatives. It is planned to develop and test these for future cholera control campaigns as well as for more general application to health education:

* A writer for local radio is preparing a four part story for his popular light drama programme, incorporating the key cholera control messages. This would be broadcast in the language of the people in the worst affected area.

* In cooperation with two local theatre groups production of a stage drama is considered. The radio script might be used and the play recorded on video for a wider audience.

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5. A learner-centered approach to participatory training which has been applied to numerous projects by the PROWWESS/UNDP Programme "Promotion of the Role of Women in Water and Environmental Sanitation Services".

* Experimentation with story telling is being planned based on the participatory methods developed by the Health Education section of the Adult Literacy project (ABES), Lahore.

▸ **Advice to village organisations**

At the request of AKRSP Human Resource Development Institute, the Project is contributing a page of topical advice on water and sanitation, to their new bi-monthly magazine "Dahi Tanzeem". In a forthcoming issue it explains that people can become ill from dirty water, and that water can get contaminated if it is not stored properly in the home. The advice given is to cover stored water and to use clean utensils to dispense it for drinking.

▸ **Training for WO managers and AKHS LHVs**

Assistance will also be given to AKRSP-HRDI in developing a training module on water and domestic hygiene for WO managers. The training will use several participatory techniques. A special series of slides, drawings and story boards are being prepared and pre-tested. The module will be used in Gilgit, Baltistan and Chitral in the coming months. Plans are also being developed to give a similar module, using the same participatory techniques, to the LHVs of AKHS.

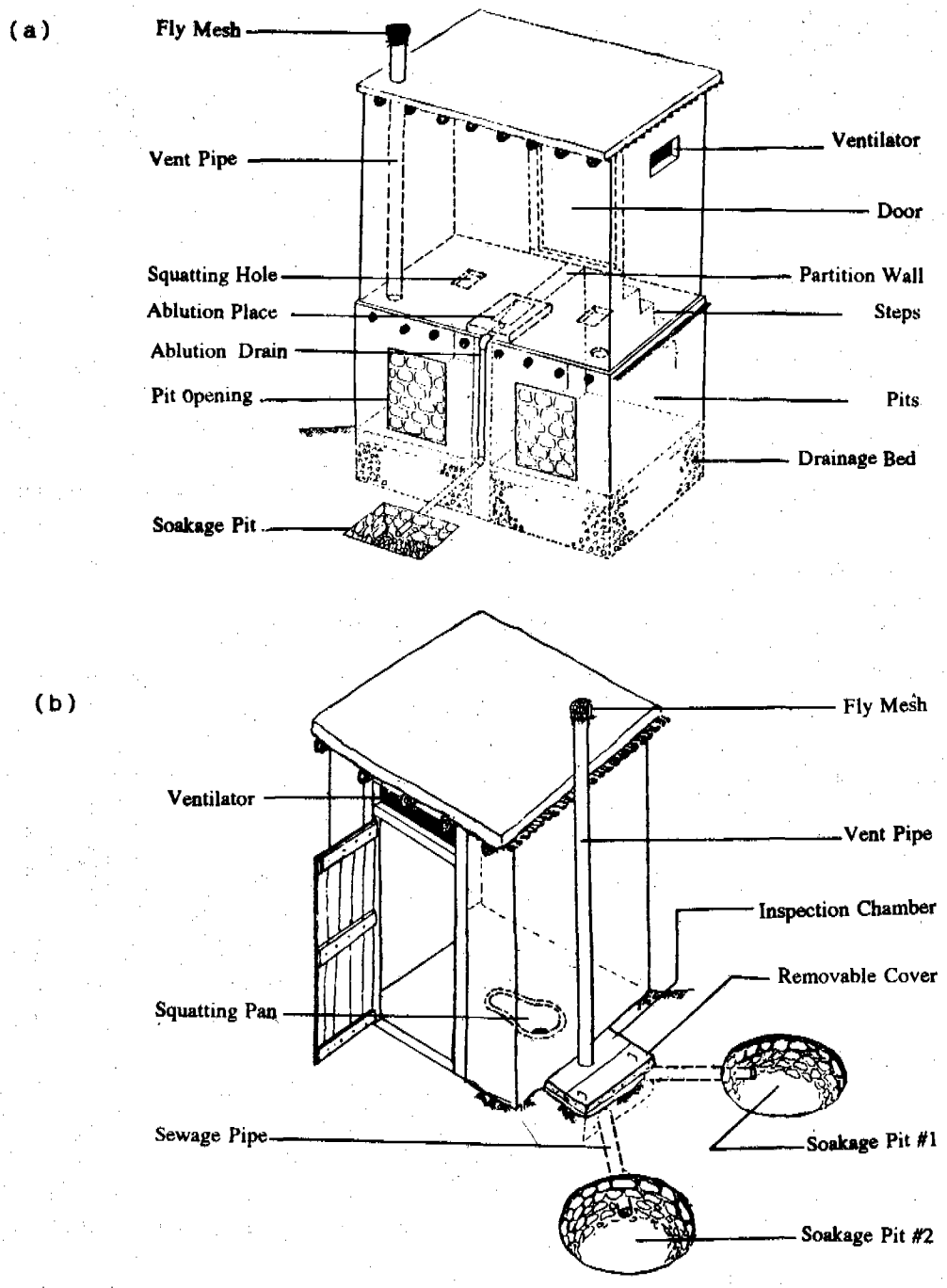
▸ **Links with other health education projects**

Contacts have been made with a number of agencies working in the fields of health and education. Locally these include AKHSP Child-to-Child project, AKES, AKRSP and SWAB; and at Provincial and National level, UNICEF, the Federal Support Unit, the HEAL and ABES, and Dorsch Consult.

Future plans

Many of the activities mentioned in the preceding paragraphs will be continued during the coming six months. To summarize, the main ones are listed below:

* Participatory research, development and testing of communication materials and methods.
* Indepth domestic studies of water use, hygiene and sanitation practices.
* Indepth studies of men and womens' involvement in community water supply projects.
* Conducting training module on water and domestic hygiene with groups of WO managers.
* Workshop for LHVs on the use of participatory methods for health and hygiene education.
* reparation of materials for cholera control campaign.



Schematic Diagrams of a) Twin-pit compost latrine, b) Twin-pit pour flush latrine.

TECHNICAL REPORT

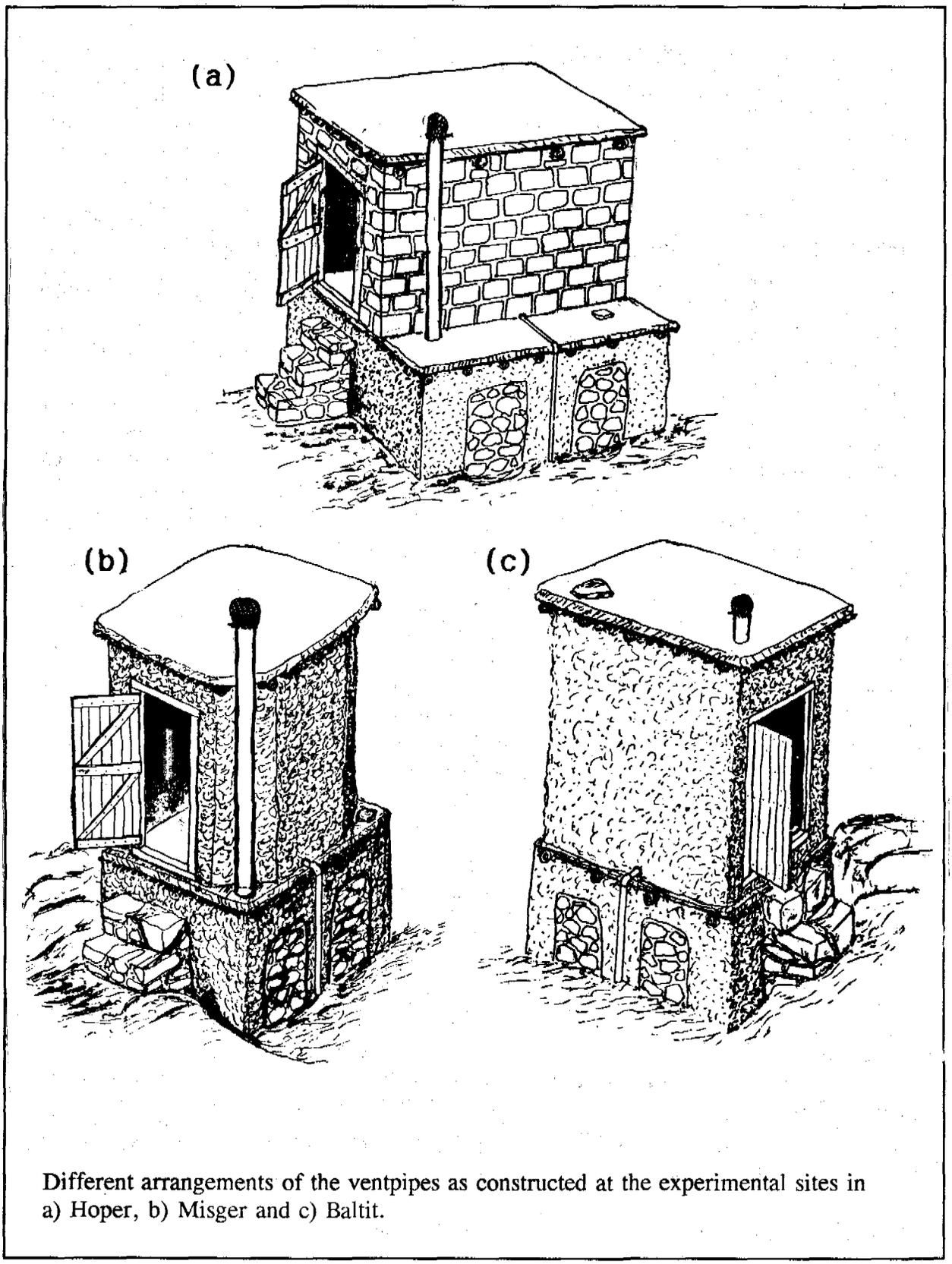
During the period under review the engineers and the microbiologists have been busy in the field conducting practical research and collecting information on the existing water and sanitation situation. The major activities were: experimental latrine design and construction; water sampling; and commencing water and sanitation inventories in each district.

Experimental latrine construction

Three of the experimental latrines located at Misger, Hoper, and Baltit in the Hunza valley are twin-pit compost systems and the fourth is a twin-pit pour flush latrine at Nilt. See opposite page for schematic diagrams. The owners started building in late July and it took three to four months to complete the work. One reason for this slow progress was that experienced masons did not like building this kind of latrine as a matter of pride, and the owners therefore had to find less experienced masons for helping them. This indicates that special efforts will be required to consult and motivate local skilled masons for gaining their interest and involvement in any future implementation programme.

In order to investigate ideas for minimizing the nuisance of smell and flies, it was decided to provide the experimental compost latrines with ventilation, and to keep the pit contents as dry as possible. Typical designs of ventilated pit latrines recommend vent pipes outside the superstructure to help improve the ventilation process by obtaining a convection effect from the warmth of the sunshine. For achieving this, the first plan was to angle two of the exterior corners of the superstructure. Part of the superstructure walls in this case rest on the latrine floor and in practice this proved difficult to combine with a floor made traditionally from wood and earth. Therefore it was decided to modify the design so that the superstructure walls rest directly on the pit walls which results in the vent pipes being inside. This option was recommended for the experimental latrine at Baltit. See next page for different arrangements of the vent pipes.

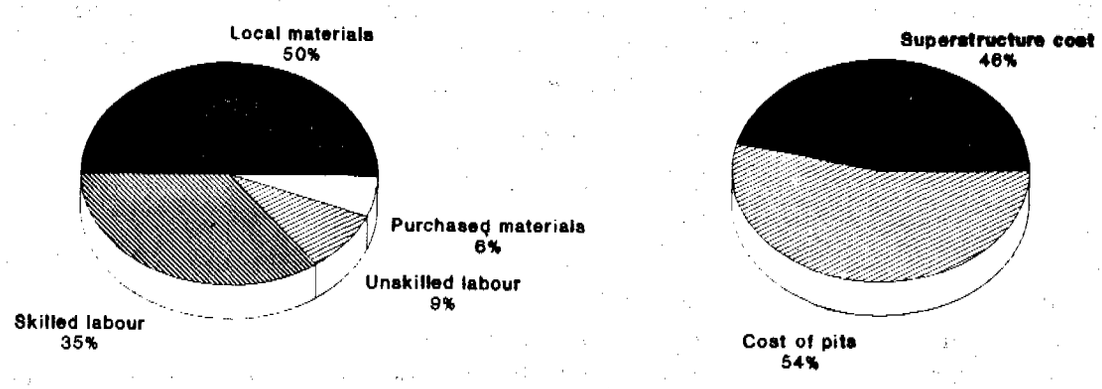
It has been observed in Gilgit region that the traditional latrines are often disliked due to the smell from the pits. People have expressed reluctance to use such an unpleasant latrine and later to empty it. They seem more inclined to go to the open fields even though many recognize this as being unhygienic. One of the contributing factors is the disposal of ablution water into the latrine which makes the contents wet. To overcome this problem, the experimental compost latrines have a separate cemented platform for ablution inside, and waste water is disposed of by a pipe to a soakage pit outside. This idea has been enthusiastically received by the owners. Also, to make the floor neat and washable a cement-mud plaster was used, adapted from the experience of the Aga Khan Culture Service at the Baltit Fort in Hunza.



Different arrangements of the ventpipes as constructed at the experimental sites in a) Hoper, b) Misger and c) Baltit.

Experience has shown that the cost of stones for the stone masonry walls was the major item in the overall cost of the twin-pit compost latrine. Due to the continuous use of stone, its availability near to some settlements has become difficult. Although a local material, procurement of stones has become an expensive task: it includes cutting of boulders to make stones of an appropriate size, which may involve blasting in some cases, transportation of these to the site, and then preparing them for building. Contrary to expectations, the increasing cost of transportation and labour has actually made this option an expensive one and in some cases un-economical. For the experimental latrine at Hoper, the owner preferred to use concrete blocks in the superstructure, which he found to be favourably comparable to stone masonry at that particular site. At Baltit 45 percent of the overall cost was spent on the procurement of stones. The actual overall cost of the latrines varied between Rs. 7,000 to Rs. 10,000 per unit. About 35 to 50 percent of this was for labour. The level of Project assistance to the owners varied between 35 to 45 percent which mainly covered the skilled labour wages and the cost of non-local materials. The figure below shows the breakdown of actual costs as a percentage of total costs, based on the average of two twin-pit compost latrines.

Breakdown of construction cost



Arising from the participatory approach used, several changes were necessary during construction which resulted in additional time and labour. It is estimated therefore, that the normal cost should be in the range of Rs. 5,500 to Rs. 8,500, the lower figure being applicable in most cases. Cost reduction could be achieved by decreasing the pit size to provide six months retention instead of twelve, the time normally recommended for thorough pathogen destruction. However, the practicality and implications of this idea need further investigation.

The families actually began using their latrines towards the end of the year and consequently it is early to draw conclusions. During the planning stage the users had agreed to help monitor performance by keeping weekly records of their observations about temperature and smell inside the latrine, and recording the frequency and type of materials added to the pit. Initial feedback indicates that aesthetically the system is substantially better than the traditional composting latrine, the Chukan. Also, discussions with the owners have revealed that the latrines are considered as a sign of improvement in living standards. In the coming monitoring phase field

staff will review the record-keeping activities, carry out tests and make their own observations. This involves sampling of latrine contents and testing for *Ascaris* egg counts and their viability, temperature, pH and moisture content.

During the indepth sanitation studies carried out in Chitral in November, dialogues about sanitation alternatives were held. A clear preference was expressed for disposal systems rather than re-use systems; for example, the Ventilated Improved Pit latrine was preferred to a compost latrine. Families interested in cooperating with experimental construction of a VIP-latrine have been identified, and it is planned to start this activity in April. Unlike Chitral, in Baltistan there is a strong tradition of utilizing human excreta in agriculture; most of the households have a composting latrine known as the Chaksa. The popular adoption of an alternative system seems unlikely from both economical and socio-cultural points of view unless there are very strong reasons for doing so. Therefore, it is planned to make an indepth socio-technical study of the Chaksa to understand its pros and cons. A sanitation sampling exercise will be carried out in which samples of the latrine contents will be taken to check for the presence and viability of *Ascaris* eggs. This activity is planned for February when people start emptying their Chaksas. Samples will be taken from different layers inside the latrines as well as from the fields where the latrine-manure has been deposited. The aim is to assess the health risks associated with the manual emptying and spreading of the latrine contents on the fields and the likelihood of subsequent contamination of drinking water supplies. Based on the results of this exercise, recommendations will be formulated and tested with the aim making the continued use of Chaksas hygienically safer.

Water sampling

Water sampling was initiated in June, with the objective of analyzing the quality of different water sources and systems in the area, and investigating the contamination levels at different points between the source and the consumer. Starting from Gilgit town and the surrounding villages the water sampling activity was gradually extended to the other districts. Sampling commenced in Chitral in August, and in Baltistan in December. More than 100 villages have now been included in the survey; samples taken before the end of September have been classified as summer samples, whereas those taken afterwards are considered winter samples.

Considering the variety of water usage practices in the area, sampling of different sources and locations has been undertaken in as many villages as possible. The bacteriological data on water quality has therefore been tentatively analyzed on the basis of these different sources and locations in the supply systems. For an overview of the water quality situation in the area, data has been summarized separately for Gilgit, Chitral and Baltistan. See Tables 1 to 3 on the opposite page. Data has also been arranged to compare summer and winter results to reveal the influence of the changing seasons on water quality. Bacteriological analysis was performed using the membrane filtration technique for detecting faecal contamination arising from human or animal activity. Turbidity was measured using a graduated turbidity-tube; the results are presented separately in Tables 4 and 5 on page 19. The other two parameters which have been measured routinely are pH and temperature.

Table 1. Statistical Abstract of Bacteriological Data of Water Samples in Gilgit Region (indicator: E.coli)

SAMPLING POINT	SUMMER					WINTER				
	# of Villages	# of Samples	Colonies/100 ml Range	Mean	SD	# of Villages	# of Samples	Colonies/100 ml Range	Mean	SD
Spring Outlet	3	6	0 - 0	0	0	14	38	0 - 32	4.2	9.4
Main Channel Outside Settlement	11	24	0 - 250	43.7	54.0	22	46	0 - 66	9	14.2
Main Reservoir	6	16	0 - 2920	494.5	687.0	19	42	0 - 700	75.7	165.4
Intermediate Reservoir	2	4	80 - 488	253.0	154.0	5	16	0 - 1666	561.5	1104.4
Communal Tap	6	22	0 - 590	221.4	195.4	14	54	0 - 605	139.4	178.4
Yard Tap/House Connection	7	30	40 - 1790	304.4	335.6	20	62	0 - 1300	104	261
Domestic Water Channel	5	18	0 - 860	157.5	238.4	30	98	0 - 2500	132.4	361.5
Water Pit (Gulk)	3	12	90 - 2680	862.5	901.6	11	40	5 - 2000	435	429.5
Household Storage container/vessel	3	23	10 - 1340	528.5	426.5	16	67	0 - 600	46.8	113.1
Irrigation Channel	6	19	80 - 2640	533	628	13	31	0 - 3900	449.7	690.4
River (used for drinking)	-	-	-	-	-	6	12	0 - 13	6.5	4.5
Ground-Water Well	6	20	0 - 547	148	232	7	50	0 - 210	20.7	43.4

Table 2. Statistical Abstract of Bacteriological Data of Water Samples in Chitral District (indicator: E.coli)

SAMPLING POINT	SUMMER					WINTER				
	# of Villages	# of Samples	Colonies/100 ml Range	Mean	SD	# of Villages	# of Samples	Colonies/100 ml Range	Mean	SD
Spring Outlet	5	10	0 - 370	76.2	126.7	20	52	0 - 254	11	46
Main Channel Outside Settlement	-	-	-	-	-	3	6	0 - 100	43.33	37.0
Main Reservoir	1	2	0 - 38	34	4	8	26	0 - 86	15.8	22.2
Intermediate Reservoir	3	6	38 - 1180	240	420.5	1	4	30 - 50	42	8.5
Communal Tap	10	31	0 - 170	34.4	36.8	13	56	0 - 230	14.5	37.7
Yard Tap/House Connection	6	31	0 - 1250	147	284.2	17	56	0 - 102	19.4	28.0
Domestic Water Channel	7	23	0 - 1700	158.6	401.6	16	63	0 - 1930	174.5	371.5
Water Pit (Sardawai)	5	32	0 - 1720	445	491.0	8	41	0 - 1130	234.2	300.7
Household Storage container/vessel	-	-	-	-	-	13	36	0 - 290	25.6	56.5
Irrigation Channel	1	1	1030	1030	1030	-	-	-	-	-
River (used for drinking)	1	2	14 - 30	22	8	4	10	2 - 300	45.2	85.6

Table 3. Statistical Abstract of Bacteriological Data of Water Samples in Baltistan Region (indicator: E.coli)

SAMPLING POINT	SUMMER					WINTER				
	# of Villages	# of Samples	Colonies/100 ml Range	Mean	SD	# of Villages	# of Samples	Colonies/100 ml Range	Mean	SD
Spring Outlet	-	-	-	-	-	6	12	0 - 7	0.67	1.9
Main Channel Outside Settlement	-	-	-	-	-	-	-	-	-	-
Main Reservoir	-	-	-	-	-	3	6	32 - 275	117.5	100.5
Intermediate Reservoir	-	-	-	-	-	1	2	0 - 2	1	1
Communal Tap	-	-	-	-	-	3	14	10 - 190	105.4	67
Yard Tap/House Connection	-	-	-	-	-	1	2	215 - 216	215.5	0.5
Domestic Water Channel	-	-	-	-	-	5	12	0 - 308	64.1	108.4
Water Pit (chudong)	-	-	-	-	-	-	-	-	-	-
Household Storage container/vessel	-	-	-	-	-	6	30	0 - 833	105.3	196.0
Irrigation Channel	-	-	-	-	-	-	-	-	-	-
River (used for drinking)	-	-	-	-	-	-	-	-	-	-
Ground-Water Well	-	-	-	-	-	1	2	0 - 0	0	0

Discussion of the results

From the data collected about water quality, and from the information gathered by the water and sanitation inventories and other investigations, a detailed picture is beginning to emerge.

- **Springs**

  Where springs exist they are the preferred drinking source to all other alternatives. Whilst generally of good quality under natural conditions, most of them are unprotected and are consequently vulnerable to contamination by human and animal activity, especially when they are easily accessible. The results from more than 50 samples in Gilgit and Baltistan show that bacteriological quality often meets WHO guidelines[6] for drinking water, especially in the winter months. The results from Chitral were less encouraging, possibly because most of the springs sampled were close to inhabited areas. Measures to properly protect the sources should be given priority by implementation programmes for safeguarding the natural water quality.

- **Main supply channels**

  Glaciers and snow deposits are the principal source of all water in the area. The melted water enters streams called Nullah, which subsequently feed man-made channels that bring water into the settlements for their agriculture, livestock and domestic requirements. The purpose of sampling the main supply channels outside the settlements was to assess water quality immediately before entering the inhabited area. The bacteriological quality for seventy summer and winter samples in Gilgit region was found to be second best after springs. Contamination can probably be attributed to grazing animals and the common practice of people to defaecate in open areas. Winter data shows lower contamination levels which may be accounted for by less animal and human activity in these locations during the colder months.

- **Storage reservoirs**

  Most of the rural piped water systems in Gilgit and Baltistan have been implemented by LB&RDD. These systems are built on a user participation basis where the community provides un-skilled labour and locally available materials, and the remaining costs are borne by the Department. The responsibility for maintenance rests with the users. The main components are the main storage reservoirs, intermediate reservoirs in the case of large villages with several Mohallas, and the distribution network. Main reservoirs are generally located outside the settlements and they are usually filled by the channels. Most of them are built without covers which makes them vulnerable to contamination. Also, cleaning seldom takes place, and consequently any impurities that enter these

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6. See: WHO, Guidelines for Drinking Water Quality, Second edition, Volume 1: Recommendations, WHO Geneva 1993. This guideline requires zero *E-coli* colonies in a 100 ml sample of all drinking waters.

reservoirs can remain there for long periods and may even multiply. Frequently dead animals such as frogs are found inside. Algal growth is also common. The intermediate reservoirs are sometimes connected with the main reservoirs by a pipeline, or they may be filled directly from the water channels in the village. They are generally covered, but again cleaning does not often take place. Summer data for the main reservoirs in Gilgit region shows a high mean contamination level of 495 (*E-coli* colonies per 100 ml of water sample), ten times greater than that obtained for the main supply channels. Winter results are considerably better, but still show the same order of difference compared to the main channels in the winter.

- **Communal taps and house connections**

The results show high contamination levels for both communal and household taps in Gilgit region during both summer and winter. The mean value for communal taps is 221 (22 samples) and 139 (54 samples) for summer and winter respectively. A similar pattern is seen for household taps: mean value 304 (30 samples) and 104 (62 samples). The above situation raises serious doubts about the usefulness of these piped systems in terms of improving water quality. It appears that unless steps are taken to properly construct and maintain future systems good quality water will not be obtained. Worth noting is the fact that water quality in distribution channels has sometimes been found to be of better or comparable quality to tap water. The results from Chitral are notably better, but data for the house connections still shows unacceptably high levels of contamination.

- **Domestic water distribution channels and irrigation channels**

Water distribution channels are the most common domestic water supply in the area. People usually fetch their water for drinking and cooking purposes from places where it is thought to be cleanest. The same channels are used to fill the traditional water pits known as Gulk, Sardawai or Chudong. As expected the data clearly shows higher levels of contamination compared to the main supply channels before entering inhabited areas. In Gilgit region the mean value for summer contamination was 158 (18 samples), and in winter 132 (98 samples). For Chitral the data is very similar. Unlike all other sources, there appears to be very little difference between summer and winter results. This may be explained by the similar patterns of domestic and livestock activity in these settlements throughout the year. Irrigation channels are not normally used for drinking purposes. The reason for sampling these was to compare them with the domestic water channels and to assess deterioration of water quality in these traditional systems.

- **Traditional water pits**

Combined with the domestic water distribution channels, water pits are the most common source of domestic water for a large part of Gilgit and Chitral. Water usage from the pits increases significantly in the winter months when these are often the only

system functioning. The data shows that these sources are the most contaminated of all the alternatives throughout the year. In Gilgit region the mean value for summer contamination was 863 (12 samples), and in winter 435 (40 samples). For Chitral the mean values were 445 (32 samples) and 234 (41 samples) respectively. Both individual and communal pits are found in the area. Water is usually obtained from an opening at one side which involves the person standing close to the waters edge. Consequently water often splashes onto the ground and runs back into the pit. There is no provision for draining the pit and cleaning appears to be infrequent. Considering the importance of this source, an indepth study is planned to investigate possibilities for improvement.

- **Household water containers**

Samples from household water containers were taken to analyze water quality at the final point of use and to check hygienic conditions of the stored water. The summer data shows a mean contamination value of 529 (23 samples), which is only slightly better than the worse source, the water pits. There is some evidence that water in containers becomes more contaminated during its storage in the home, however, an indepth study is required to draw firm conclusions. The corresponding winter data appears remarkably better, 47 (67 samples), but is still outside WHO norms. These results highlight the need for hygiene education and motivation to change habits, as an integral component of future water and sanitation implementation programmes.

- **River water**

Compared to other sources, river water is used by a small number of people for drinking purposes, and the practice is usually limited to the winter months. In summer, other sources are often available, and most river water becomes extremely turbid. From the small number of winter samples taken from river-side collection points in Gilgit and Chitral, contamination values have been surprisingly low with means of 7 (13 samples) and 45 (10 samples) respectively.

- **Ground-water wells**

The use of ground-water is very limited in the area. Only in Gilgit town and in a few river-side villages in Baltistan do people have shallow wells. In Gilgit town, these wells were the main source of drinking water before installation of the piped systems. Many people still prefer to these wells which are mainly found in the central low-lying part of the town. Many of the wells are covered and fitted with simple hand pumps. Several wells were sampled in the summer and winter. The results show a mean value for summer contamination of 148 (20 samples), and for winter 21 (50 samples). Although these figures are well outside WHO guidelines for safe drinking water, it can be seen that in many cases, the quality of well water is actually better than household tap water in the town. Disinfection tests of the most contaminated wells proved effective, but the risk of recontamination, particularly from nearby soakage pits, should not be overlooked.

Turbidity results

The turbidity data shows that in the winter months more than 80 percent of the samples have turbidity levels below 20 TUs, excluding the water pits. It can be concluded from these results that the majority of surface water sources may not need any special pre-treatment during this period. The timing and length of this period will vary with location, and an indepth study will be required to define this more clearly. The limited summer data shows very high turbidity levels, above 2000 TUs in some cases. This suggests the need for some form of pre-treatment such as roughing filtration to reduce levels to below 20 TUs, the recommended maximum limit for treatment by slow sand filtration.

Table 4. Summary of Turbidity Data of Water Samples in Gilgit Region (percentage of samples falling under the different ranges of Turbidity,(TU)

SAMPLING POINT	SUMMER							WINTER						
	# of Samples	0 – 5	6 – 20	21 – 100	101 – 500	501 – 2000	> 2000	# of Samples	0 – 5	6 – 20	21 – 100	101 – 500	501 – 2000	> 2000
Channel Outside Settlement	13	15.4	7.7	7.7	7.7	38.5	23.0	23	69.5	13.0	8.7	4.3	4.3	–
Main Reserrior	7	57.1	14.3	–	14.3	14.3	–	20	90.0	5.0	–	5.0	–	–
Drinking Water Channel	9	22.0	11.0	11.0	22.0	11.0	22.0	33	72.7	12.1	3.0	–	–	–
Irrigation Channel	8	37.5	12.5	–	12.5	25.0	12.5	14	71.4	–	21.4	–	7.1	–
Traditional Water Pit	16	12.5	31.25	25.0	25.0	6.25	–	26	38.5	19.2	27.0	15.4	–	–
River Water	4	–	–	25.0	75.0	–	–	6	83.3	16.7	–	–	–	–

Table 5. Summary of Turbidity Data of Water Samples in Chitral Region (percentage of samples falling under the different ranges of Turbidity,(TU)

SAMPLING POINT	SUMMER							WINTER						
	# of Samples	0 – 5	6 – 20	21 – 100	101 – 500	501 – 2000	> 2000	# of Samples	0 – 5	5 – 20	21 – 100	101 – 500	501 – 2000	> 2000
Channel Outside Settlement	–	–	–	–	–	–	–	2	100	–	–	–	–	–
Main Reserrior	–	–	–	–	–	–	–	9	100	–	–	–	–	–
Drinking Water Channel	7	51.1	0	14.3	14.3	14.3	–	16	87.5	–	12.5	–	–	–
Irrigation Channel	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Traditional Water Pit	21	14.3	47.6	33.3	4.8	–	–	20	35.0	30.0	30.0	5.0	–	–
River Water	–	–	–	–	–	–	–	3	100	–	–	–	–	–

Water and sanitation inventories

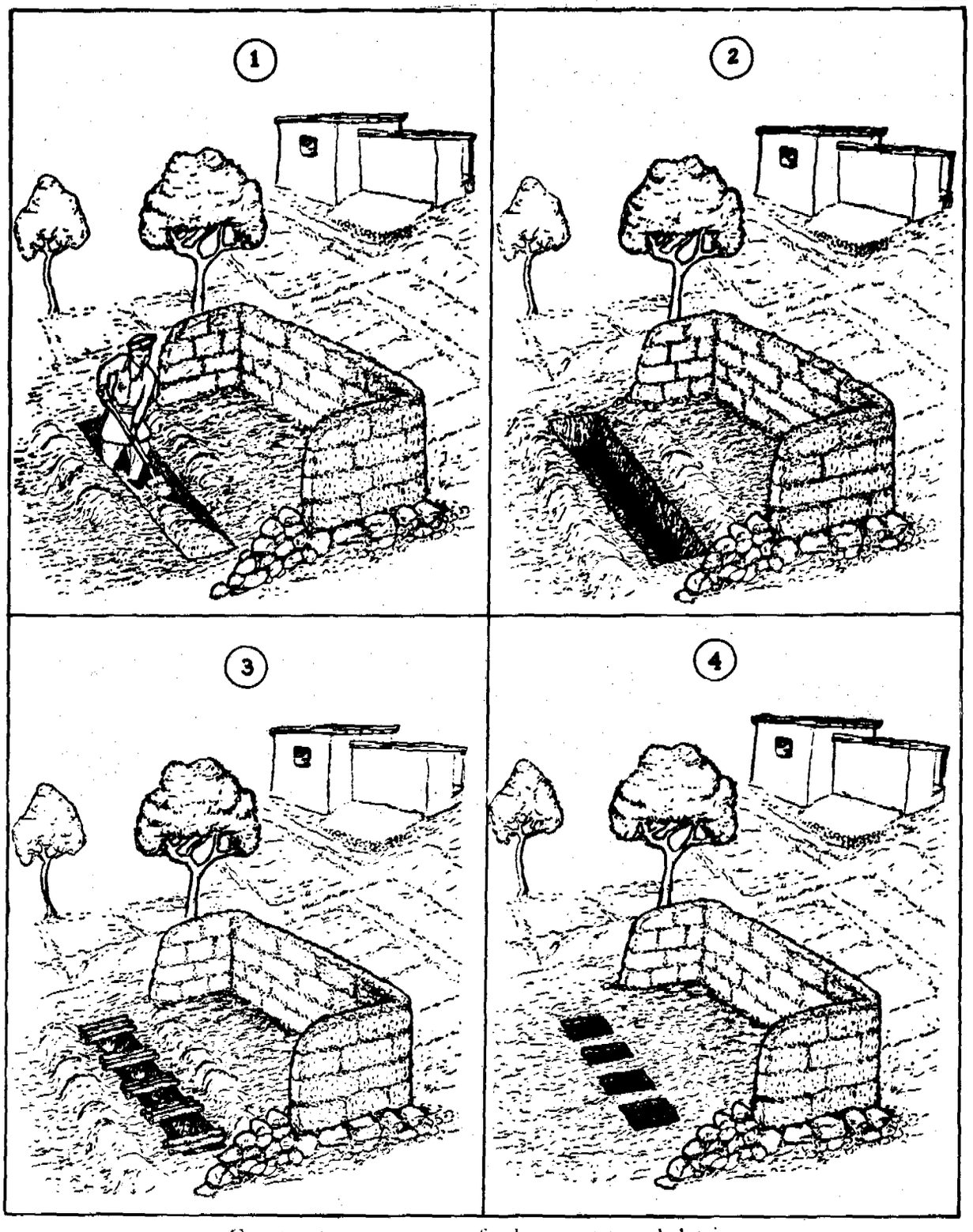
The lack of precise data about the water and sanitation situation in the area has lead the Project to commence a water and sanitation inventory exercise. Originally it was proposed to do this with the help of AKHSP and AKRSP field workers, but finally it was decided to begin this task independently. To date, 85 villages in Chitral, 33 in Baltistan and 50 in Gilgit have been included in this activity. The aim is to cover as many villages as possible to establish a reliable data base about the actual situation in the area. Using a questionnaire, information has been collected from key informants in the villages. Specifically, information is obtained about the extent of water and sanitation coverage, the functional condition of systems, different types of water source and sanitation systems being used, usage patterns at different times of the year, etc. The villagers are also asked about the problems they face with the traditional and improved water and sanitation facilities. This exercise will continue during the coming period. Also it is planned to begin analyzing in detail this and the water quality data in the next trimester.

Future plans

Many of the activities mentioned in this section of the report will be continued or will commence during the coming six months. To summarize, the main ones are as follows:

* Water quality sampling.
* Water and sanitation inventories.
* Development and monitoring of experimental latrines.
* Evaluation of Musaffa water filter bags.
* Minimum flow measurements of springs.
* Indepth studies of turbidity and bacteriological contamination trends.
* Indepth studies of the Balti latrines and traditional water pits.

ANNEX A



Construction sequence of a low cost trench latrine

LIST OF PROJECT STAFF

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