Drinking Water Supply

&

Water Borne Disease Prevention

In Tajikistan

My report is divided into two parts. First, it summarizes the background of the Tajik economic and social conditions of life at the present time. Then, it will try to define a global strategy for a water program. The objectives of this program are to supply drinking water in urban and rural areas, but also to contribute in any other way towards the improvement of sanitary conditions.

Present water and sanitary situation in Tajikistan

Access to water

People in the centers may have access to **piped water**, when power supply works on a regular base, rather frequent breakdowns of pumps would quickly be repaired and the pipe network would be in a good state. A big problem remains in the several- storied buildings, where water in many cases does not reach the upper floors. A big problem of these systems remains the cross-contamination with the sewerage system coupled with the irregular adding of chlorine.

Most people in rural area have no access to piped water connections. They relay currently mostly on irrigation channel water that only works in summer time, and on tinkering the water. Some of them rely on rainwater harvesting from the roofs.

Water quality & sources of pollution: sewerage and latrines

Sewage systems are even in worse state repair than water systems. Many smaller cities and rural communities do not have sewage collection systems nor do they have adequate latrine systems.

Lots of **irrigation channels** in the regions of Tajikistan originate from rivers heavily contaminated from the chemical factories (nitrites, ammonia, fluorine, sulfates). Consequently the irrigation channels water is dirty with fecal, chemical and other pollutants.

Up to 1991 large cotton fields were irrigated using **pesticides, fertilizers and insecticides**. Large quantities of organochlorine - compound pesticides were previously used (especially heptachlor and DDT), and the stable residues will persist in the ground for many years to come. Probably the practice to make extensive use of these chemicals stopped, but another problems are cropping up.

Since 1991 maintenance of the **drainage systems** has been completely neglected. Consequently the aquifer is rising, and the fluctuations between winter and summer levels may reach 2 meters. This development has serious consequences in the long run. Latrines may reach into the aquifer, because of evaporation; the soils will become more saline and consequently also the groundwater.

Concerning water quality of the untreated water, different organizations carried out tests. In summary, one can draw the following conclusions:

- Water from rivers, irrigation and drainage channels is heavily polluted and not recommended for human consumption
- Water from shallow aquifers (driven boreholes, hand dug shallow wells) is of medium quality and f for human consumption, but boiling is recommended
- Water from deeper boreholes is of good quality, if the upper part is sealed
- Rainwater is fit for human consumption, but addition of minerals is recommended
- Spring water has to be tested case to case.

OPERATON AND MAINTENANCE, SUSTAINABILITY

Historically, the FSU practiced a centralized form of planning in all state activities, a rather easier way of controlling for them but with less quality of results and slow accomplishment. Water Supply System in FSU, including Tajikistan was centralized. In Tajikistan, the Department of Rural Voda Canal was implementing a big water supply project. The cost of this project is so enormous that all the UN and International Agencies budgets put together would not be adequate to solve half of the project needs. The completion of the water supply project is far from reality, only a fraction of it has been done (35%), so that most towns and villages were left without being reached by the project, "no water supply". The Government (top officials) very much wishes the over ambitious water supply project to continue, notwithstanding the fact that no organization, not even the World Bank is willing to fund such a project. What the UN, International agencies and the local institutions are contributing towards the improvement of water supply in the country is very highly being appreciated by the lower people of the society (rural). They are the ones that are most affected, because in almost every capital city of the Oblasts, there is piped borne water supply, but small towns and Kishlaks are completely left out without any form of safe drinking piped water supply.

With the collapse of FSU, exacerbated by the civil war of 1992 in Tajikistan, piped borne water supply system has been affected as well since the whole system is old and dysfunctional due mostly to lack of funds to buy spare parts and change the decayed (rusted) parts, lack of liquid chlorine to purify water from source. In former times, it is a fact that local water systems were heavily subsides by a variety of local and regional state entities (e.g. free electricity, water provided free by other agencies such as Tajik Rural Water Supply Organization, or capital improvements financed by the government).
This system collapsed more or less, and prices for commodities (like power, imported goods like equipment, spares and chemicals) rocketed, but the water prices were only slightly increased.
Another reason is that especially in Tajikistan lots of **qualified and experienced staff left** (German, Koreans, Jewish, Russians).

As mentioned before, energy prices increased, although Tajikistan has lots of hydropower. Nowadays, the **power supply in rural areas is almost non-existing in wintertime** partly due to the replacement of imported gas and coal by hydropower, but also other reasons. Fluctuations in the 3-phase current often occur. It results in damaging pumps and motors of the water supply systems. Most of the facilities have no 3-phase voltage protector, or heat and water level protector.

Another problem of these systems is that even when power supply and pumps are working, there is **no guarantee** that safe water will be delivered to the customers. Main problems are illegal connections, cross-contamination and partly no availability of chlorine. In general one may state, that the bigger system, the higher the risk that cross-contamination may occur. In other words: even not contaminated borehole will be contaminated at the user point if the distribution system is in a bad state, and the purification is not done properly.

The mechanism by which water get contaminated by the general water supply system is that sewerage system enters the piped water system through rusted and licking pipes catalyzed by low pressure of the water in the pipes, thereby creating some sort of a reversal flow of water. One best method of solving this problem is to change all the rusted and licking water piped system, which is enormous and quite expensive. Tajikistan has a lot of the typical example of an urban city that has been affected with typhoid due to the city water supply, which is being contaminated by the outflow of excreta after floods. UNOPS, IFRC and international agencies injected big amounts of funds to improve the sewerage and water supply system. In no time did the

system collapse and more funds were requested from the UN and international community. What many agencies have not done is to make matters/issues very clear to the community that humanitarian assistance is a short-term aid and that they are being only helped to stand on their own.
The positive outcome amongst the UN and International agencies is that there is much collaboration that enables them makes do with the little funds available to improve the situation of WATSAN in areas of priority.

Summary: water systems, which depend on inputs from outside (energy, manpower, spares, chlorine, etc.) would need a proper and appropriate revenue collection system, which would cover all costs of operation and maintenance, but also depreciation of the system. Supply of power, chlorine, spares should be secured.

Water and Sanitation is a great concern in many parts of Tajikistan, and has a direct impact on the population health wise. Every year, there are outbreaks of typhoid fever, diarrhea diseases, and so many others as a result of contaminated drinking water through decaying sewerage system.

Summary: Water system, which depend on inputs from outside (energy, manpower, spares, chlorine, etc.) would need a proper and appropriate revenue collection system, which would cover all costs of operation and maintenance, but also depreciation of the system. Supply of power, chlorine and spares should be secured.

An **alternative** to these systems is **decentralized systems**, which do not rely on heavy input from outside, like spring catchments with short gravity pipeline, shallow well with hand pump, slow sand filters, rainwater harvesting, etc. These systems require low investment costs, practically no operational costs and may be operated, maintained and repaired on the community level. Materials and staff are locally available and people can solve the problem themselves and will have less financial constraints.
This alternative requires the involvement of the beneficiaries, which can be reached through **community awareness program**, which will include components like **hygiene education, sanitation and preventive health.**

Hygiene awareness and cultural habits/ beliefs

Commonly held conceptions include the following:

- Water is a gift from God
- Running water is clean
- Running water is cool, and standing water is not. As it is a gift from God, it has to be flowing, in irrigation channels or from open taps.

Water quality control

The control of the water quality is under SES **(Sanitary Epidemiological Station)**, which is a department of The Ministry of Health. This department has lots of other duties to perform and has certainly lost partly the control of the situation. It also seems that SES lost some of the power it had before1991. Or in other words: what shall they do if water is heavily contaminated, but there is no immediate alternative available? Close the facility?

II Strategy

The strategy is organized into four main steps:

- Identification of the sensitive areas
- Selection of the most appropriate programme in each place
- Cooperation between UN, international agencies and the local institutions
- Establishing of a monitoring process (disease incidence, water quality control). For this purpose the creation of the Water committee with representatives of the international community and the Tajik authorities (Tajik Rural Water Supply, Tajik Vodocanal, SES) will be established.

Sensitive area Identification

We select the intervention areas according to three criteria:

1. The incidence of **water borne diseases**
2. Shortages in the **existing water supply**
3. Potential of the **self-reliance of the population**

Water borne diseases

In 2004 2500 children died from water borne diseases

400 deaths were attributed to typhoid

65% of the population lacks access to potable water

54% of urban population lacks adequate sanitation

While some of these frightening statistics are a direct result of the conflict of 1992 in Tajikistan, which caused severe damage to infrastructure as well as the government's capacity to maintain what water systems remained intact, in some communities these conditions existed during the Soviet Era. Annual typhoid and malaria epidemics are endemic to the country, and the health system is poorly equipped to deal with even the simplest medical requirements.

People can contract water borne diseases by drinking water and just by being in contact with polluted water. Usually, those diseases are linked to generally bad sanitary conditions. Therefore, environmental disease incidence can be high too. The SES registers numbers of cases of typhoid, malaria, dysentery, diarrhea, hepatitis and others. But these data are not fully reliable because not every sick person goes to a health center.

In order to deal with these issues, a three-pronged approach is necessary. At one level, immediate interventions must be continued and expanded. While a number of initiatives have been undertaken over the past three years, such as provision of sand water filters for schools and clinics, hand pumps, hand- washing basins, efficient latrines, etc.

Secondly, rehabilitation of central water systems at the district and community level will continue, with particular focus on collapsed sewage systems and clearance of canals, which are not only breeding grounds for mosquitoes and water-borne diseases but also often the only source of drinking water for communities.

Finally, with a view towards the longer term, the United Nations will continue, through UNICEF and WHO, to work with the Government and the local institutions on water management policy reform, which would

address the needs of the community for an increasingly decentralized management system of water resources. Linkages with the agricultural sector to ensure protection from pollutants (insecticides, fertilizers, etc.) will be advocated, as well as increasing access to clean piped water for all sectors of the population.

Therefore the international community and the local institutions consider it essential to focus on three areas within the sector. In order to address the immediate needs in terms of access to potable water and reduction of water-borne diseases, expansion of current initiatives must occur swiftly. These interventions include:

1. Provision of sand water filters, hand pumps and hand washbasins to schools and health facilities
2. Cleaning of community canals and latrines
3. Construction of proper latrines in schools and health facilities
4. Provision of basic hygiene training to school children and health workers community awareness materials and advocacy concerning drinking water and typhoid, diphtheria.

It is anticipated that with these primary level interventions, the intensity of the annual typhoid and malaria epidemics will be reduced, as well as the incidence of other water-borne and communicable diseases.

However, the secondary level must also be supported, as it involves the community's overall access to clean water. The water management systems cannot continue to survive on the Soviet model, and communities must address these issues themselves.

There are currently some larger scale projects underway which are aimed at repairing vital infrastructure within communities. This includes piped water systems and sewage systems, as well as the water systems within community institutions such as hospitals and clinics. UNOPS and other agencies have already identified a number of projects through consultation with the communities and health assessments. These projects are hybrids - they address urgent humanitarian needs with elements conducive to longer-term development and sustainability.

Task with other sectors, the primary objective is to prevent further deterioration of the infrastructure, and to prevent the negative impact of the situation on the population.

However, WHO and others organizations will continue to work on a policy level in order to ensure that the decentralization essential to the survival of the sector is properly supported within the legislation. Other entities, such as UNOPS, the NGO community involved in the sector, and local authorities at the district and village levels, will continue to deal with the immediate crises while also looking to the future of protecting the public's health in a sustainable manner. Mechanisms for cost-recovery, such as user fees, water committees and provision of other income generating activities from which the profits will cover maintenance costs and salaries.

Self-help
The population must be involved and trained for post-management to ensure the sustainability of the project. Moreover, to improve the sanitary conditions of the population, the installation of new equipment must be linked to health education. Awareness campaigns on water use have to be conducted in the long term.

Water programme selection

First, we will explore the technical options for providing water and to improve sanitary conditions. Then we will describe how we select the best options from an economical, environmental and social perspective.

Technical options

To avoid the incidence of water borne diseases, two factors can be improved: drinking water supply and sanitary conditions (to avoid the pollution of the water resources).

Connection to an existing water pipeline

If the public network is close to the village, we can build a connection. However, the water pressure must be high enough. According to the geographical situation, the system is built with or without tank.

Advantages	Disadvantages
This is a long – term structure. Water quality can be controlled (by chlorination). It can provide water to a whole village or kolkhoz.	There can be cross-contamination with the sewerage system in the existing pipelines. This system needs an electrical supply. Usually when there is access to energy, it is limited, in winter, to two hours in the morning and two hours in the evening. Installation and post-management are expensive.

Public water supply from rivers

Advantages	Disadvantages
This is a long – term structure. Water quality can be controlled (by chlorination). It can provide water to a whole village or kolkhoz.	This system needs an electrical supply. The river can contain chemical waste. Installation and post-management are expensive

Public water supply from the deep aquifer

Advantages	Disadvantages
This is a long – term structure. Water quality can be controlled (by chlorination). It can provide water to a whole village or kolkhoz. Usually, water quality in the deep aquifer is better.	This system needs an electrical supply. Installation and post-management are expensive

Suction pump

Advantages	Disadvantages
It is easy to install and to manage. Users can repair it themselves. There is no need for electricity.	Water is taken from the shallow aquifer, ground table (which can be polluted).

Deep well hand pump

Advantages	Disadvantages
It is easy to install and to manage. Users can repair it themselves. There is no need for electricity. Water is taken from the shallow aquifer, ground table. Compared with simple hand pumps, it can provide water to more families	Compared with simple hand pumps, it is more expensive and management it less easy. It will not be as close to the houses as simple pumps can be. Moreover people may continue taking water from the canal in summer.

Others

Spring catchments with gravity pipeline: advantage: not polluted, no energy required, low maintenance.
Rainwater harvesting: rainwater is fit for human consumption, but addition of minerals is recommended.
Disadvantage: Asbestos sheets are a high-risk product for cancer.
Tankering.

Improvement of the sanitary conditions
Many infections are the result of a bad environment. Garbage, bad canal management, improperly constructed and maintained latrines, etc., contribute to water source pollution. To improve the sanitary conditions, several actions deem to be necessary:

Improvement of latrines
Latrines are a reservoir for flies and other insects that can transmit diseases. They may also pollute the aquifer. Sometimes, they are installed near pumps or canals.
It may help to rehabilitate or improve the old ones, by installation of a ventilation pipe improvement of the squatting slab and to seal the pit with yet materials to be specified.
It is also useful to build new ones, especially in public places to avoid contamination of soils and groundwater by stools.

Canals
In summer, people are used to take baths in the canals and sometimes drink water from it too. Canal water is also used to wash dishes and clothes, and some garbage can be poured in it. Also contact with contaminated water can bring diseases. Therefore, the water quality has to be improved by the dredging of these canals (removal of the silt, laying of pipes, etc.).

Garbage disposal
For the same reasons as with latrines, garbage has to be collected and buried at a safe place, at least 30 meter away from a water source.

Public bath
In summer, people bathe in the canals. In winter, in most of the villages, there is nothing.

Sand filters
Of course, all those projects are useful only if they are linked to a **strong health education campaign.** The goal is to avoid the incidence of the same mistakes (latrines near canals, garbage near water pump, etc.) in the future.

TECHNICAL SELECTION

Parameters
We have to take into account several parameters:

- **Geographical situation**

In urban areas, it is paramount to curb the wastage of water by introducing proper revenue collection systems and implementing a widespread public campaign, touching also sensitive cultural issues. Water should be chlorinated and residual chlorine content should be maintained at all users points. In densely populated urban areas, shallow wells are no alternative to piped systems and should only be considered as a last option.

In rural areas all options are available, but most important criteria should be sustainability, and effectively and investment and operation costs and for these the decentralized technical options are to be favored clearly.

In the mountains, there are several options, in order of priority: spring catchments, roof catchments, hydraulic ram, and river intake with slow sand filtration.
In lowland, we can chose between groundwater abstractions and river intake with treatment plant.

- **Accessibility of groundwater**

In some parts of the project area the aquifer is very deep. If the water is deeper than about 10 m, hand pumps cannot be produced locally. Options would be the IM II or III, which are used in many parts of the world. For depths of more than 60 m, submersible pumps are recommended.

- **Quality of the aquifer**

The quality of the aquifer is good, the quality of the shallow aquifer of medium quality. Abstractions from the shallow aquifer have to be coupled with a sanitary survey and necessary action to be taken, when a possible source of contamination is discovered.

ANALYSIS

The international agencies and the local institutions to select the best have created a **tool of supplying** drinking water. For each technical option, we can estimate the feasibility and cost (including water quality measurement and post-management). For that, we have to collect some data in the village.

For each village, we conduct an analysis based on several criteria. These analyses take into account: technical feasibility (set-up, costs, working life), water quality (of raw water and for delivery) and management (cost, difficulty).

Multi-criteria analysis for water programme selection

Indicators for the raw water quality
Physic-chemical
Microbiological

Indicators for the duration
For implementation
For equipment (working life)

Difficulty in managing the equipment
Tank
Filter
Borehole pump or booster
Hydraulic pump
Chlorination
Pipe/tap

Indicators for the guarantee of delivery
Water quality
Water quantity
Power supply
Water quality analyses
Chlorine supply

Costs
Equipment setup
Yearly operation and maintenance costs
Water quality analyses

General indicators
Water quality
Duration (setup and working life)
Technical management
Guarantee for delivery
Costs

After the technical and economical analyses, marks are allocated to each technical option. In this way, in each village me can choose the best way of providing water.