Current situation of water supply and improvement of Sanitary Conditions in Republic of Tajikistan

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Abstract. Access to piped water was never 100% in Tajikistan. The mountainous topography of the country presents major physical challenges to extending the water supply network. According to UNICEF, 57% of the population (3.7 million people) is covered at present, including 93% of the urban population and 47% of the rural population. Just over 10% (650,000 people) use spring water, 3.7% (235,000 people) use river water, and nearly 25% (1.52 million people) use water *from* gorges, canals irrigation ditches or pools. Access to piped water does not mean simply access to safe drinking water. The case of Dushanbe is illustrative: 16% of supplies into of the Dushanbe water *system* are diverted direct1y from the river into local distribution net works without any treatment.

1. Introduction

Water is essential for all aspects of life, yet one billion people worldwide are denied access to clean water supplies and half of the world's population lacks adequate water purification systems. The global consumption of water is doubling every twenty years, and it is estimated that in 2025, if present rates of water consumption are maintained, five billion out of the world's 7-9 billion people will be living in areas where it will be difficult or even impossible to meet basic water requirements for drinking, cooking and sanitation. The supply of safe drinking water is of vital importance because of the high risk of contracting life-threatening diseases from polluted or contaminated water sources and absence improper use of sanitation facilities [1].

The world's population continues to grow by some 77 million annually. Over the next is years almost all of the projected 1,1 billion increase in global population, from 6,1 billion in 2000 to 7,2 billion in 2015 will be in developing countries, which now account for four-fifths of the global total [2]. Taking a longer time span, the world's population is expected to reach 7-9 billion by 2025 and 9-3 billion in 2050. Population growth rates are particularly high in the least developed countries estimated at 2,4 per cent annually in the period 2000-2015, while in the developed countries this figure is estimated to be just 1,1 per cent. Of course, global figures conceal major differences in growth rates between regions and countries. Global population is also becoming more urban, with the proportion of the world's population living in urban areas projected to raise from 47 per cent in 2000 to 53 per cent in 2015; this trend being especially pronounced in the developing countries [3].

1.1. Water shortages

The ever-increasing demand for water, especially in cities, is caused by the increased demand by large populations in the expanding urban areas. Urban sprawl and residential development draw off increasing quantities of water, reducing water recharge. Where this occurs concurrently with the extraction of groundwater, subsidence and saltwater intrusion are commonly the result. This can accentuate flooding problems and, again, it is the poor living on flood –prone lands that are most vulnerable to these effects. The combination of rapid population growth, groundwater depletion, poor drainage and sea-level rise is a potent threat for many large urban populations in coastal areas [1]

1.2. Health targets and critical linkages to water

The high cost of water and lack of water quality for the poor are responsible for a low level of personal hygiene and associated spread of communicable diseases, and high prevalence

of water-related diseases. Some 60 per cent of all infant mortality is linked to infectious and parasitic diseases, many of them water-related [4].
With adequate supplies of safe drinking water and sanitation, the incidence of some illnesses and deaths could be reduced by much as 75 per cent [5].
Water-related diseases constitute a major obstacle to the achievement of a healthy population in most developing countries. While the quality of water itself is of prime concern to reduce and eventually eliminate the risks associated with microbial infection, water as the medium of vector support is also a crucial consideration. Infants and young children are particularly vulnerable to this cluster of diseases and infant and child mortality rates from these causes in many low-income countries are unacceptably high. The same set of diseases has a wide impact on mothers and newborn children and account for a large proportion of maternal deaths [3].

1.3. Water access and Hazards to Health

Water is an essential resource for sustaining health, yet both the quantity and quality of available water supplies are declining in many parts of the world. About half the world's rivers are seriously depleted and polluted, and some 80 countries with 40 per cent of the earth's population are suffering from water shortages [6]. This trend has contributed to the entrenchment of poverty in whole countries, and marginalized large sectors of population in others. There people in particular are vulnerable to water-related illnesses, including those resulting from poor sanitation and hygiene.

Appropriate hygiene and sanitation practices are both dependent for their effectiveness on access to clean water. Most water-related infections are acquired through the faucal-oral route; hence, adequate latrines, cleanliness to keep human and animal faucal material out of living quarters, and washing hands after defecation, are necessary measures to avoid infection. It is difficult to practice even elementary hygiene without sufficient of water free of these contaminants. In addition, it is necessary to protect the water sources themselves from faucal contamination and agricultural and industrial pollutants. In developing countries, go to 95 per cent of all sewage and 70 per cent of all industrial wastes are dumped into surface water [7].

Making adequate water supplies available and accessible to the poor, providing hygiene education in schools, and protecting water sources from contamination, play critical roles in breaking the faucal-oral transmission cycle. Studies show that improving water and sanitation can reduce the number of diarrhea episodes by between 20 per cent and 26 per cent, and better hygiene practices, such as washing hands regularly, can reduce the number of diarrhea cases by up to 35 per cent [1].

1.4. Water – related is eases and their effect on reproductive health

The ingestion of water contaminated by faucal material infects people with viruses such as hepatitis, bacteria such as amoeba. In communities where such contamination is low, and where generations have used the same water source and have become immune to a low level of pathogens, the water may not carry life-threatening risks. However, children, pregnant women and those whose immunity is compromised by HIV/AIDS and other diseases are at significant risk.

Water-related diseases, such as diarrhea and cholera, kill an estimated three million people a year in developing countries, the majority of whom are children under the age of five. Other diseases, such as malaria, which are carried by insects and other water-based vectors, account for up to 2.5 million deaths a year [8].

Over two million people, most of them children under five years of age, die each year of diarrhea disease linked to inadequate water supply and poor hygiene. Another million die of malaria. In China alone, 1.5 million people are infected with hepatitis A [9]. Intestinal worms, which can lead to malnutrition, anemia and retarded growth, infect about 10 per cent of the population of the developing world. An estimated 200 million people are infected with schistosomiasis, of which 20 million suffer severe physical debilitation. The disease, which is found in 74 countries of the world, is caused by one of the five species of the parasite Schistosomiasis that attacks the liver, bladder, lungs or central nervous system [10].

All of these diseases affect pregnancy outcomes: the health of the mother as well as the as the developing fetus and the newborn. Infectious hepatitis is usually fatal in pregnancy. Malaria may cause anemia, chronic fatigue and hemorrhage in childbirth. Hookworm alone affects some 20 per cent of the world's population, and because it causes chronic faucal blood loss, it has the most detrimental effect on maternal anemia [11].

2. Water supply and Improvement of Sanitary Conditions of Tajikistan [12]

2.1. The purposes on water supply and improvement of sanitary conditions

Problem 10 from PMD 7 is "decrease twice by 2015 quantities of the people who are not having steady access to safe drinking water ". In addition to it, the World Summit on steady development, which took place in 2002 in Johannesburg (2002) also, has accepted the plan: "to decrease twice 2015 by quantity of the people who are not having access to the basic services of sanitary". In the same 2002, Special Session of UNO devoted to children has made a decision: "To provide by 2015 all schools with pure water and means of sanitary" Improvement of access to safe drinking water and means of sanitary are important elements in efforts on achievement PMD 2 - maintenance of general base education, and PMD 4, 5, concerning health of the population.

Maintenance of the population with safe drinking water - one of the most important purposes of human development, without which achievement other tasks of MDG are unrealistic...

2.2. Current situation and tendencies

Now, water supply and sanitary in Tajikistan are neither safe, nor adequate. According to Ministry of Health RT (November 2004) from 699 centralized systems of water supply available in the country 113 do not function, 358 do not meet the sanitary requirements, operating systems submit water with faults and are not guarantee of stable and steady access to safe potable water.

With mid-annual prepossessed water resources in volume more than 13000 cubic meters of water per capita, Tajikistan - one of the richest states with water resources in the world, and still the country can provide only 59 populations with access to safe drinking water (Table 1).

Table 1. Access to sources of drinking water Villages

	Tajikistan	Cities	Villages
percent			
Safe	59,0	92,9	46,9
Dangerous	41,0	7,1	53,1
Total	100	100	100

As a whole, the country has the lowest level of access to drinking water in the CIS, and outbreak of the illnesses caused by a condition of water; represent serious risk for public health. A high level of the diseases caused by water condition in areas with inadequate system of water supply and sanitary - the main reason of children's death rate and a bad nutrition in the country.

In some cities (Dushanbe, Sarband) the raw crude river water directly enters in water pipe system which is strongly destroyed and subject to frequent disconnection.

In rural regions where less than half of inhabitants have access to the improved water sources, the most part of the population uses water on the further current from channels, ponds, reservoirs the rivers and other dangerous sources.

Concerning sanitary conditions, almost all households have access to dug lavatories in the form of a hole, but the majorities of them is badly constructed and are risk for public health.

The majority of rural schools and medical institutions lack appropriate public health services and systems of water supply. So, for example from 3694 schools (546 city and 3148 rural schools) the water pipe is available only in 1718 of them, at other schools there is no access to safe drinking water. At 140 rural schools of the country there are no lavatories.

The same situation takes place in some part of 3352 units of medical institutions. Owing to deterioration of water-distributive networks and other basic constructions of water systems the tendency of decreasing in percent of population security is observed by safe water from water supply system.

There are some reasons of bad condition of water and sanitary services in Tajikistan. As well as in other sectors, the difficulties caused by the post Soviet transition to market economy and civil war, have worsened an infrastructure of water supply. A low level of official budgetary appropriations and difficulties with gathering payment at water-users has strongly limited internal financing, which has appeared insufficiently to execute essential requirements of capital investments. Even if financing would be increased, it is doubtful, that bodies of water supply could effectively to distribute resources in sector with account of its many urgent needs. In addition to investments structural reforms are necessary for increase efficiency of maintenance services and strengthening of stimulus of rational water consumption.

Achievement planned PMD for maintenance with water will demand providing of access to safe water in addition for 3 million peoples for the period from 2005 till 2015. According to estimations, hardly more than 1 million from them will be born in areas, where the improved water systems have been already the New infrastructure of water supply should be constructed to provide access for other 2 million people, overwhelming majority from which live in rural areas. As it is marked by Government RT in National Strategy for Reduction of Poverty (NSRP) as city areas already have more expanded access to an infrastructure of water supply, the policy should be concentrated on improvement on service for agricultural population. Unfortunately, by present time small progress in this direction has been reached. If the situation soon and essentially will not change hardly Tajikistan can reach planned for it PMD in sphere of maintenance with water.

In the program document of the European regional bureau of WHO “Tasks on Health achievement for everybody” (Copenhagen, 1991) the most important place is given to the problem of water quality. By 2000 all people should have access to adequate systems of drinking water supply, and the pollution of earth waters, rivers, lakes and seas should not represent threat for health of the man ".

Priority of this task is caused by that in accordance with the data of CART, 80 % of all illnesses in the world are caused by the use of substandard water and infringement of sanitary - hygienic norms of water supply. To the water factor is connected incidence of about 2 bln. man. The access to water pipe line water in Tajikistan never was absolute. According to UNICEF water pipe-line water uses about 57 % of all population (3.7 mln. man), switching 93 % urban and 47 village population. Little more than 10 % (650 thousand man) uses spring water, 3.7 % (235 thousand the man) river water and almost 25 % (1.52 mln. man) consume water from channels, hauzes and reservoirs. The access to water pipe-line water not necessarily means access to safe drinking water. On the data World Bank (WB) in Dushanbe 16 % of water acts in system of urban water supply from the river without clearing. About 65 % of systems of water supply of republic of water-supply and water-division network are in a semi-destructive condition.

The shortage of water especially hardly has an effect for a rule of schools and other public institutions. The joint research which has been carried out by UNICEF and ACTED, in many respects spills light on the given situation: the estimation of the projects on a sanitary condition 6OO of schools of Khatlon and Sogd areas has shown, that more than 45 % of schools has no access to safe drinking water.

Low skill level of the employees and significant reduction of financing have resulted in 50 % to decrease of clearing ability - with 245 mln. m^3 in 1990 up to 120 mln. m^3 in 2000. Less than 10 % of water of the basic network of water supply is exposed to clearing. In portable account on all population having access to water it means 44 liters of safe water on soul of the population per day. In Dushanbe 16 % of river water gets in distributive networks without clearing (Fig.3). On village water pipes in failure condition contain public of a water inlet column, there is no industrial laboratory control, submit water 2-3 hours per day, that results in

fall of pressure in networks and infiltration of pollution. So for example, on 35 waterpipes which provide in the basic population of the regional centers, from existing 270 deep pumps 47 % do not function, and in areas of republican submission from 285 42.8 % do not function, to a Kurgantube zone of Khatlon area from 127 67 % do not function.

In sewer of a cleaning network in 1999 there were 480 failures, from them 460 in of Sogd area.

The pollution of water resources communal-household and industrial wastes is the disturbing factor requiring urgent intervention. The experts assert, that in the rivers of Tajikistan at 40-45 times more bacteria getting there with a household waste, than in the rivers the industrially advanced countries. In 1998 the dump of the polluted waters in the Vakhsh river has made 8 %, in Kafirnigan -60 %, in Syrdarya -23 %. The general pollution of water resources has made more than 6 <d on one inhabitant.

On a slide pollution of water resources has made more than 6 m^3 on one inhabitant.

In areas of irrigated agriculture, where the most part of the population uses mainly arik water, morbidity in 3-9 times is higher.

Strong dependence of Tajikistan on an agriculture and, as a consequence, influence of the chemists used in cotton-planting, and also presence others agricultural wastes render negative influence on health of the people. Such illnesses, as typhoid, diarrhea, dysentery, diphtheria and hepethite are caused by the use of the polluted water, while marsh-ridden sites provoke distribution malaria. To it testify the table on.

Water as one of the basic and most dynamical components is especially vulnerable to the factors of influence of anthropogenesis character.

In conditions of Tajikistan in connection with high concentration of the population on valleys of the rivers and accommodation of the basic industrial objects in this zone the factors of influence of anthropogenesis character get the special outline and urgency.

The choice of technology of qualitative drinking water, at which the probability of formation mutagen-active connections during processing is shown to a minimum, depends, first of all, on physical-chemical and microbiological structure of natural water, which is defined by climatic and hydro chemical conditions, character of water vegetation, anthropogenesis loading on natural sources.

The deterioration of drinking water quality following its collection from a community well or standpipe and during storage in the home has been well documented. However, there is a view that post-supply contamination is of little public health consequence. This paper explores the potential health risk from consuming recontaminated drinking water. A conceptual framework of principal factors that determine the pathogen load in household drinking water is proposed. Using this framework a series of hypotheses are developed in relation to the risk of disease transmission from re-contaminated drinking water and examined in the light of current literature and detailed field observation in rural Honduran communities. It is shown that considerable evidence of disease transmission from recontaminated drinking water exists. In particular the type of storage container and hand contact with stored drinking water has been associated with increased incidence of diarrhoeal disease. There is also circumstantial evidence linking such factors as the sanitary conditions in the domestic environment, cultural norms and poverty with the pathogen load of household stored drinking water and hence the risk of disease transmission. In conclusion it is found that re-contaminated drinking water represents a significant health risk especially to infants, and also to those with secondary immunodeficiency [13].

The traditional technological circuits of preparation of drinking water consisting of processes pre-chlorination, the processing's by coagulant, filtering and disinfecting by chlorine reduce the total contents of organic impurity approximately on 50 %.

One of the sharpest problems in modern technology water-preparation is the formation collateral of chlorine-organic products at chlorination of water, which contains soluble organic substances.

The presence in water Cu, Mn, Zn, Al, Fe increases the contents trigalogenmethan in 2-3 times, and Pb- in 5-6 times. In result of chlorination are formed trichlormethan, chlorine-acetic an acid, chlorine-acetone, polichlorination, phenol, chlorate. It is known, that chlorate alongside with chlorite causes hemolytic anemia in an animal. At chlorination of waters containing lignin's and humus connections, is formed mutagen connection MX (3-chlorine - 4-dichlorinemethil -5-hydroxide -2 (5H) –phuranol), present in drinking water in concentration 2-87 ng/ dm^3.

Carried out onco-epidemic of supervision testify to presence of the raised level of diseases at the population of bodies of digestion and increase of risk of morbidity by a crawfish urinary bubble and tumour thick of bowels at the long use of chlorinate drinking water. WHO is recommended that the total contents ClO_2+ClO^-_2 + ClO^-_3 - in drinking water did not exceed 1 mg/dm^3.

Chlorine, a useful water treatment agent, is less effective in turbid water, and lacks a visible effect, limiting its acceptability. A product incorporating precipitation, coagulation, flocculation, and chlorination technology (combined product) to reduce microbial, organic and heavy metal contaminants in water was evaluated. The combined product's microbiological efficacy in Guatemalan villagers' households was evaluated. One hundred randomly selected households from four neighboring Guatemalan villages were enrolled. Three groups received the combined product and either the Centers for Disease Control (CDC) water storage vessel, a covered bucket with spigot, or no vessel. One group received chlorine bleach and the CDC water storage vessel, and one group no intervention. Household water samples were collected for 4 weeks and Escherichia coli, chlorine, and turbidity levels were measured. Potable water was defined as having less than one E. coli per 100 ml. Eight (8%) baseline water samples were potable. Follow-up water samples were more likely to be potable than control samples (combined product and traditional vessel 83%; combined product and CDC vessel 92%; combined product and covered bucket with spigot 93%; chlorine and CDC vessel 92%; versus control 5%). Among combined product users, 98% reported improved water clarity compared with 45% of chlorine bleach users ($p<0.0001$). The combined product technology improved water portability as effectively as chlorine bleach; improved water clarity could motivate more persons to effectively treat their water [14].

The parameters of quality inputs are conditionally subdivided into two groups: primary and secondary. The primary parameters characterize water of a source and include organleptic, permanganate oxidation, biological parameters, and concentration of various components. The secondary parameters characterize collateral products of processing of water reagents, such as chlorine-organic connection (products chlorination) aldehides, kethone (products of ozonization) residual aluminum (at use coagulant on the basis of aluminum) residual phloculant etc.

The basic distinction between two groups is, that the primary parameters decrease, and secondary are increased with growth of dozes reagents. Thus, the secondary parameters impose rigid restrictions on dozes reagents.

At the analysis of systems of water supply the basic direction considers optimization water-supply in connection with the large expenses of energy for swapping of water. Much less attention is given to optimization of the charges reagents for processing water, though this problem becomes more and more urgent.

In process of coagulate clearing of natural superficial waters from them the most part of polluting substances causing turbidity and colour leaves.

Thus the contents ditoplanktone microorganism, connections of various metals also is sharply reduced.

In this plan by development of the modern technological circuits of water-preparation it is necessary to pay special attention to unit coagulation.

Most widespread coagulant are sulfate of aluminum (chloric iron, aluminate of sodium. From them sulfate of aluminum frequently is applied as in our country, and abroad. However recently in practice water-preparation and water-clearing tendency to use more effective coagulant - basic sulfates (Thus the contents phytoplankton, microorganisms, connections of

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Most widespread coagulant is sulfate of aluminum (SA), chloric iron, aluminate of sodium. From them sulfate of aluminum frequently is applied as in our country, and abroad. However recently in practice water-preparation and water-clearing tendency to use more effective coagulant - basic sulfates (BSA) and basic chlorides (BSA) of aluminum is observed.

Essential lack SA is the decrease of efficiency it coagulating action at lowered temperature of cleared water. The increase of stability sol hydroxide of aluminum in these conditions (1-20^{0}C) slows down speed aggregate- formation and sedimentation that result in increase of the contents of residual aluminum in the cleared water.

The aluminum in alive organism does not carry out any physiological function, though enters into structure of alive substance. Acting in organism with water the aluminum in the form insoluble phosphate is deduced with faecals, and is partially soaked up in stomach-intestinal a path in blood and taken out by kidneys. If the activity of kidneys is broken, there is an accumulation of aluminum accompanying with growth of fragility of bones, infringement methabolism Ca, Mg, P, F and development of the various forms anemia. Were found out and more formidable of display toxicity of aluminum: infringements of speech, failures of memory, turbidity of mind, convulsion. On the contrary, at research BSA and BCA more complete removal of clay and organic substances, reduction of quantity of the dissolved aluminum in the cleared water is reached. It is established, that the increase base BSA results in strengthening formed corns and improvement them sedimentative properties, and in a case BCA depending on quality of initial water the decrease of a doze reagent on 10-30 of % is reached.

The stage postchloration in technology of clearing is necessary for preservation of sanitary quality of water in networks because of presence at water of residual quantity biologically of oxide organic substances.

At absence disinfective reagent the quantity of bacteria contained in water can reach up to 107unit/sm^3. The introduction of chlorine even in quantity up to 3mg/dm^3 has the limited influence on the already generated biofilm and does not remove an opportunity of its formation on a pure surface. A major role in formation of a biofilm play contained in water organic bio-sulfate substance, i.e. presence of nutritious environment for bacterial growth. At decrease of concentration of the dissolved organic carbon (DOC) on an input in a network up to 0,1-0,2 mg/dm^3 it is possible to prevent formation of a biofilm on walls pipelines.

Thus, if to reach complete extraction DOC from drinking water, it is possible absolutely to refuse from post-chlorination.

The world organization of public health services formulates the concept of creation of technologies of preparation of qualitative drinking water, which consists of Creation of multiple barriers in process water treatment for complete removal of the pathogenic agents polluting substances and biodecomposed connections before realization final disinfection ;

Optimization of use at clearing water chemical reagent both developments of physical and biological methods of clearing for decrease of necessary dozes chemical reagent.

The raised interest to such strong gaseous to an oxidizer, as ozone recently is shown. It, first of all, is caused by that at its application in drains any additional impurity are not brought in, and the most important disinfectant substance ozone works at 15-30 of time faster, than chlorine. Ozone is made on a place of consumption; ozonization promotes saturation of water by oxygen.

The basic expenses influencing on cost of process ozonation , are the capital expenses for the equipment and cost of the electric power. Now there is a lot of ways of perfection of this rather perspective process in particular, for the account, increase of concentration of raw material on the basis of complete replacement of atmospheric air by technological oxygen.

The analysis of world achievement in area of the most perfect technologies of preparation of drinking water shows, that one or two stages ozonation with the subsequent filtering of water through granulating active coal are strongly included as components of modern technology

water-preparation.

It is remarkable, that denitrified bacterium in absence of oxygen or at its low concentration use nitrites for oxidation on organic substances. At surplus of organic substances, which it is necessary oxidize at presence appropriate of bacterial cultures a reduction nitrite up to molecular nitrogen is carried out.

By results of researches of last years it is possible to approve, that a way coagulantion, based on application as the additives natural powdery silicate together with basic coagulating reagent - by sulphate aluminium is perspective and promising.

For example, the introduction of clinoptilolit in cleared water together with coagulant at parity 1:1 allows in comparison with traditional way coagulation to increase a degree of clearing of water on muddiness - by 73 %, on color - on 55 % and on residual aluminum - on 65 %.

The decrease of the contents of residual aluminum in the cleared water up to norm recommended a WHO is especially important that is there is less 0,2<mg/dm^3.

The optimum doze of coagulant $Al_2 SO_4$ for clearing water muddiness - 5,1 mg/dm^3 and colour - 49 hailstones makes 15< mg/dm^3 in account on Al_2O_3. The joint application of sulphite aluminum and powder manner clinoptilolit allows saving the charge coagulant on 10-15 %. Besides at the additive clinoptliloit is considerably increased hydraulic lump size formed corns and is improved them of sedimentative property.

Hydroxide of aluminum besieged on a granular material, effectively takes fluorine from water. Therefore disf;ourinazation of water produced , using processed by salts of aluminum sand, ceramist , breaking clinoptilolit . Maximal capacity on fluorine has aluminum modified clinoptilolit (0,5-10mg/g, which in the natural form does not take fluorine.

Thus, for achievement of high parameters on quality of drinking waters and embodiment in life of the concepts the WHO is necessary to strengthen research and applied works on modernization traditional and development of modern technologies of water preparation with wide attraction of local aluminum-silicate raw material of Republic of Tajikistan.

National strategy on supply by potable water includes five elements:

(1) Increase in financing. The important priority of the Government is the increase in investments for restoration of water systems. Now, investment is carried out basically at the expense of international financial help on development and concentrated in large and small towns of republics. As it was marked in (SRPR), authorities recognize necessity of direction investments into rural areas.

(2) Improvement of management of the municipal companies. A part of National Strategy of Reduction of Poverty is increase of abilities municipal enterprises -service providers on operation and technical maintenance of water supply systems. The low wages and emigration within the last decade have decrease personnel potential, both at the level of management, and on technical level. Reforms of managements also are necessary for strengthening management of organs of water supply at national and regional levels.

(3) Realization of legal and normative-legal reforms. Legal and normative-legal reforms for increase of an overall performance of water system, especially concerning regulation and tariff policy are required. Strengthening of potential for the control and regulations also is necessary to separate function of supervision from operational function. Amendments to the legislation on the enterprises of public service are aimed at the further division of the organs, engaged on development of policy and strategy of sector and regulation, from service providers.

(4) Increase of compensation level of production costs. To achieve "compensation of all production costs" which SRPS allocates as the final purpose for services, some time it is required, and it will demand large modernization of the technical and administrative resources necessary for the control of water distribution, definition of the size of payment for using water and its gathering from users.

The strengthened tariff reforms and gathering of payment will help to strengthen stimulus for rational use of water. The government knows influence at increase in tariffs for water and how the level of their gathering will be reflected on poor households, and hopes to work with

th6e international partners on development of the program on mitigation of influence price increases on poor households.

(5) Rationalization of water consumption. In addition to reduction of physical outflow from getting old system of water supply, the Government should strengthen stimulus for consumers to reduce their prodigal consumption. It is necessary to improve gathering of tariffs and the tariff policy. Some limited tariff increases are planned in 2004, but at the same time it is necessary to estimate, whether organs on water supply can reach higher level of gathering tariffs as they raise the prices.

Considering potential benefits for social development, the investment in development of water services should be a high priority for Tajikistan. The volume of resources necessary for expansion of access to safe water and adequate sanitary conditions in Tajikistan, much less, than in sectors of education and public health. The greatest needs are in rural areas where construction, development and functioning of water supply systems of is rather cheap. Expenses for restoration of urban systems of water supply, however, is high and considerably add the problems, facing to sector in aspect of financing demands.

Tajikistan, hardly, will execute PMD on water supply and sanitary without joint efforts from national authorities, local communities and the international partners. As a whole, cost of achievement PMD 7 on water supply and maintenance of sanitary conditions is estimated in US$992,5 million (Table 2). Separate, greatest clause of charges for achievement PMD 7 restoration of the urban systems of water supply which have come to a bad condition (603,0 million US dollar). Without essential investments in this sphere the growing urban population of Tajikistan, most likely, more and more faces danger of the illnesses caused by quality of water. Outbreak of typhoid in the capital in autumn of 2003 and in summer of 2004 once again demonstrated potential consequences not investment the investments into services of water supply.

Table 2. The General expenses for water supply and improvement of sanitary conditions

	2005	2010	2015	Total	2005	2010	2015	in average
	US$ mln. (2003)				Pro person US$			
Capital expenses	59,0	63,6	68,2	700,9	8,5	8,3	8,1	8,3
Current expenses	19,6	26,2	34,4	291,6	2,8	3,4	4,1	3,5
Water supply	57,8	61,6	64,1	675,6	8,4	8,1	7,6	8,0
Sanitary and purifying construction	20,0	27,5	37,6	307,4	2,9	3,6	4,5	3,7
Population possessing of information	0,8	0,9	0,9	9,5	0,1	0,1	0,1	0,1
Totally expenses	78,6	89,9	102,6	992,5	11,4	11,8	12,2	11,8

The level of water consumption per capita in towns is extremely high. Without installation of counters of consumption water in households and improvements of gathering payment for it, it will be extremely difficult for Tajikistan to lower prodigal consumption of water and use internal resources for investments into operation and development of urban systems of water supply. The basic investments for restoration of urban systems of water supply are for a water-distributive network, stations of water-preparation, pump stations, and for installation of hydrometers.

Improvement of gathering incomes - key aspect of water supply strategy sector of Government RT and a primary factor supporting long-term stability of granting of services on water supply. If the level of a collecting tariffs will increase up to 95 and tariffs will increase up to 0,15 US dollars for cubic meters of drinking water then urban organs on water supply could receive up to US$155 mln. for the period 2005-2015 and these incomes would be sufficient to pay both expected current working costs, and needs for regular investments in the basic means of infrastructure of water supply.

From nearby 2.9 million people in Tajikistan, living without regular access to improved water sources, 2.8 million lives in rural districts.

There are three basic variants for expansion of access to the improved water sources in rural areas: the new centralized systems of water supply based on drilling of chinks and installation of electric pumps, deep manual pumps and springs. It is necessary to emphasize, that in some rural areas (Kharasan, Danghara and some others) are not available in nearby settlements sources of water supply (not neither no superficial underground). Water supply of such settlements should be made from the crown sources transfer of water on a long distance. Now, about 1,7 million countrymen are connected with rural operating central systems of water supply. These networks require large restoration at all levels-withdrawal (fence) of water, its processing and distribution. Expenses per capita on rehabilitation of rural systems of water supply make US$7 (US$5 for the networks providing access through public water-folding columns instead of inside domestic column).

Other means of maintenance with water (for example manual pumps, springs and the protected wells) have lower expenses for restoration on unit and are rather cheap for repair. All charges on repair existing rural systems of water supply in Tajikistan are estimated approximately in US$10 million.

Calculations show, that full volume of the main investments necessary for construction of new central systems of water supply in rural areas where there are sources of water supply (superficial and underground) vary approximately from US$16 up to US$26 per capita. It depends, by the way, on quality of material resources and from, whether cranes in a court yard will be established or to be limited only with street water-folding column.

Research of UNICEF offers, that cost on unit of installation the deep manual pump, capable to provide 300 people with pure water, makes nearby US$3,000. If to be realistic, only manual pumps cannot execute planned PMD. They are the best approach as expansion means of the improved access to water the remote communities, providing reliable deliveries of water for schools and hospitals, and for maintenance of temporary service of communities which, finally, will receive the central systems of water supply.

Annual working costs are insignificant; maintenance service and expenses for replacement are necessary only when naturally calamity or actions of the person destroy water system. When it is necessary, expenses for repair are usually paid by local units. The official statistics shows, those sewer constructions are accessible only approximately for 23 percent of population, almost all of which live in town districts. Expenses for sewage treatment are insignificant in rural areas where a little household have access to the water drain and where there is no necessity to build clearing stations (table 3).

Table 3. Expenses on sanitary and purify of sewage

	2005	2010	2015	Total	2005	2010	2015	average
	US$ mln. (2003)				Pro person US$			
Capital expenses	11,5	14,9	19,1	165,9	1,7	2,0	2,3	2,0
Urban sewage purify construction (SPC)	3,7	5,5	7,7	61,1	1,8	2,1	2,3	2,1
Urban sanitary units	5,0	6,5	8,4	72,5	2,4	2,5	2,5	2,5
Rural SPC	0,0	0,0	0,0	0,1	0,0	0,0	0,0	0,0
Rural SPC (bath and lavatory)	2,8	2,9	3,0	32,3	0,6	0,6	0,6	0,6
Current expenses	8,5	12,5	18,4	141,5	1,2	1,6	2,2	1,7
Urban SPC	4,4	5,5	7,5	61,6	2,2	2,1	2,2	2,1
Rural on SPC	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Totally expenses	20,0	27,5	37,6	307,4	2,9	3,6	4,5	3,7

Rise of a level of public education concerning sanitary conditions and hygiene is the important element of strategy of improvement of parameters of health in Rural areas. The analysis considers cost of maintenance of training at a level of communities, for an explanation the question of necessity investments in sanitary means of households.

National campaigns on assistance of raising of health, by estimations can approximately cost US$32 000, they can offer model for campaigns on water and sanitary conditions. The UNICEF has suggested leading wide informational-explanatory campaign on hygiene at schools. Cost of the program on the average makes 1000 dollars on school which includes expenses for lectures, materials of the basic literature on hygiene.

Prospective total financing of all expenses on sector "Water supply and Sanitary" is resulted below in Table 4.

Table 4. Supposed financing

Source	US$ mln. (2005-2015)
Urban households	265
Rural households	22
Government	33
International	85
Total	**405**
Shortage (break) of financing	587

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