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### Access to Water and Sanitation in China: History, Current Situation and Challenges

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Water is the source of life, and is critical to the life and health of the human being. Access to water and sanitation is the basic rights of the human being. China is the country with the most population in the world. It is statistical that at the end of 1999, the population in the mainland reached 1259 million, of which the population in contents of rural water supply (including towns) was 940 million. The population in the rural areas supplied by tap water was 370 million. The population in the rural areas supplied by the distributed water sources including the central water sources, hand wells, water pools and water cellars ect., was 520 million. Particularly in the western China, the tap water coverage in the rural areas was only 27%-43%<sup>1</sup>. According to the investigation of the health departments and assessment of UN agencies, there are about 34% rural population existed in unsafe drinking water supply, with about 320 million populations.

In China, access to water and sanitation is considered as the preliminary task for the water resources development in the new century. 2002 Water Law (Article 54) defines that “the government at the various levels should implement positive methods to improve drinking water supply”. In the recent years, the Chinese governments at the different levels put more attention to water and sanitization, especially to the rural regions, by increasing investments and strengthening management. But the access to water and sanitation is still a critical issue for China in the new century, which threatens the health of the people.

In China, access to water and sanitation includes two contents, access to water is to change water, access to sanitation is to change latrines. Of course, these activities are mostly in the rural areas. The access problems of rural drinking water supply in China could be concluded into three types:<sup>2</sup>

- Resources-shortage type. The northwest, north, northeast China has an annual precipitation of only 200-600mm, and is suffered from fluent droughts.
- Engineering-shortage type. Due to complex topographical and geological condition, some areas in southwest, south and middle China, with an annual precipitation of more than 1000mm, lack of storage facilities and is difficult to store water.
- Quality-shortage type. The fluorine and arsenic contents of groundwater and surface water in some regions in China exceeds standards, and are harmful to health. Additionally, due to the fast economic development, discharge of wastewater pollutes water body and makes some areas lack of safe drinking water supply.

### **1 The development of water and sanitation in China<sup>3</sup>**

China covers a wide area, with uneven temporal and spatial distribution of water resources. Affected by the topography, location, hydro-geological conditions, the wide rural areas in the hilly mountains, loess plateau, pasture land, coastal areas, islands and high- fluorine areas, exist drinking water shortage to some extent. In order to survive, local people had to drink water from pools with poor quality or saline water, and resulted in epidemic diseases. In high- fluorine areas, the local residents

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<sup>1</sup> Yangbin Li. Rural water supply in China: circumstance, issue and strategy. Available at [http://www.iwhr.com/SpecialNews\\_More.asp?ClassID=7](http://www.iwhr.com/SpecialNews_More.asp?ClassID=7).

<sup>2</sup> 2004, China Water Resource, No.21.

<sup>3</sup> Ministry of Water Resources, 50 years of water resources development in China, <http://www.mwr.gov.cn/ztbd/huihuang/hh50/chapter7.htm>.

lose working ability due to drinking high-fluorine water. In the mountainous areas, the fetch of drinking water occupies too much time, and caused to poverty. In China, there are more than 46000 towns with population of 200 million. These towns are the local political, economic and cultural centers in the rural areas. Due to the lack of water supply infrastructures or water sources, the economic development and improvement of living standard in many towns are constrained. Also due to the less developed economy, the poor sanitation connected with water is a major threat on the health of the residents in the rural areas. But it is fortune that since the foundation of PRC, access to water and sanitation has developed significantly, especially after 1978 when China implemented the reform and opening policy.

### **1.1 Rural drinking water supply**

The rural drinking water supply developed through four stages since 1950s as following:

(1) The beginning stage.

In 1950s, the rural population in China is relative less, with lower productive level and relative less water usage. The drinking water supply in normal year was not a problem. The state incorporated with the building of irrigation engineering to solve drinking water issue. In 1960s, water resources departments in some regions began to build rural drinking water supply projects with plans, and organized the local peoples to dig water cellars and wells, and build water pools family by family. At this stage the scale was small and it is the beginning to solve rural drinking water supply.

(2) The fully developed stage.

In 1970s, the continuous droughts in northern China resulted in difficulty in drinking water supply. The drinking water supply was listed as the important issue in rural water resources development. Under the support of the state, the machinery wells were wide developed to solve field irrigation and drinking water supply as well. At the same time, some engineering special for drinking water were built, including machinery wells, storage pools etc. In 1976, the water supply in the pasture areas was listed in the national plan, focusing on solving drinking water supply. During this stage, besides to use water resources projects to solve drinking water supply, the local peoples were organized to build many drinking water supply engineering by the ways of storing, diversion, digging, interception. Until 1979, more than 40 million peoples and more than 21 million livestock's drinking water supply was solved, 49% and 42% needed to solve respectively.

(3) The fast development stage.

After 1979, the state increased the support on poverty reduction and the rural drinking water supply stepped into the fast development stage. In 1980, the first national rural drinking water supply working conference was held by Ministry of Water Resources (MWR), and developed the target of solving drinking water supply of 40 million peoples and 30 million livestock's in five years. In 1983, the rural drinking water supply plan began to formulate and implement. In 1984, the State Council issued "the temporary regulation on rural drinking water supply", defining scope and standard to solve the issue.

In 1985, the second rural drinking water supply working conference was held by MWR to implement the State Council's policy.

In order to fast solve rural drinking water supply, with the poverty reduction strategy, the state increased the investment on rural drinking water supply. During 1984-1989, the state used the stored cotton, grain, and clothing and other industrial products to support the poor regions to solve rural drinking water supply. At the same, the state used the World Bank low-interest loans to support rural water sources change and water supply project engineering.

Under the support of the governments and other parties, the rural water supply achieved fast development, until 1990, 2.2 million rural water supply projects were built totally, which solved 132 million peoples and 78.87 million livestock's drinking water problem. But there was still 82 million peoples and 50 million livestock's suffered from drinking water supply in 1990.

(4) The hard-difficulty-solving stage.

In 1990, the rural drinking water supply went into a time to solve the critical difficult issue. In 1991, the State Council issued "the Ten Year Plan and the Eighth-five Year Plan for Rural Drinking Water Supply and Township Water Supply". In 1992, the State Council issued "China Children Development Plan Profile in 1990s", which claimed that the rural drinking water supply (including water flourosis) in water shortage areas would cover 95% of the population. In 1994, the State Council formulated "the Eight-seven Poverty Reduction Plan ("eight" means 80 million population, "seven" means seven years). It was planned to solve the poverty reduction issue of 80 million peoples by seven years, of which rural drinking water supply was one of the key tasks. The state arranged special capital resources to solve the problems.

It is mentioned that during this phase, with the development of market economy in China, the innovative method was introduced in rural drinking water supply, such as farmer participation etc.

From 2000 to 2004, 57 million rural residents had solved drinking water supply problem, which realized the objective of rural drinking water supply for "Tenth-five" year plan one year earlier than planned. Until the end of 2004, the rural drinking water supply had been solved according to the standard of rural drinking water supply formulated in 1984. The rural drinking water supply stepped into a new era to solve rural drinking water safety, to solve the population drinking high-fluorine water, high-arsenic water, saline water and areas suffered from schistosomiasis.

## **1.2 Township water supply**

The township water supply provides water to domestic and productive water use for the towns in the rural area. So the township water supply develops with the town development. Since 1950s, the township water supply in China has developed from the preliminary level to a higher level.

(1) The preliminary stage.

In 1950s, the economy at most rural areas is less developed. There were only a few towns at the suburb areas of the large cities building some water supply projects with simple facilities and poor water quality. During 1960-1970, towns in developed areas in China built central water supply projects, providing tap water to farmers, as well as productive use for service sector, with improved water quality.

(2) The beginning stage.

In 1980, with the fast development of the township enterprises and increase of township population, the water supply shortage constrained the social and economic development in the rural areas. In order to meet the demand, many towns utilized the water resources projects as the reliable water sources, and supplied water to towns according to locality. Since 1989, a lot of pilot cases were conducted around China, which accumulated many experiences for dissemination.

(3) The fast development stage.

In 1991, the first township water supply conference was held by MWR. In 1991-1992, China Agricultural Bank, with MWR, conducted the pilot cases for township water supply by using agricultural loans, with interest subsidy from water resources funding. Since 1993, the State Council arranged special loans for township water supply. At the same time, the provinces and regions collected funding. The increase in investment fastened the township water supply. Additionally, the training and plan, as well as technical guidance, were formulated and conducted.

In China, township water supply development is a new sector growing with the rapid township enterprises, development in agricultural production, the labour transmission to township, and urbanization. At the end of 1998, more than 30000 township water supply projects with different scales had been built, with the supply capacity of 60 million tons daily, providing water services for 150 million people and productive activities, supporting the local economic development, improving living condition and health.

### **1.3 Urban water supply and wastewater treatment**

#### **1.3.1 Urban water supply<sup>4</sup>**

The urban water supply in China developed since 1879. Until 1949, there were about 9 million populations in 72 cities getting access to tap water, with the capacity of 2.406 million tons daily. In 2003, the total urban water supply capacity reached 239.67 million tons daily, 291.25 million populations getting access to the urban water supply (Ministry of Construction, 2004).

The modern urban water supply begins in 1950s. In 1950s, China began its urban water supply construction by itself. In 1960, the cities with urban water supply increased to 171, with a supply capacity of 10.208 million tons daily and served population of 78.53 million, with coverage of 60.2%.

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<sup>4</sup> The 50 years of urban water supply. Available at <http://www.hg98.net>.

Also in 1950, China formulated its first urban water supply standard with 11 indicators, and revised in 1955, 1956 and 1959 by increasing indicators.

During 1960-1970, the urban water supply was under continuous development. In 1980, China developed its urban water supply capacity to 29.79 million tons daily, with annual water supply of 8.83 billion tons, supplying 72.88 million urban residents. At the same time, China began water saving activities.

Since 1980, with the fast urbanization process, urban water supply in China went into a great development. At the same time, water supply capacity, water quality, service, supply technology and operational standards were improved and increased. During this period, a lot of projects were built to alleviate supply and demand conflicts (Table 1).

### **1.3.2 Urban wastewater treatment<sup>5</sup>**

Compared to urban water supply, urban wastewater treatment developed very later. In 1950-1960, there were only about 10 wastewater treatment plants with the maximum plant capacity of 50000 tons daily. In 1950, China encouraged wastewater irrigation too. At the end of 1970s, China began to build its first experimental wastewater treatment in Tianjin, which prepared to build large-scale plants in China. The experimental plant operated in 1984 with capacity of 260,000 tons daily. At the same time, provinces in the eastern China began to build wastewater treatment plants.

During to the great investment requirement to build urban wastewater treatment plants, the foreign investments became an important source, and accelerated the wastewater infrastructure development in 1990s and at present. In 2003, the total wastewater treatment capacity in China was 42.54 million tons daily with annual treatment of 14.80 billion tons (Table 1).

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<sup>5</sup> The circumstance and trends of wastewater treatment in China, available at <http://www.hg98.net>.

Table 1 The urban water service development in China<sup>6</sup>

year	integrated production capacity (million tons/day)	total water supply (billion tons)	residential use (billion tons)	population supplied (million)	Coverage rate (%)	wastewater treatment capacity (million m <sup>3</sup> /day)	wastewater treated (billion tons)	wastewater treatment rate (%)
1986	104.08	27.74	7.07	117.58	51.3			
1987	113.64	29.85	7.6	126.85	50.4			
1988	127.16	33.86	8.74	140.5	47.6			
1989	128.21	39.36	9.31	147.86	47.4			
1990	142.2	38.23	10.01	156.11	48			
1991	145.84	40.85	11.6	162.13	54.8	3.17	4.45	14.86
1992	160.36	42.98	11.73	172.81	56.2	3.66	5.22	17.29
1993	169.28	45.02	12.83	186.36	55.2	4.49	6.23	20.02
1994	182.15	48.95	14.22	200.83	56	5.4	5.18	17.1
1995	192.5	48.16	15.81	221.66	58.7	7.14	6.89	19.69
1996	199.9	46.61	16.71	219.97	60.7	11.53	8.33	23.62
1997	205.66	47.68	17.57	225.5	61.2	12.92	9.08	25.84
1998	209.92	47.05	18.1	231.69	61.9	15.83	10.53	29.56
1999	215.52	46.75	18.96	238.86	63.5	17.67	11.36	31.93
2000	218.42	46.9	20	248.09	63.9	21.58	11.36	34.25
2001	229	46.61	20.36	258.33	72.26	31.06	11.97	36.43
2002	235.46	46.65	21.32	274.2	77.85	35.78	13.49	39.97
2003	239.67	47.53	22.47	291.25	86.15	42.54	14.8	42.39

<sup>6</sup> Dept. of integrated finance, Ministry of Construction, 2004, China Urban Construction Yearbook 2003. China Architecture & Building Press.

## 1.4 Rural sanitation

Rural latrine change is an important method to prevent and control intestinal epidemic diseases, and a hygiene basis to improve rural living standards. The latrine change in rural areas is the main activities to improve sanitation in China. In China, rural sanitation improvement is one activities of “Patriotic Hygiene Movement”, which is a Chinese characteristically movement recovered in 1978. The great achievement gained since 1978, especially in 1990s. The 1993 national survey on rural sanitation conducted by National Patriotic Hygiene Movement Commission Office revealed that 85.9% of households have access to latrines, of which only 7.5% had sanitary latrines. A National Multi-Indicators Cluster Survey in March 1995, reported an average national sanitation coverage of 24% in 74% in urban and 7% in rural areas respectively (Unicef, 2000).

A national statistics reporting system on rural sanitation was established in 1995. According to the reporting system, the average national rural sanitation coverage in 1995, 1996, 1997, 1998 and 1999 was reported as 15.78%, 20.91%, 29.55%, 35.03% and 39.83% respectively.

In recent year, through the government initiation, many provinces and municipalities have made tremendous progress on sanitation in rural areas. For example, Shanghai had achieved rural sanitation coverage of over 90%. At the end of 2003, in 248.79 million rural households, the coverage of sanitation latrines was 50.92%, 2.26% higher than 2002. The 126.24 million sets of sanitary latrines had been built, adding 10.8 million households using public toilets and high-temperature fertilizer treatment in minority regions, the rural manure disposal rate has reach 55.28%.<sup>7</sup>

According to Chinese Government Criteria, a sanitary latrine should have a water proof underground compartment, a proper roof and superstructure as no fly and maggot and obnoxious smell. The 6 main types of technology options currently being promoted and built in China are:

- Three-compartment: with 34.3591 million sets in 2003, 27.22% of the total sanitary latrines, which is widely promoted in Hainan, Fujian, Shanghai, Guangdong, and Zhejiang provinces and municipality.
- Double urn: with 12.3839 million sets in 2003, 9.81% of the total sanitary latrines, which is widely promoted in Henan, Xinjiang and Guangdong provinces and regions.
- Biogas: with 10.6555 million sets in 2003, 8.41% of the total sanitary latrines, which is widely promoted in Guangxi, Sichuan provinces and regions.
- Urine separation: with 0.685 million sets in 2003, 0.54% of the total sanitary latrines, which is widely promoted in Shandong, Guangxi provinces and regions.
- Flush latrine: with 8.1887 million sets in 2003, 6.49% of the total sanitary latrines, which is widely promoted in Hebei, Hubei provinces.
- Other type: with 59.9687 million units in 2003, 47.50% of the total sanitary latrines.

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<sup>7</sup> Bulletin of Patriotic Hygiene Movement, 2004, Vol.3., available at <http://www.moh.gov.cn>.



The choice of these technology options is depending on local culture and habits, climate and geographic conditions, economic capability of household and farmers' habit on the utilization of digested human sludge as fertilizer.

Table 2 Rural sanitary latrine development in 2003<sup>1</sup>

year provinces	Rural households (1000 households)	Sanitary latrines (1000 households)							sanitary latrine coverage (%)	Increase in 2003 (1000 households)	Accumulation (1000 households))	Manure disposal rate (%)
		Sum	three-compartment	double urn	biogas	urine separation	flush latrine	others				
1999	0	0	23658	11061	6727	0	0	43651	39.8	0	0	23658
2000	237725	0	27196	11063	7507	0	0	49953	44.8	237725	0	27196
2001	247441	0	29527	11497	8179	1232	6144	57471	46.1	247441	0	29527
2002	0	120617	0	0	0	0	0	0	48.7	0	120617	0
2003	247898	126241	34359	12384	10656	685	8189	59969	50.9	247898	126241	34359
Beijing	1254	915	334	127	5	0	10	440	73	1254	915	334
Tianjin	1096	404	100	4	2	0	105	192	36.9	1096	404	100
Hebei	14048	5554	208	281	407	0	1102	3555	39.5	14048	5554	208
Shanxi	5926	2468	4	105	95	2	254	2009	41.7	5926	2468	4
Inner Mongolia	3903	1383	36	0	0	0	7	1341	35.5	3903	1383	36
Liaoning	6899	3383	236	4	139	19	291	2694	49	6899	3383	236
Jielin	3948	2215	0	0	2	6	14	2192	56.1	3948	2215	0
Heilongjiang	6664	3505	69	22	0	84	258	3072	52.6	6664	3505	69
Shanghai	1277	1186	1071	114	0	0	0	0	92.8	1277	1186	1071
Jiangsu	17451	8004	3842	360	113	15	424	3249	45.9	17451	8004	3842
Zhejiang	11493	8456	4758	74	117	55	625	2827	73.6	11493	8456	4758
Anhui	12137	6182	801	199	215	17	418	4532	50.9	12137	6182	801
Fujian	6817	3535	3223	157	117	0	38	0	51.9	6817	3535	3223
Jiangxi	8504	4858	1027	25	780	10	437	2580	57.1	8504	4858	1027
Shandong	20051	12984	1505	2228	406	191	920	7735	64.8	20051	12984	1505
Henan	19624	11728	618	6990	241	26	1054	2798	59.8	19624	11728	618
Hubei	11260	6841	909	500	687	0	1141	3604	60.8	11260	6841	909
Hunan	12919	7020	1616	398	778	2	474	3752	54.3	12919	7020	1616
Guangdong	14247	10413	8633	0	169	0	0	1611	73.1	14247	10413	8633
Guangxi	8416	3825	1681	40	1651	99	45	309	45.5	8416	3825	1681
Hainan	1305	669	626	0	26	0	0	16	51.3	1305	669	626
Chongqing	7269	2752	415	0	502	5	0	1831	37.9	7269	2752	415
Sichuan	19110	6395	1632	21	2722	5	254	1562	33.5	19110	6395	1632
Guizhou	7596	1634	82	7	210	0	95	1240	21.5	7596	1634	82
Yunnan	8569	3938	375	26	767	2	29	2740	46	8569	3938	375
Shaanxi	7007	2296	288	309	427	126	84	1063	32.8	7007	2296	288
Gansu	4963	2204	70	78	66	3	82	1906	44.4	4963	2204	70
Qinghai	699	403	0	0	0	0	19	384	57.6	699	403	0
Ningxia	1003	266	0	25	13	18	9	202	26.5	1003	266	0
Xinjiang	2444	827	0	290	0	0	0	537	33.8	2444	827	0

1, National Patriotic Hygiene Movement Commission Office, available at <http://www.stats.gov.cn/>.

Table 3 Rural drinking water supply in 2003<sup>1</sup>

Year Provinces	Accumulated population benefited (1000)	Running water plant and station			Hand well			Rainwater harvest			others	
		Unit	Accumulated population benefited (1000)	Benefited in 2003 (1000)	1000 set	Accumulated population benefited (1000)	Benefited in 2003 (1000)	Water cellar (unit)	Accumulated population benefited (1000)	Benefited in 2003 (1000)	Accumulated population benefited (1000)	Benefited in 2003 (1000)
1990	665850	332044	271280	0	33110	172510	0	0	0	0	222060	0
1991	705550	522691	300920	0	36070	198980	0	0	0	0	205650	0
1992	740575	551517	327283	26532	37746	203412	4818	0	0	0	209880	3921
1993	762114	591251	350066	22695	39758	206621	2702	0	0	0	205421	-1699
1994	779706	650103	370046	19871	38238	208052	1497	0	0	0	201608	-3698
1995	798792	640375	400862	31885	39987	204983	698	33058	213	143	192734	-8704
1996	824121	568168	428274	25830	43997	219118	5688	400581	3642	1063	173087	-3736
1997	848430	605626	458057	29130	46816	225467	5504	525626	4258	608	160648	-8730
1998	864428	614686	481039	28627	47296	227905	2175	990020	6971	1926	148512	-14403
1999	876079	652814	508436	24420	52154	224432	-2417	1119854	7782	762	135428	-9464
2000	881122	674758	526695	24114	48910	222648	1266	1622886	10023	1141	121756	4749
2001	861132	694138	521458	22163	67251	212140	397	1370335	10539	992	116994	-3370
2002	868330	645939	536527	23083	66159	209178	-2210	1559750	11888	1218	110740	-5508
2003	873866	630903	548370	17613	56123	208105	-1837	1760607	12596	1189	104796	-4306
Beijing	3468	3713	3382	7	19	59	-3.1	0	0	0	27	4
Tianjin	3776	2946	3279	32	162	437	0	2019	9	0	52	-32
Hebei	52772	38722	42680	799	10328	8429	-363	57450	168	6	1494	-163
Shanxi	22104	17384	18062	132	286	961	33	47876	208	32	2874	35
Inner Mongolia	13488	4935	5253	127	1582	7222	153	54792	267	78	745	2
Liaoning	23002	6469	14106	-1107	2455	8132	335	401	4	2	760	427
Jilin	15643	6389	7511	619	2244	7210	-308	0	0	0	922	-196
Heilongjiang	21880	13450	12467	351	2142	8434	-124	0	0	0	979	-99
Shanghai	4628	156	4625	0	0	0	0	0	0	0	2	0
Jiangsu	55019	7628	47456	3574	727	4775	-472	0	0	0	2788	-458
Zhejiang	35376	31783	31335	568	289	1036	-11	26864	84	11	2921	-132
Anhui	43821	12403	14974	1060	6426	23037	178	2402	316	17	5495	-666
Fujian	26864	15292	19581	216	1612	1547	68	0	0	0	5735	-282
Jiangxi	33454	13566	15399	630	2197	9967	170	0	0	0	8089	-402
Shandong	69633	39948	44165	1664	6203	24858	-1323	33715	212	-27	397	-172
Henan	76699	48457	38720	631	8213	37189	-2	17588	148	3	641	-88
Hubei	40580	36620	22901	261	1326	10116	-107	91233	763	107	6801	97
Hunan	45236	58417	25919	731	1770	8954	-105	0	0	0	10363	-461
Guangdong	59208	24927	44376	873	1730	10493	-373	52	10	0	4329	-387
Guangxi	35685	32170	20328	880	1734	11108	89	210722	1908	37	2341	-226
Hainan	5602	11000	3348	312	154	1480	-81	52	4	0	770	-159
Chongqing	23246	49629	16325	765	98	960	33	0	0	0	5961	-431
Sichuan	64837	77567	29993	1160	2476	12946	147	29198	176	85	21723	-856
Guizhou	20974	31221	15085	650	21	84	12	86131	1377	104	4427	33
Yunnan	29808	28302	20807	590	166	1045	2	241798	1413	170	6543	-27
Shaanxi	15215	6432	7309	848	1236	3068	171	106927	1073	174	3765	199
Gansu	16662	6244	7932	608	265	1921	33	731547	3677	264	3131	135
Qinghai	2879	1444	2239	121	18	392	10	3891	69	51	180	0
Ningxia	3610	344	1357	100	239	1002	0	15949	711	74	541	0
Xinjiang	8699	3345	7456	411	7	1243	0	0	0	0	0	0

1. National Patriotic Hygiene Movement Commission Office, available at <http://www.stats.gov.cn/>.

From the review of development of water and sanitation development in China, it could be concluded that the development of this process mainly are driven by the following factors:

- Political willingness and governmental support. The water and sanitation improvement is the key issue for the rural areas. Due to the less developed economy in these regions, the governmental support and political willingness became the main driving force to improve water and sanitation condition.
- The critical situation of water and sanitation & user need. It could be founded that the water and sanitation issue itself becomes the factor to solve the issue. For example, the droughts in 1970s in northern China became a factor to accelerate the process to solve drinking water supply. At the same time, with the development of towns, the requirement for water and sanitation is the cause to improve township water supply.
- Economic development. The solution of this issue should be dependent on economic development and financial resources. With the fast economic development after 1980s, China significantly fastened the process to solve the access to water and sanitation issue, and basic solved the problem in 20 years.
- Change with the external environmental change. The solution strategy changes with the external environmental changes in about 50 years. Before 1980, the access to water and sanitation was almost supported and pushed by the governments; but since the end of 1990, the innovative methods were introduced. The wide participation of the farmers makes the water and sanitation pushed both by governments and beneficiaries, makes the projects more sustainable and consider the user needs.

## **2 The current situation of access to water and sanitation in China**

### **2.1 Access ratio**

With the fast economic development, access to water and sanitation in China achieved great progress in the recent year, and this process will continue in the foreseeable future with China to build a harmonious society, which focus on the balanced development and the poor.

According to the statistical data, unit 2004, China has solved rural drinking water problem for 297 million peoples totally<sup>8</sup>. At the end of 2003, the urban supply capacity reached 47.53 million tons daily, supply 291.25 million urban residents, with coverage of 86.15%.

At the end of 2003, in 248.79 million rural households, the coverage of sanitary latrine was 50.92%. At the end of 2004, there were 708 wastewater treatment plants in 661 cities, with the treatment capacity of 49.12 million tons daily, more than two times in 2000. The total urban wastewater treated was 16.28 billion tons. The urban wastewater treatment rate reached 45%<sup>9</sup>. But from a nationwide view, the development of wastewater treatment is not balanced. Until the end of June, 2005, there were still 297 cities in total 661 without wastewater

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<sup>8</sup> Ministry of Water Resources, 2005, 2004 Statistic Bulletin on the national Water Activities.

<sup>9</sup> Ministry of Construction, notice of national urban wastewater treatment, 2005.

treatment plants including 8 large cities with population more than 500 thousand. The eastern China is better than the western China.

## **2.2 Water tariff**

### **2.2.1 Rural water supply**

According to the “Digest of Project Assessment Report on National Rural Drinking Water Supply for Poverty Reduction”<sup>10</sup>, in the different kinds of projects, the acceptance of rural water users to water tariff is different. The rural water users’ satisfaction degree on water tariff was highest in one-household supply project (without tariff); the second was central water supply project; the lowest was distribution supply. But even in the distribution water supply projects, the satisfaction degree was nearly 85%. The satisfaction degree on water tariff reflected the user attitudes to project operation and management, which directly connects with the supply cost (tariff).

Through the survey around China, the water tariff in the central water supply projects was higher. Additionally, for this kind of projects, the users have to pay for the cost from the supply sites to the households. But compared to the difficult water use condition and cost of labor and money previously, the users could accept the water tariff of central water supply projects.

Additionally, the acceptance of farmer to water tariff is closely connected with the water tariff formulation procedure and formality, and participation of farmers in water tariff formulation. The one-household supply project refers to micro-water supply project, including water cellar, pool, well ect., which is built, owned, managed and used by one household. So it is most satisfied because of without water pricing and tariff. The central water supply project always is managed by the water resources departments or professional organizations, with formal standards and higher service level. The water tariff should be approved by the pricing departments and be obeyed by all parties. While in the distribution water supply projects, the “one affair one discussion, democratic decision” method is adopted in order to let the beneficial farmers to solve the issue by themselves. This institutional design is less flexible than the one-household supply project. Also the water quality and quantity guarantee degrees of the distribution water supply projects is less than those of the central and one-household. The negotiation cost to design use, management and financial institutions satisfied most users is higher too.

In the questionnaire analysis, compared the farmer groups with poor economic condition and good economic condition, it is found that the satisfaction degree of the poor on project operation and management including water tariff is much less than the good one. This reflects the economic condition affecting the farmer acceptance. In the poor areas, due to special poor condition, and without the concept to pay, and hygiene concept, there is different opinion on

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<sup>10</sup> Digest of Project Assessment Report on National Rural Drinking Water Supply for Poverty Reduction, 2004, China Water Resource, No.21.

water tariff. Additionally, for some factors resulted in high supply costs, such as high-head pumping projects in dry areas, if water tariff was collected according to cost recovery, the users would not be able to afford and special compensation should be implemented.

The assessment report concluded that, in general, the farmer has a higher acceptance to water tariff, and water tariff acceptance is related with the economic condition, the poor area has a lower acceptance. The acceptance is related with the participation: more participation and self-management, more satisfaction. The water pricing and water tariff collection is not a pure economic issue, it is a management and institutional issue first. It is a question about the farmers' full participation based on clarified property rights of the projects.

### **2.2.2 Urban water supply tariff and wastewater treatment fee.**

The urban water tariff in China is under regulation all the time since the beginning of 1990s, with the market reform, and will continue in the foreseeable future. The water tariff regulation in China could be categorized into three steps:

- The first step, with the characteristic of rising urban water supply tariff, is an efforts to cover the water supply cost and reduce the government subsidies; this step is still undergoing, but in some cities the urban water supply have been at a reasonable level to cover the supply cost.
- The second step, with the collection of wastewater treatment fee, is to provide the funding for wastewater treatment. At the end of June, 2005, there were 475 cities collecting wastewater treatment fee, and 186 cities had not yet collected. But problems existed in wastewater treatment fee are lower fee level and lower collecting rate. The fee standard in one-fourth of cities collected was less than 0.3 RMB/m<sup>3</sup> (domestic). The current wastewater tariff level could not meet the cost to treat, so it will continue regulating.
- The third step, with the implementation of water resources fee regulation, will regulate water resources fee level. This process will begin in next year.

As for the residential user payment, current in China, most cities in China pay water supply and treatment service at a cost of less than 1% of the average salary (Table 4). So in the urban area, the water service is not a burden for the users.

Table 4 Water and Wastewater Treatment Tariff of the Provincial Capital Cities in China

Cities	water tariff <sup>1</sup> (RMB/m <sup>3</sup> )	wastewater treatment fee <sup>2</sup> (RMB/m <sup>3</sup> )	population supplied <sup>3</sup> (1000 person)	residential water usage <sup>4</sup> (million tons)	annual residential water usage (m <sup>3</sup> per capita)	average salary <sup>5</sup> (RMB)	Water service cost of the salary (%)
Beijing	3.7	0.9	9627	464.3	48.23	25697.95	0.86%
Tianjin	1.03	0	6238.9	188.46	30.21	19011.88	0.16%
Shijiazhuang	2	0.6	2014	90.66	45.01	14368.32	0.81%
Taiyuan	1.35	0	2502.7	118.78	47.46	12764.8	0.50%
Huhehot	1.03	0	950	22.36	23.54	15101.94	0.16%
Shenyang	1.15	0.5	3590	131.07	36.51	15512.57	0.39%
Changchun	1.03	0	2392	111.5	46.61	15694.3	0.31%
Harbin	1.8	0.5	2640	199.25	75.47	13204.96	1.31%
Shanghai	1.03	1	12782.3	929.14	72.69	27393.6	0.54%
Nanjing	1.09	1	4200.9	332.28	79.10	22565.96	0.73%
Hangzhou	1.35	0.5	2369.1	179.45	75.75	25532.39	0.55%
Hefei	0.77	0.2	1477.2	89.1	60.32	15231.91	0.38%
Fuzhou	1.2	0	1533.2	136.4	88.96	16122.71	0.66%
Nanchang	0.88	0.22	1963.7	187.82	95.65	15206.47	0.69%
Jinan	2.6	0	2433	130.02	53.44	17306.25	0.80%
Zhengzhou	1.5	0.65	2400	118.79	49.50	14691.08	0.72%
Wuhan	1.03	0	3874.9	424.45	109.54	13729.79	0.82%
Changsha	1.02	0.2	1889.8	187.19	99.05	17579.68	0.69%
Guangzhou	0.9	0.7	5711	715.7	125.32	29778.54	0.67%
Nanning	1.08	0.5	1207	113.21	93.79	15263.52	0.97%
Haikou	1.03	0	1230	60.45	49.15	14818.98	0.34%
Chongqing	2	0.6	5450.1	265.52	48.72	13706.81	0.92%
Chengdu	1.05	0.15	3638.1	221.78	60.96	16447.75	0.44%
Guiyang	1.03	0	1501	100.47	66.94	12168.11	0.57%
Kunming	1.3	0.5	2044.3	44.73	21.88	14700.78	0.27%
Xian	2.45	0.16	3627	120.02	33.09	13825.53	0.62%
Lanzhou	0.7	0.2	1500	70.72	47.15	14143.28	0.30%
Xining	1.3	0	788.5	58.51	74.20	20050.83	0.48%
Yinchuan	1.3	0	655.3	24.03	36.67	14122.54	0.34%
Urumqi	2.1	0	1815	148.77	81.97	16543.47	1.04%

1, Water tariff is 2005 data from [www.waterchina.com](http://www.waterchina.com).

2, Wastewater tariff is 2005 data from [www.waterchina.com](http://www.waterchina.com). In some cities, the wastewater metering volume is calculated as the 90% of freshwater usage, the table does not clarify this.

3, Population supplied comes from China Urban Construction Statistics Yearbook 2003. The data is 2003.

4, The residential water usage comes from China Urban Construction Statistics Yearbook 2003. The data is 2003.

5, Average salary comes from 2004 City Development Report of China, China Statistics Press. The data is 2003.

## **2.3 Water quality**

### **2.3.1 Water quality and supply stability assessment in the rural drinking water supply**

According to the “Digest of Project Assessment Report on National Rural Drinking Water Supply for Poverty Reduction”, with comparison of various regions with different reasons in difficulty to access drinking water, in general, except for the regions with high-fluorine and arsenic in water, the quality satisfaction degree in other regions was higher than that of quantity. This is because the first stage of projects mainly focused on solving drinking water problems in regions that could not meet the basic standards and there was a great improvement in water quality. Only those regions with high-fluorine and arsenic contents in water, the satisfaction on quality was lower than quantity. According to the assessment by experts, 91.7% of projects reached the standards, 8.3% did not. This generally reflects the farmer assessment.

In terms of daily water quality management and water sources protection, in the expert assessment, 78.5% of the projects have formal water quality monitoring, and 21.5% not. At the same time, 95% projects were regarded as good water quality. This indicated that in such a wide project operation in rural drinking water supply, through efforts, the better water quality management could be reached.

### **2.3.2 Urban domestic water supply**

Since 1950s, China has adopted six revisions on drinking water quality standards<sup>11</sup>. The Ministry of Health issued “Hygiene Standard for Drinking Water” in 2001. The new standard has 96 indicators, 51 more than the previous standard in 1985.

In term of urban water quality, according to the monitoring of 36 key cities by Ministry of Construction in October, 2004, in the 634 samples collected, the ratio meeting the standard is 90.11% for public water suppliers, 80.83% for the secondary water supply, 45.12% for self-constructed project.<sup>12</sup> The water quality in large cities is better (Table 5).

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<sup>11</sup> Renyuan Song, Danian shen. Presence and prospect of China’s urban water supply quality, available from [www.cnwaternews.com](http://www.cnwaternews.com).

<sup>12</sup> Baoxin Chou, Urban environment: circumstances, challenges and strategy, available at [http://host1.cein.gov.cn/news/show.asp?rec\\_no=13073](http://host1.cein.gov.cn/news/show.asp?rec_no=13073).



Table 5 The standard-meeting percentage of urban water supply in the key cities, March 2005<sup>1</sup>

Cities	Plant				Network			
	Residual Chlorine	Turbidity	Total Bacteria	<i>E.coli</i>	Residual Chlorine	Turbidity	Total Bacteria	<i>E.coli</i>
Beijing	100	100	100	100	100	99.58	100	100
Tianjin	100	100	100	100	100	98.6	100	100
Shijiazhuang	100	100	100	100	100	100	100	100
Taiyuan	100	100	100	100	99.39	100	100	100
Huhehot	100	100	100	100	100	100	100	100
Shenyang	100	100	100	100	100	100	100	100
Dalian	100	100	100	100	100	100	100	100
Changchun	100	100	100	100	100	100	100	100
Harbin	100	100	100	100	100	100	100	100
Shanghai	100	100	100	100	100	99.32	100	100
Nanjing	100	100	100	100	99.55	100	100	100
Hangzhou	100	100	100	100	100	100	100	100
Ningbo	100	100	100	100	100	100	100	100
Wenzhou	100	100	100	100	100	100	100	100
Hefei	100	100	100	100	100	100	100	100
Fuzhou	100	100	100	100	100	100	100	100
Xiamen	100	100	100	100	100	100	100	100
Nanchang	99.93	99.81	100	100	99.39	100	100	100
Qingdao	100	100	100	100	100	100	100	100
Zhengzhou	100	100	100	100	100	99.5	100	100
Wuhan	100	100	100	100	100	100	100	100
Changsha	100	100	100	100	100	100	100	100
Zhuzhou	100	100	100	100	100	100	100	100
Guangzhou	100	99.87	100	100	100	100	99.83	100
Shenzhen	100	100	100	100	100	100	100	100
Zhuhai	100	100	100	100	100	100	100	100
Nanning	100	99.91	100	100	100	100	100	100
Haikou	100	100	100	100	100	100	100	100
Chongqing	100	100	100	99.07	98.86	97.43	99.14	99.71
Chengdu	100	100	100	100	99.62	100	100	100
Guiyang	100	100	100	100	100	100	100	100
Kunming	100	100	100	100	100	100	100	100
Xian	100	100	100	100	100	100	100	100
Lanzhou	100	100	100	100	100	100	100	99.22
Xining	100	100	100	100	100	100	100	100
Yinchuan	100	100	100	100	100	100	100	100
Urumqi	100	100	100	100	100	100	100	100

1, The data is from [www.waterchina.com](http://www.waterchina.com).

### **3 The challenges ahead for water and sanitation in China**

Obviously, in the recent 50 years, especially in the recent 20 years, China achieved great progress in access to water and sanitation. But due to the unbalanced economic development, local condition and emerging problems, China is still facing critical challenge to complete solve this issue.

#### **3.1 Water quality**

Although China basically solved the water quantity issue for drinking water supply, there is still more than 300 million populations without safe drinking water supply. According to the investigation conducted by MWR and Ministry of Health, the percentage of drinking water supply that meets the rural drinking water quality standards is only 66%, and 34% not.

The water sources in China are heavily polluted. 71% of rivers and lakes are polluted to some extent. The chemical fertilizers and pesticides are more and more used in the rural areas. The shallow groundwater quality is widely deteriorated. In some areas, whether there is a river, it dries; whether there is water, it is polluted. All those result that the drinking water of 191 million populations have a poisonous contents exceeding the standard. In the rural areas, there are 50 diseases related to or transmitted by unsafe drinking water supply. The unsafe drinking water supply is the main cause of water-related endemic disease and schistosomiasis. At present, 63 million rural residents drink high-fluorine water, 38 million rural residents drink saline water. There rural residents mainly distribute at northern China and east coastal regions. The schistosomiasis-uncontrolled regions are related to 7 provinces, 110 counties, which have 60 million residents.

So, to solve drinking water supply fully, to guarantee the safety of drinking water supply and sanitation are still a critical problem facing Chinese and Chinese government. Compared to provide drinking water supply, providing safe drinking water supply is a much more difficult task.

#### **3.2 Service standard**

The design standards of rural drinking water supply projects in China are relative lower. In 1984, the state defined “three one” drinking water difficulty standard, which referred to that the distance between the residential site and water supply site is more than 1km or the difference of elevation is higher than 100m, the water shortage days at the normal year is more than 100 days. According to this standard, the planned populations with difficulty in drinking water supply were more than 240 million at that time. The project design standard was to basically solve drinking water difficulty, to provide water supply to public water site, with the supply standard of 10 liter per capital daily in northern China, and 40 liter per capita daily in southern China, which is lower than the international standard for developing counties with 20-50 liter per capita daily.

In terms of drinking water standard, China also is later behind. In 1959, China formulated its first drinking water hygiene standard with 16 indicators, revised in 1976 with 23 indicators, revised in 1985 with 35 indicators. In 2001, Ministry of Health formulated new standard with 96 indicators. This standard just begins to implement. Due to lack of water supply facility or water treatment facility in most rural areas in China, it is very common that water quality could not meet the standard and it is fact that it is very difficult to implement the standard. So in 1994, according to reality, the state formulated “the standard for implementing drinking water hygiene standard in rural areas”. The water quality indicators implemented reduced to 20, and loosed the value at the same time. Even so, it is investigated that 34% of the populations could not meet.

The rural drinking water treatment facility is relative simple. According to the water sources, the selected water treatment technology is different: (1) the water from deep wells and spring always does not treat and directly supplies to the households. (2) The chemical materials and chloride dosing into the water sources for sterilizing is not ideal also in fact. (3) The traditional treatment technology, such as quick blending, depositing, filtering, sterilizing. (4) The special treatment technology, such as electro dialysis, reverse osmosis membrane technology for high-fluorine and arsenic water treatment. Although with good water quality, it is costly. According to investigation by Department of Water Resources, Zhejiang Province, the tap water supply facility equipped with treatment facility was 30%, with simple sterilizing treatment was 50%, and 20% without treatment. Other provinces are worse than that in Zhejiang Province. So the rural water treatment is the weakest point in safe drinking water supply in China.

### **3.3 Management of water and sanitation projects**

The characteristics of water and sanitation projects in the rural areas are small-scale, larger number and wide distribution. From the practice, the management in farmer self-managed projects and water supply stations is better, but the problematic one is the one-village project. The unclarification in property rights results in lack of “owner”. At the present, the policy has not solved the problem that who should be the representative of the investor and responsible for the operation and management.

### **3.4 Adaptability to the external environmental change**

With the development in social and economic development in China, the external environment of water and sanitation sector has changed. The solution to water and sanitation is not the same as 20 years ago, whatever in contents and solution methods. So it is becoming a challenge for water and sanitation sector to adapt to all these changes. Of course, all these changes are the chance for the sector too, but the adaptability of the sector is a challenge. Recently, in rural drinking water supply, the participatory methods has been accumulated a lot of experiences and is under the process of disseminating all over China. Also as mentioned previously, the management of the projects under market economy is a challenge to how to fully realize the social and economic benefits.

Under fast economic development, water and sanitation sector in China is in the best time never before. The Chinese government develops the strategy of “Harmonious Society Development”. In 2005, the Chinese government also develops the strategy of “Developing new rural areas”. Under these strategies, the rural infrastructures will be improved further. The access to water and sanitation in China is in the transformation from quantity to quality. China has covered the basic water and sanitation, but the standards and service quality is not better. China has realized the problems in the quality issue and is trying to improve in the future.

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