Shanyin Safe Drinking Water Pilot Project

Site Investigation Report

Summary

Global Health and Education Foundation has determined, with assistance from the Chinese Academy of Sciences, that it will pursue the establishment of a pilot project in Shanyin County, within the northern sector of Shanxi province. The local CDC has agreed to provide corresponding support and they recommended several villages in Shanyin as candidates for this project due to their high levels of fluoride and/or arsenic in the drinking water and the high prevalence of fluorosis or both fluoride and arsenic among the population.

The selected villages are: Laiyuan (LY), Xishuangshan (XSS), Anrong (AR), Yangzhuang (YZ), Baijiapu (BJP), and Kuailecun (KLC).

On January 25, 2007, a planning team traveled to these villages, and over a period of five days, conducted a preliminary site investigation to guide the project execution plan.

Site General Introduction

Shanyin County, which lies in the middle north sector of China, is a typical area in rates of fluorosis and arsenicosis. In most areas of Shanyin, the population exploits ground water for subsistence. However, most of the current ground water supply is contaminated with fluoride and arsenic. This have already led to widespread of chronic, endemic diseases, principally fluorosis and arsenicosis.

It is reported that fluorosis is prevalent in 90 villages within Shanyin spreading over 500 square kilometers, while arsenicosis is prevalent in 42 villages, with a total population of 26,000 spread over 380 square kilometers.

Site Investigation

With assistance from Chinese Academy of Sciences and local governors, we successfully visited the 6 villages -- we executed a comprehensive safe drinking water-related survey, and carried out water source quality analysis.

The popular endemic diseases among these villages are dental fluorosis and skeletal fluorosis, which are caused by fluoride in drinking water.

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Village	LY	AR	YZ	XSS	BJP	KLC
Population	942	5,200	820	676	614	890
Average Income (Person/Year)	CNY 1,500	CNY 3,000	CNY 3,000	CNY 3,300	CNY 700	CNY 3,200
Average Fluoride Concentration (mg/l)	**2.2**	**3.5**	**2.7**	**1.5**	**2.3**	**1.2**
Average Arsenic Concentration (mg/l)	0.0025	0.0016	0.0017	0.0028	0.0012	**0.186**
Dental Fluorosis Prevalence	92.3%	88.6%	84.9%	81%	52.9%	66%
Skeletal Fluorosis Prevalence	24.5%	4%	14.5%	20.0%	6.5%	8%
Arsenicosis prevalence						7.7%

* China National Standards for Drinking Water Quality limitation: Fluoride: 1.2mg/l, Arsenic: 0.05mg/l.

Here are some photos attached showing the endemic diseases.

Photos 1-2. Dental fluorosis

Photos 3-4. Skeletal fluorosis

Photos 5-6. Arsenicosis (Keratosis of palm)

The water sample test results show that the 6 villages fluoride concentration have all exceeded national standard. Village KLC has both fluoride and arsenic exceed. Water there also has high turbidity and hardness. Other water quality guidelines are within the national standard.

Based on the survey family by family, we obtained a better understanding of the villagers' thoughts and needs. Together with **China Foundation of Disable Persons** and **Chinese Academy of Science, Global Health and Education Foundation** is now on the way of making execution plans in order to provide safe drinking water to people on need-based and seeking sustainable development of the project.

Background Information

Geographical Information

- Shanxi Province Introduction

Total Geographic Area:	156,000 km^2, 1.6% of China's total.
Population:	33 million (2005)
GDP:	CNY 412.12 billion (2005)
Disposable income per capita:	- Urban CNY 8,914 - Rural CNY 2,891

Shanxi Province also known as:

- **"Coal Warehouse of China"**: Shanxi reserves the largest coal fields in China.
- **"Museum of Ancient Arts"**: Shanxi is one of the birthplaces of the ancient civilization of the Chinese Nation.

Shanxi Province is situated at west of North China, east of the loess plateau. The terrain of Shanxi is complexity of mountains, plate and basin, the mountain takes up more than 2/3 of the total area. It is a landlocked province bordering Hebei, Henan, Inner Mongolia and Shaanxi.

The Yellow River (Mother River of China) forms the western border of Shanxi with Shaanxi. The largest natural lake in Shanxi is Xiechi Lake, a salt lake in southwestern Shanxi.

Shanxi has a continental monsoon climate, and is rather arid. The annual temperature is 3°-14°C and the annual precipitation is 400-650 mm**,** but both of them highly vary on season and terrain

- Current Water Resource Situation

Shanxi Province currently experiences a shortage in water resources, with per capita water consumption in Shanxi at 17% of China's average, and 4.3% of the world average. Drought occurs on average once every 1.3 years. In many areas of Shanxi Province, the population exploited ground water for subsistence. However, the over-exploitation of ground water resources has led to a

decreased water levels and it is currently rumored that there is relatively no potential exploitation of ground water in the entire basin.

There have been several water projects taking place in Shanxi Province, such as reinforcing or creating 842 large-size water reservoirs, rainwater harvesting for micro-irrigation and a water transfer project. However, there are still many challenges to overcome in order to solve the water issues in Shanxi.

On top of the water shortage, another critically important issue is that most of the current ground water supply is contaminated with arsenic. This leads to widespread of chronic, endemic diseases, principally arsenicosis.

Shanyin County, which lies in the middle of the Datong Basin, ranks third in China in rates of chronic arsenic poisoning, or arsenicosis. It is reported that arsenicosis is prevalent in 42 villages within Shanyin, with a total population of 26,000 spread over 300 square kilometers.

Endemic Diseases Information

- Arsenicosis

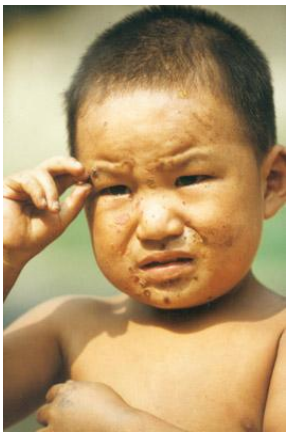
Chronic arsenic poisoning results from drinking water with high levels of arsenic over a long period of time. Effects include changes in skin color, formation of hard patches on the skin, skin cancer, lung cancer, cancer of the kidney and bladder, and can lead to gangrene.

The World Health Organization recommends a limit of 0.01 mg/L of arsenic in drinking water; consumption of higher levels over long periods of time can lead to arsenicosis.

Non-carcinogenic chronic effects include liver injury - jaundice and cirrhosis, peripheral vascular disease involving blueness of the extremities, Raynaud's syndrome, and blackfoot disease (a type of gangrene); anemia, and hyperkeratosis of the skin.

Inorganic arsenic (As) is a documented human carcinogen associated with skin, liver and lung cancers. Long-term exposure to high arsenic levels in the air, diet and drinking water can also result in permanent and severe damage to human health, including lesions of the skin, skin cleft on palm and feet, mucous membranes and digestive, respiratory, circulatory and nervous system damages.

Examples of health effects of endemic Arsenicosis:



Two types of endemic arsenicosis have been identified in China. The first is caused by high levels of arsenic in the drinking water supply, which is based on ingestion of contaminated food and arsenic 2~40 times higher in drinking water than the state standard of 0.05 mg/l. The second is caused the inhalation of coal smoke pollution which is created from combustion of high arsenic coal.

Fluorosis

Ingestion of excess fluoride, most commonly in drinking-water, can cause fluorosis which affects the teeth and bones. Moderate amounts lead to dental effects, but long-term ingestion of large amounts can lead to potentially severe skeletal problems. Paradoxically, low levels of fluoride intake help to prevent dental caries. The control of drinking-water quality is therefore critical in preventing fluorosis. The condition and its effect on people Fluorosis is caused by excessive intake of fluoride. The dental effects of fluorosis develop much earlier than the skeletal effects in people exposed to large amounts of fluoride. Clinical dental fluorosis is characterized by staining and pitting of the teeth. In more severe cases all the enamel may be damaged. However, fluoride may not be the only cause of dental enamel defects. Enamel opacities similar to dental fluorosis are associated with other conditions, such as malnutrition with deficiency of vitamins D and A or a low protein-energy diet. Ingestion of fluoride after six years of age will not cause dental fluorosis.

Chronic high-level exposure to fluoride can lead to skeletal fluorosis. In skeletal fluorosis, fluoride accumulates in the bone progressively over many years. The early symptoms of skeletal fluorosis, include stiffness and pain in the joints. In severe cases, the bone structure may change and ligaments may calcify, with resulting impairment of muscles and pain.

Acute high-level exposure to fluoride causes immediate effects of abdominal pain, excessive saliva, nausea and vomiting. Seizures and muscle spasms may also occur.

Examples of health effects of endemic Fluorosis:

For more information, please contact:

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