Environmental Monitoring Report

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Annual Report
2004

PRC: Zhanghewan Pumped Storage Power Station Project

Prepared by Hebei Zhanghewan Pumped Storage Co., Ltd. for the Hebei Electric Power Co. and the Asian Development Bank.

PEOPLE'S REPUBLIC OF CHINA

ZHANGHEWAN PUMPED STORAGE POWER STATION PROJECT

Contract N° 03IJBJGB/000144FR between
Hebei Zhanghewan Pumped Storage Co., Ltd.,
Cetic International Tendering Co., Ltd
and Electricité de France

ANNUAL ENVIRONMENTAL MONITORING REPORT FOR 2004

(CONTRACT N°03IJBJGB/011201FR, IFB1)

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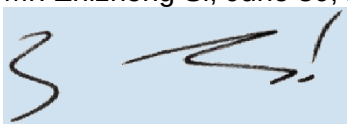
Mr. Zhizhong Si, June 30, 2005 	

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ZHANGHEWAN PUMPED STORAGE PROJECT

Annual Environmental Monitoring Report for 2004

Zhizhong Si

1. INTRODUCTION

Dr. Zhizhong Si, Environmental Specialist paid a visit to Hebei for the Zhanghewan Pumped Storage Project (ZPSP) in June, 2005. The purposes of the mission are to monitor the environmental performance of the ZPSP for the preparation of the annual environmental monitoring report for the preceding year of 2004.

During the mission, the Environmental Specialist met with Mr. Liu Jie, Chief Engineer, and Mr. Zhang Xingbin, Engineer, both of Zhanghewan Pumped Storage Company Ltd. Mr. Liu Jie and Mr. Zhang Xingbin are the designate Environmental Officers. A telephone communication was also held with Professor Jia Jianhe, Head of the domestic environmental monitoring and advisory agency.

The field visit also included inspections to the construction sites of the upper and lower dams, and to the wastewater treatment facility.

2. ENGINEERING PROGRESS

2.1 Upper Reservoir

The engineering works for the upper reservoir are undertaken by the China Gezhouba Hydraulic and Hydropower Engineering Group Ltd. They include: (1) excavation for the reservoir basin, with accumulated volume of excavation to date amounting to 2.788 million cubic metres; (2) discharge canal, with the completed depth reaching 312 metres; (3) construction of the dam, with 2.156 million cubic metres filled; (4) outer layers, with 175 metres of concrete pouring completed and 467 metres excavated; and (5) water inlet/outlet, with 10 metres drilled for the #1 tunnel and 5 metres drilled for the #2 tunnel.

2.2 Underground System and Sand Weirs

The underground power houses and sand weirs are contracted to the 4th China Hydraulic and Hydropower Engineering Company. Of the main and auxiliary power houses, 36.3% of the planned excavation was completed. For the transformer and switch chambers, 48.7% of the planned excavation volume was completed. Other engineering components were finished to varying degrees.

2.3 Lower Dam

The reconstruction of the lower dam is contracted to the 11th China Hydraulic and Hydropower Engineering Company. During 2004, excavations were started on both the right and left banks, and on the overspill section of the dam. Concrete pouring was also carried out on the discharge tunnels in the middle section of the dam.

2.4 Wastewater Treatment Facilities

In 2004, both the sewage treatment facilities and the engineering wastewater treatment plant were put into operation.

By July 2004, the sewage treatment facilities at the upper reservoir, lower reservoir and the office building area were completed and put into operation, in accordance with the schedule as proposed in the environmental impact statement. The treated sewage entails toilet discharges, laundry discharges, wastewater from office buildings and kitchens and clinics. The major pollutants include TSP and organic matter. The treatment process is as follows: screens → hydrolyzation and acidification → oxidation → sedimentation → disinfection.

The engineering wastewater comes from seepage of underground excavation activities and liquids from protection of concretes. Located near the outlet of the ventilation tunnel, the engineering wastewater treatment plant was put into operation in 2004.

Field inspection showed that the sewage and engineering wastewater treatment facilities have been functioning properly.

3. MONITORING FREQUENCY AND REPORTING

By the end of 2004, three internal environmental monitoring exercises have been undertaken. The domestic monitoring and advisory agency consists of the Hebei University of Science and Technology and the Hebei Tiandichaoyang Environmental Science and Technology Company Ltd. The field sampling and laboratory tests were subcontracted to the Shijiazhuang City Environmental Monitoring Centre and the Jingxing County Environmental Monitoring Station.

For the first environmental monitoring, the atmospheric, aquatic and acoustic samplings were carried out between April 17 and May 13, 2004. The first environmental monitoring report was completed in July 2004. For the second monitoring, the atmospheric, aquatic and acoustic samplings were conducted between August 14 and October 15, 2004. The second environmental monitoring report was completed in November 2004. The atmospheric, aquatic and acoustic samplings were done in September and October 004 for the third environmental monitoring; and the third environmental monitoring report was completed and submitted in January 2005.

A review of the three available environmental monitoring reports has revealed that: (1) the monitoring exercises covered the ambient environmental quality parameters of relevance to the environmental performance of the Project; (2) credible sampling and analytical methods were used; and (3) the conclusions are valid.

4. ENVIRONMENTAL MANAGEMENT SYSTEM

4.1 Institutional Arrangement

According to the applicable laws and regulations of PRC, the Zhanghewan Pumped Storage Company has set up a Project Environmental Management Department (PEMD) which is headed by a Deputy Chief Engineer. The work of the PEMD is supported by a consortium of two environmental consulting firms (the Hebei University Science and Technology University

and the Hebei Tiandichaoyang Environmental Science and Technology Co. Ltd.), and supervised by environmental protection agencies at national, provincial and local levels.

4.2 Environmental Management Responsibilities

The responsibilities of the PEMD are as follows:

- Implement national, provincial and local environmental laws, regulations and policies;
- Conduct periodic dialogue with environmental protection agencies at various levels, to gain timely understanding of the national, provincial and local environmental requirements;
- Supervise and support the work of the environmental consultants on environmental impact monitoring and evaluation during project construction, and revise and improve the environmental management and M&E requirements when necessary;
- Formulate the environmental protection and ecological restoration program, organize training of personnel of construction contractors, and supervise the implementation of the environmental protection and ecological restoration program;
- Organize the submission of environmental M&E reports as per specified schedule;
- In accordance with the recommendations of the environmental M&E reports, formulate and organize the implementation of corrective actions, and provide feedback to the public;
- Keep track of the epidemic situation of the project area, and establish an early warning mechanism, to ensure the health of construction workers and local communities; and,
- Establish safety and ecological protection emergency response system, to coordinate and deal with any such emergencies as rock-and-mud flow, accidental discharge of pollutants and adverse ecological damage.

4.3 Environmental Management Activities

During 2004, the ZPSC completed a series of environmental management activities in accordance to the approved environmental management plan (EMP). The environmental management activities included:

- An environmental management system has been set up, with the environmental management responsibilities and procedures defined;
- Through competitive bidding, the consortium of Hebei Science and Technology University and the Hebei Tiandichaoyang Environmental Science and Technology Co. Ltd. was retained to serve as the environmental monitor and advisor for the construction period, and reporting procedure agreed;
- Three environmental management training courses by the environmental monitoring and advisory agency for the construction contractors were organized during the year;
- Four comprehensive inspections on labour safety, public health and environmental protection were conducted during the year;
- Timely and effective corrective actions were taken on environmental management deficiencies and gaps identified by the environmental monitoring

and advisory agency and discovered during the regular and ad hoc inspections; and,

- Regular inspections of sewage and engineering wastewater treatment facilities were also performed during the years, and improvements were made on the drainage system for the effluent of the sewage treatment facility.

More detailed information on the environmental management activities in comparison to those contained in the environmental impact statement (EIS) are provided in **Table 4.1**.

Table 4.1 Implementation of Environmental Management Requirements in 2004

Environmental Elements	Potential Impacts	Mitigation Measures Contained in EIS	Status of Implementation in 2004
Surface Water	Impacts of engineering wastewater	Treatment facility	Facility constructed and functioning well
	Impacts of sewage	Treatment facilities	Three treatment facilities constructed for upper reservoir and lower reservoir construction camps and for the office area; all three functioning well
Air	Impacts of air pollutants on air and construction workers	Installation of dust suppressors and use of personal protection equipment	Dust suppressors installed on concrete mixing machines and other dust sources; water spraying on dirt roads; workers close to dust sources provided with protection masks
Noise	Impacts of noise on workers and communities	Insulation chambers and personal protection equipment	Insulation chambers set up; ear plugs provided for those working in noisy areas
Solid Waste	Garbage causing pollution to land, water and air, and spread of diseases	Collection, incineration and landfill	Garbage collected in construction camps and disposed; but littering was still found in some sections and at times
Public Health	Influx of workers and resettlement may cause spread of diseases	Clearing of reservoir bottom; strengthening public health management and disease prevention	Clearing of reservoir bottom carried out; regular health inspection for workers; periodic information sharing with public health bureau
Ecological System	Destruction of vegetation by construction activities	Re-vegetation of construction sites and reforestation	Restoration of vegetation for completed construction sites; new road sides reforested
	Increase in soil and water erosion	Engineering measures for soil and water protection	Sand weirs and meshes for exposed slopes
Socioeocnomic System	Inundation, population resettlement	Adequate compensation, and proper resettlement	Land acquisition and population resettlement has just begun

5. ENVIRONMENTAL MONITORING

In accordance with the environmental management requirements of the ADB and the environmental management policies of the PRC for construction projects, the monitoring of the ambient environment was carried out during 2004. The environmental monitoring program covered air, acoustic, water and wastewater treatment facilities, as per the approved environmental management and monitoring plan.

The monitoring locations, parameters and frequencies are provided in **Table 5.1** and **Table 5.2**.

Table 5.1 Monitoring Locations

		Location
Environmental Quality	Air	Office building area, construction camps (upper reservoir), Ceyuzhen and adjacent villages
	Water	Headwater, centre and tail water of ZHW Reservoir
	Acoustic	Office building area, construction camps, Ceyuzhen and adjacent villages
Treatment Facilities	Wastewater	Discharge outlets of the treatment facilities of the upper reservoir, lower reservoir and office building area; outlet of the engineering wastewater treatment system

Table 5.2 Monitoring Parameters and Frequencies

Type	Parameters		Frequencies
Air	TSP, SO_2, NO, CO	Daily average concentration	4 quarters/yr, 3 days/quarter, 1 time/day, minimum of 18 hrs/time
	SO_2, NO2, CO, HC	Hourly average concentration	4 quarters/yr, 3 days/quarter, 4 times/day, daily 8:00, 11:00, 14:00, 17:00, min of 45 minutes per time
Noise	Ambient noise	1 time/quarter, 2 days/time, 24 hrs continuous/day	
Surface Water	pH, TSS, COD, BOD, DO, NH_3-N, nitrate N, Cr_6, TP, TN, oil, chlorophyll, phenol, cyanide, arsenic, Pb, Zn, fluoride, chloride, Hg, Cd, coliform, sulphate		Monthly
Wastewater Treatment Facilities	TSS, COD, BOD, NH_3-N		Monthly

5.1 Atmospheric Monitoring

Over the year, 144 hourly samples were taken at each of the three monitoring sites (upper reservoir construction camps, office building area and the Ceyuzhen Village), giving a total of 432 hourly air quality monitoring samples.

The results of the atmospheric monitoring during 2004 showed that:

(1) The daily average concentrations of SO_2, NO_2 and CO in all monitoring locations were below the maximum allowable limits of the National Ambient Atmospheric Quality Standards (GB3095-1996, Level 2).

(2) The daily average concentrations of TSP in the office building area were below the maximum allowable limit of the applicable national standards.

(3) 22% of the samples of TSP at the Ceyuzhen Village (ranged between 0.202 and 0.321 mg/m_3) exceeded the maximum allowable limits of the applicable national standards at 0.300 mg/m_3. But the mean of the daily average concentrations was at 0.275 mg/m_3, below the maximum allowable limit of the applicable national standard.

(4) All of the samples of TSP at the construction camps of the upper reservoir exceeded the maximum allowable limits of the applicable national standards. However, the mean of the measured daily average concentrations of TSP was 0.352 mg/m_3, or exceeding the national standard (0.300 mg/m_3) by 17%.

It is obvious that the violation of TSP at the construction camps of the upper reservoir and at the Ceyuzhen villages was related to the construction activities at the upper and lower dam sites. It should be noted, however, that the degree of violations was not serious. Yet, it warrants a call for the strengthening of dust suppression measures for construction activities at the dam sites, particularly water spraying for dirt roads.

5.2 Aquatic Monitoring

In accordance with the environmental monitoring plan, water quality monitoring was carried out at three locations (intake, centre and outlet of the Zhanghewan Lower Reservoir) during 2004. A total of 2 parameters were monitored. A set of 207 monitoring data was generated for each monitoring location, giving a total of 621 water quality data for all three locations combined.

The monitoring results showed that all monitored parameters, except for TN and TP, met the applicable national standards (Environmental Quality Standards for Surface Water, GB383-2002).

(1) At the intake of the reservoir (Nangao Bridge), the concentration of TP ranged between 0.097~0.187 mg/ml, with the number of violating samples accounting for 100% and the mean being 0.133 mg/l compared to the applicable standard of 0.05 mg/l. The concentration of TN ranged between 0.87~1.72 mg/l, with the violating samples accounting for 88.9% and the mean being 1.338 mg/l, compared to the applicable standard of 1.0 mg/l.

(2) At the centre of the reservoir, the concentration of TP ranged between 0.111~0.156 mg/l, with the number of violating samples accounting for 100% and the mean being 0.128 mg/l, compared to the applicable standard of 0.05 mg/l. The concentration of TN ranged between 1.13~2.58 mg/l, with the number of violating samples accounting for 100% and the mean being 1.672 mg/l, compared to the applicable standard of 1.0 mg/l.

(3) At the outlet of the reservoir, the concentration of TP ranged between 0.106~0.150 mg/l, with the number of violating samples accounting for 100% and the mean being 0.126 mg/l, compared to the applicable standard of 0.05 mg/l. The concentration of TN ranged between 1.12~1.88 mg/l, with the number of violating samples accounting for 100% and the mean being 1.45 mg/l, compared to the applicable standard of 1.0 mg/l.
From the results of the water quality monitoring, it can be concluded that the construction activities have to date generated little or no impacts on the aquatic environment. The widespread and large-magnitude violation of the TN and TP concentrations is not related to

the ZPSP per se, but likely resulted from the widespread, excessive use of fertilizers in the upstream areas. High concentrations of TP and TN are characteristic of all lakes and reservoirs in Northern China. For example, the TP and TN concentrations of the Gangnan and Huangbizhuang Reservoirs in Shijiazhuang both violate the applicable standards.

5.3 Wastewater Treatment Facilities

Monitoring of the quality of effluent from four wastewater treatment systems were conducted during 2004: sewage treatment systems for upper reservoir, office building area and lower reservoir, and the engineering wastewater treatment system (underground). A total of 84 samples were taken, including 24 for each of the three sewage treatment systems and 12 for the engineering wastewater treatment system.

The results of the monitoring indicated that:

(1) All four wastewater treatment systems were operating properly during the year.

(2) The effluent discharges of the all four wastewater treatment systems met the applicable standards of the “Comprehensive Standards for Wastewater Discharges” (GB8978-1996).

(3) The effluent discharges from the three sewage treatment facilities were being used to irrigate green plants, without flowing into the surface water body (the Zhanghewan Reservoir).

(4) In summary, the four wastewater treatment facilities were functioning well such that their effluent met applicable standards. Moreover, judging from the surface water monitoring results discussed in the previous section, the impact of the effluent discharges was negligible.

5.4 Acoustic Monitoring

Acoustic monitoring was conducted at three locations during 2004: the construction camp (upper reservoir), office building area, and the residential settlements of Ceyuzhen. Three hundred sixty (360) samples were collected from each site, totalling 1,080 samples for the three sampling sites.

The results of the acoustic monitoring showed that:

(1) The day-time noise levels for the three locations ranged between 52.3~56.4 dB(A), which is below the maximum allowable level of 60 dB(A).

(2) The night-time noise levels for the three locations ranged between 42.6~45.8 dB(A), which is below the maximum allowable level of 55 dB(A).

In conclusion, the Leq measurements were all within the maximum allowable limits (“Noise Standards for Urban Areas”, GB3096-1993) for respective areas, indicating no acoustic annoyance to construction workers, office staff or local communities.

5.5 Public Health

In order to prevent the spread of epidemic and infectious diseases because of influx of construction workers, the ZPSC established a public health emergency response system, in accordance with the policy requirements and the approved environmental management plan. The following measures were implemented during 2004:

(1) A health examination system was established for all construction contractors. Construction workers would be required to pass a health examination prior to being allowed to enter the construction sites. The health examination covered influenza, dysentery, hepatitis and STDs. Health examinations were conducted twice for 1,832 construction workers over the year, or 3,634 person-times.

(2) Two health examinations for the residents in the relocation areas of the upper and lower reservoirs were also performed over 2004. The program covered a total of 2,233 persons, or 4,466 person-times.

(3) Training was carried out for construction contractors, in accordance with Shijiazhuang regulations on public health emergency response.

(4) Regular, periodic dialogue and exchange of information with local health clinics and hospitals was carried out.

(5) The management of the water supply and waste disposal was strengthened.

6. PUBLIC PARTICIPATION

6.1 Instruments of Public Participation

The comprehensive public participation program was implemented by the environmental monitoring and advisory agency. The main purpose was to solicit views of the relevant agencies and social groups as well as those of the people residing in the project-affected areas, so as to gain a good understanding of the potential social impacts, and provide feedback to the ZPSC for formulation and implementation of mitigation and corrective actions.

The following instruments were used in 2004 for public participation:

(1) Telephone hotlines:

Environmental Monitoring and Advisory Agency: 0311-8588-0186
ZPSC Environmental Management Department: 0311-8513-2252

(2) Quarterly questionnaire surveys:

Every quarter, a questionnaire survey was conducted. A total of 90 questionnaires were received during 2004, of which 33% were completed by women.

(3) Interviews with people in affected communities:

Focus and random interviews with people residing in affected communities were carried out over three periods of time during the year. A total of 50 people were interviewed, and special attention was paid to women.

(4) Interviews with construction contractors:

A total of 15 representatives of the construction contractors were interviewed over three periods of time.

6.2 Public Comments and Responsive Measures

(1) Dust

a) Comments

Dust at the construction sites affected the daily life of the reservoir workers and the residential quarters of the ZPSC nearby the lower reservoir. The dust in the air made people's laundry dirty, and people, especially those living close to construction roads, could not open their window.

b) Corrective action

The construction contractors increased the frequency of water spraying on the roads. A 1.2-metre-tall fence was erected around construction sites. Digging was controlled when wind exceeded 4^{th} scale. Site inspection by environmental officers was also strengthened.

(2) Garbage

a) Wanton dumping

It was discovered by the environmental monitoring and advisory agency that wanton dumping of garbage in some construction camps occurred.

b) Corrective action

ZPSC ordered the construction contractors to review their own areas of responsibility. Unauthorized dumps were cleared; new garbage bins were added; and education program for construction workers were implemented.

(3) Exposed spoils

a) Comment

Some villagers commented that the spoils were not treated and protected timely.

b) Corrective action

Restoration and rehabilitation of completed segments was carried out. Both sides of the completed roads were planted with trees. Slope protection was done to spoil dumping sites.

(4) Explosion

a) Comment

Some villagers pointed out that the sound of explosion was too loud and vibration too strong.

b) Corrective action

Construction contractors were asked to conduct explosions between 11:30 and 12:00 to avoid office hours and people's noon nap.

7. CONCLUSION

(1) ZPSC has instituted the necessary institutional structure and management procedure for environmental protection. The institutional structure and management procedure have proven to be effective.

(2) The results of environmental monitoring showed that the construction activities did not cause significant impacts on the various environmental elements: air, water and acoustic. There was certain degree of environmental pollution, but it was limited to some localities, short-term, reversible and acceptable.

(3) The ecological impact of the project, such as excavation of mountains and hills and construction of roads, is unavoidable but can be minimized. The recovery will be a long-term process.

(4) The wastewater treatment facilities were all put into operation in 2004. These facilities have been operating satisfactorily and met the specifications as proposed in the EIS.

(5) The project did not result in any health problems to the construction workers and local community members.

(6) The results of the public participation program indicated that the vast majority of the respondents in the surveys and interviews believed the impact of the project on their daily life and activities to be acceptable, and the environmental management to be satisfactory. Some problems were identified, and corrective actions were taken by ZPSC and the construction contractors.

Upper Reservoir Under Construction
(Photo by Zhizhong Si, June 2005)

Upper Dam Under Construction
(Photo by Zhizhong Si, June 2005)

Lower Reservoir and Dam Under Construction
(Photo by Zhizhong Si, June 2005)

Lower Reservoir Upstream from Upper Dam
(Photo by Zhizhong Si, June 2005)

Engineering Wastewater Treatment Plant
(Photo by Zhizhong Si, June 2005)

Engineering Wastewater Treatment Plant
(Photo by Zhizhong Si, June 2005)

Zhanghewan Hotel as Part of ZPSC Office Complex
(Photo by Zhizhong Si, June 2005)

ZPSC Office Building (Lower Left)
(Photo by Zhizhong Si, June 2005)