

Ecological and Environmental Influences in the Construction of West Gas Supplying to East Project in China

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Key words: Ecological and environmental influence, West Gas Supplying to East Project, soil and water conservation, desertification

SUMMARY

The Project of West Gas Supplying to East in China is the largest pipeline transportation project in history. The project took four and eight months to develop and completed on the end of 2004. It is designed to transport the gas produced in Xinjiang, where has huge amount of gas storage, to the seven provinces in east part of China, where requires large amount of energy. The project costs 150 billion Chinese Yuan with total pipeline length of more than 4 000 km. It passes through nine provinces. The pipeline passes through the Yellow River three time and also Changjiang River, Huaihe River, as well as other large rivers for more than ten times. The passed areas also include a lot of ancient heritages such as Ancient Lantian in Shanxi, Ancient Silk Road, and Zunhuang in Gansu. The territorial, terrain, environment, and geology conditions are different and complex along the pass-through areas.

The project has great promotion to the economy development in China. It also has great influences to the ecological and environment in all the pipeline pass-through areas and provinces using piped gas.

This paper has comprehensively evaluated the soil and water conservation precaution and protection, the engineering and vegetative control measures, the land reclamation measures, the implementation of soil and water conservation investment, and the supervising and monitoring of soil and water loss according to the plan of soil and water conservation of the West Gas Supplying to East Project.

The ecological environment of some areas is very unstable. Once the sandy vegetation was broken, wind erosion and sand transference will accelerate the desertification process, and the ecosystem will be degenerated or destroyed. The characteristics of sandy land and the ecological environment of these areas are investigated. Some corresponding engineering countermeasures to control desertification and to keep the ecosystem balance are proposed.

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1. BACKGROUND

With the rapid economic growth in China, energy consuming becomes one of the most important factors influence further development, especially in the relatively developed east provinces such as Shanhai, Jiansu, and Zhejiang. On the other side, according to geological survey, in the Talimu Basin of Xijiang Province, the petrol gas storage is huge. There is 8400 billion cubic meters of petrol gas storage in the Talimu Basin with area of 560 thousand square meters. It take 22% of the total petrol gas storage in China. So the Chinese government decided to transport petrol gas from west part to the east part of China where requires large amount of energy. This is the well-known West Gas Supplying to East Project.

The WGSEP in China is the largest pipeline transportation project in history. It took fours and eight months to develop and completed on the end of 2004. The project costs 150 billion Chinese RMB (about US\$19 billion) with total pipeline length of more than 4 000 km which passes through nine provinces (as shown in figure 1). It will transport 12 trillion cubic meters of petrol gas annually with completion. The pipeline passes through the Yellow River three time and also Changjiang River, Huaihe River, as well as other large rivers for more than ten times. The passed areas also include a lot of ancient heritages such as Ancient Lantian in Shanxi, the ancient Silk Road, and Zunhuang in Gansu. The territorial, terrain, environment, and geology conditions are different and complex along the pass-through areas.

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2. SITUATION ANALYSIS

According to the *Law on Soil and Water Conservation*, the company responsible to the WGSEP, PetroChina Company Limited, worked out a soil and water conservation plan and approved by the government. Since the project passes through a so large area with very different environment conditions, different conservation measures should be taken accordingly.



Figure 1 The WGSEP passed areas

2.1 Influenced areas and environment characteristics

It is calculated that the total soil and water conservation area of the whole project will be about 19 000 hectares which includes construction area of 11 000 hectares and direct influencing area of 8 000 hectares. The provincial responsible areas are 7 500 hectares for Xinjiang; 4 300 hectares for Gansu; 1 200 hectares for Ningxia; 1 500 hectares for Shaanxi; 1 700 hectares for shanxi; 900 hectares for Henan; 800 hectares for Anhui; 900 hectares for Jiangsu; and 20 hectares for Shanghai.

Considering terrain and soil type, the whole project area can be divided into seven sub-areas. The first sub-area from Lunnan, Xinjiang Province to Zhongwei, Ningxia Province is an area with plain terrain which includes Gobi, desert, and oasis. The soil and water erosion in this sub-area is mainly slight and medium wind ersion. The following sub-area, to Jingbian, Shaanxi Province, includes wind ersion sands, plain cultivated field, and sand covered loess areas. It is an area infected medumly by both water ersion and wind ersion. The terrain of third sub-area, to Zhongzhou, Henan Province, changed obviously. It includes loess hilly and gulled hilly areas (ravine region), plain steps areas, and mountain areas. The main erosion

is medium and severe (possible very severe in some local area) water erosion. The fourth sub-area is alluvial flat area to Handan, Henan Province with mainly slight to medium water erosion. Then the sub-area to Huaiyuan, Anhui Province is Plain of Northern Anhui Province which has very slight erosion. The sixth to Danyang, Jiangsu Province is a hilly area with slight water erosion and the last sub-area to Baihe, Shanghai is an area in South of Yanzi River where with plenty of water and only slight water erosion will be caused.

2.2 Possible environment and ecological problems

According to WGSEP environment influence conspectus, the wild animal and vegetation protection areas passed include: Talimu River Valley Vegetation National Protection Area as well as Luobupo and surrounding areas national wild animal protection area in Xinjiang Province; the Anxi Extreme Drought and Qilianshan National Protection areas as well as some other provincial and county protection areas in Gansu Province; the Shapotou National Protection Area and several provincial protection areas in Ningxia Province; there are protection forest system as well as lots of historical remains and wild animal protection areas in Shaanxi Province; Manghe, Li Mountain, and Wulu Mountain national and provincial protection areas as well as Taihang Mountain and Huaiyang County Wetland protection areas in Shanxi and Henan Provinces; Huangpu Mountain and Guangfu protection areas in Anhui, Jiangsu provinces and Shanghai City.

The environment and ecological status is relatively frail. Possible environment problems are: firstly, destroy to forest and vegetation; second, water and soil erosion; third, dust cause influence to the air pollution; and forth, possible natural gas leakage caused air pollution.

2.3 Conservation strategies

In general, the soil and water conservation strategy is *plan as a whole and conserve sectionally*. The construction disposals should be precluded with engineering measures and enclosed first then abandoned. No casual disposal of sediments along the construction line. Major tunnel projects should make optimal choice to disposal areas and process the muddy water produced. Different vegetation should be selected with the consideration to weather conditions in different areas.

In the wind erosion areas, construction in oasis sections should do the best to go without woods destroying and less if unpreventable. Farmland protection and anti-wind woods should be developed on time so protection functions could be guaranteed. Construction in sand desert areas should keep the building and influencing area as small as possible. Biological anti-wind and sand stationary programmes are favorable measures. The pipe should avoid pass through those well conserved parts in the water and wind joint erosion areas as well as wind erosion sands. Plain farmland conservation schemes should be optimized to promote farmland qualities. Soil disposal excavated from sand covered loess land may develop into terrace, level ditch, or stepped land. Drainage systems are required for high and steep slopes. Pipeline build along loess ditch should take measures for protection slope, ditch stationary, water prevention

and dam protection. Disposal in saline and alkali soil area can be flattened in the operation areas. The disposal in water erosion and hilly loess areas can be used to build check dam and sediment protection dam. It is best for pipeline located at the dam shoulder when pass through silt prevention dams. The cutting and influencing range in mountain and woods areas should be kept in as less as possible and hill-closing afforestation measure be taken. The main tasks in plain step land areas are cutting influence precaution and restoration as well as farm land recovery. In the Yellow River alluvial plain, vegetation development is the main conservation measures for loess flat and prevention project for loess hilly in a comprehensive way. The main conservation should be focused on those intersections of pipeline with Beijing to Guangzhou Railway in the striped areas and wind and sand areas are mainly on plant of grass, tree, and farmland recovery.

The Northern Huaihe River Plain is an area with thinner cultivated soil so it should be excavated in layers and mounted concentrately for conservation. In the Chanjiang and Huaihe hilly areas, there are sections where pipeline along the edge of reservoirs. Wall should be constructed before operation to prevent disposals fall to reservoirs. Higher standards are required for the Northern Changjiang River areas where with plenty of water. The water and soil conservation in these areas need solving both dirty water processing and rice farmland soil protection at the same time. The construction companies are require to temporary protection measurements to control possible water and soil erosion in the construction period. During the construction process, the companies involed are requested to monitor water and soil erosion and provide monitoring report to qualified organizations periodically.

3. IMPLEMENTATION

The construction companies had a very detailed plan for water and soil conservation in the development process and different measures had been taken in different phases.

Preventive measures were taken for wind erosion as well as wind and water crossing erosion areas where pipe grooves in developing or development. The measures include restrict all machinaries and workers in certain planned determined areas. In the operation process, the pipeline was joint before groove excavated. Pipeline was jointing collectively so groove was excavated and refilled rapidly to reduce wind erosion. Groove prevention projects as well as ecological programmes were developed to conserve water and soil erosion.

3.1 Prevention measures

The main prevention measures motivated to the enhancement to ecological recognition and the implementation to those measurements. The construction followed the idea of 'healthy, safety, and environment friendly'. In the development process, the operation was restricted to certain area. Measures were taken to avoid or minimize machinery scoop up and changing to the line. This measurements were effectively protected the existing vegetations and it is more important than artificial recovery for the ecological frail, dry, and less rainfall areas.

3.2 Engineering prevention and protection projects

3.2.1 Broken bits blockage

A large amount of broken bits and residue were produced in the construction process formed new erosion sources. This waste residue was mainly from development of road and tunnel as well as the pass through river or along steep mountain slope. Precautions and measure were taken to deal with this residue but it is still far from the requirements of conservation plan.

3.2.2 Slope protection projects

The high and steep slopes formed in the development process were mainly in the loess hilly and donga areas when developing roads and pipeline. Typical areas include Yongpingchuan river, Yangjiageda, and Yangcha in Yanchuan and Changqing districts, Shaanxi Province as well as Yongheguan and Dazhailing in Shanxi Province. Most of the slopes formed in these areas are more than 15 meters with grade of 60 degrees. Most bare slopes were not protected according to the conservation plan so landslide, solifluction, and collapse could be caused. Although some sections were protected with grass bags, the standard was not met to those requirements by conservation plan.

3.2.3 Groove protection

High standard groove protection projects were developed when pipeline passed through small rivers and grooves such as Daning, Zichang, and Yanchuan in Shanxi Province. The high quality of these projects was guarantee both for the pipeline safety and the environment protection.

3.3 Ecological measurements

The ecological measurements were mainly for those permanent areas such as excavate areas, roads, pressure station, and operation areas. According to the survey, measurement has not taken for those unexcavated areas and most of those completing sections. Although measurements had been taken in some areas, the quality was low, standard on integration and systematic was poor so without the function of water and soil conservation.

3.4 Soil recovery measurements

A lot of farmland was occupied in the pipeline passed areas and this influenced the local production. According to the survey, most of the farmland east of Jingbian had been recovered to the original status and returned to local governments and farmers. But there are still areas that are not completely recovered and influence to local farmer were caused.

4. CONCLUSION AND SUGGESTIONS

The terrain of WGSEP passed areas is complex and ecological environment is frail so it is important to keep high quality conservation plan in the construction process. The companies involved had good conservation idea and some effective measurements were taken in the developing process. But the development emphasize particularly on the protection of main pipeline project. It is still far from the requirements of conservation plan for the conservation measurements. Only part of the area was fully protected and there were still some areas without any protection.

Ecological protection has basically not start in most areas. The woods and vegetation was destroyed seriously in the passed areas and influence was caused to ecological environment. The supervision and monitoring work is important in the construction process and unsatisfactory supervision to conservation projects influences the its quality. To solve the problems existed, construction companies are required to take action and measures taken strictly according to the conservation plan. The water and soil conservation organization are required to supervises and monitor the construction and conservation projects to evaluate the influence periodically and systematically.

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BIOGRAPHICAL NOTES

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