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SHANDONG POWER SECTOR
FLUE GAS DESULPHURIZATION (FGD) PROJECT

Environmental Management Plan

for Laiwu Power Plant 2 x 300MW coal-fired units with FGD project

Laiwu Power Plant

October 2006

I. Project Introduction

Shandong Laiwu Power Plant is located in a long and narrow valley of Liahua Hill in Laiwu, with 3 x 12.5MW homemade units. Till 2005, each unit is retrofitted to 13.5MW that is 40.5MW. For 32 years operation from the foundation, the total generation volume is accumulated to more than 65 billion kWh and 1825 continuous safety operation history is achieved. Laiwu City lies in the middle of Shandong Province and is famous as “Capital of Steel and Coal”, the natural resources and mineral resources such as coal, iron and copper etc. is abundant in this area and the transport conditions are convenient.

Laiwu Power Plant is established in 1972 of high moderation at that time. However, along with the speedy development of power sector, Laiwu Power Plant turns to an old and small plant facing potential surviving pressure from new plants with high capacity and advanced units. As a result, plant expansion of new installation becomes more urgent for subsistence and development. This project for 2 x 300MW units with FGD has received 17 approvals at provincial level and 5 approvals at national level, all the reports and approval documents for pre-preparation stage are ready for final approval. This project is planned as one of Shandong contingency energy projects at 300MW unit level and also listed into 2007 pipeline power projects by National Development & Performance Committee.

II. Project Description

∞ Investment and Location

Annual coal consumption for new 2 x 300MW units is 1.5 million tons, which is supplied by Xinwen Mining Group. Without any controls, SO₂ emission amount would be 26030 tons/year (Chinese standard is 4450 tons/year at 400 mg/Nm³). Accordingly, the new units should be equipped with FGD. For this project, limestone-gypsum wet FGD technology is selected.

The total population in Laiwu is 1.23 million and there are no national important historical sites nearby. 28.6 hectare lands will be acquired for new installation besides existing plant. The process water is from internal circulating water of 115t/h. In this project, the design coal is soft coal from Xinwen Mining Group. (Qnet,ar: 21190kJ/kg, Sar: 1.04% Vdaf: 38.53). The total investment for FGD is CNY169.39 million and USD10 million (equivalent to CNY83 million) will apply for World Bank loan. The project launch capital is contributed by Shandong Lueng Group Co., Ltd, Laiwu Economic Development Investment Co., Ltd and Shandong Fangxing Power Industry Co., Ltd.

∞ Social and Natural conditions

Laiwu City, situated in the eastern part of Mountain Tai, is located at $117^{\circ}19' \square 177^{\circ}58'E \square$ and $36^{\circ}02' \square 36^{\circ}33'N$, covering an area of 2246.21 m². Its climate belongs to warm temperate type with an average temperature of 13.6 °C. The project location lies in the northeast of existing plant, surrounding with hills. The height ranges from 994m to 148.13m above the sea horizon.

Laiwu is 112km away from Jinan, the capital of Shandong Province. There are 2 main districts and 1 development zone in Laiwu, including 19 counties and villages.

∞ Project analysis

The expansion program will occupy 28.6 hectare lands beyond existing plant.

For years, Laiwu Power Plant is always committed to environmental protection, such as electrical dust precipitator retrofitting program, circulating water and domestic wastewater treatment project to promote dust and noise reduction and wastewater treatment, and all these work is supported and approved by local environmental protection departments.

Compared with some FGD technologies and based on the actual situation, wet limestone-gypsum technology is finally selected for this project. This technology is the most mature and widely used desulphurization technology by now; the removal efficiency can be above 95%. It takes the cheap limestone or lime as absorbent. The system consists of absorbent manufacturing system, flue gas system, absorbing tower and gypsum dewatering system etc., and the final product is gypsum. This technology is of high removal efficiency, simple operation, and cheap absorbent. Water consumption of this desulphurization system is 110t/h, which comes from cooling water discharge from the existing boilers.

By-product of this technology is $CaSO_4 \cdot 2H_2O$, which can be material for construction material and cement production. Laiwu Power Plant has already signed sale agreement to avoid secondary pollution. About 83,000 tons of gypsum will be produced annually and the contract allows for the sale of up to 143,000 tons/year.

∞ Environmental Protection Objectives

The environmental protection objects around the project location are listed as follows:

- 1) There's no natural protection area and historical relics near Laiwu Power Plant.
- 2) Surface water: LianhuaRiver
- 3) Underground water: underground water sources near the project location and dust dump near Xujiayu vally.
- 4) Noise: residential area around the power plant

III. Environmental Impact Assessment

The Environmental Impact Assessment (EIA) was approved by SEPA in March 2005. The EIA included the FGD as part of the project analysis. A public consultation for the EIA was conducted in November 2004 and the document was available for public review at the Laiwu power station in March 2005

3. Environmental Management (Mitigation) Plan

Phase	Item	Issue	Mitigating measures	Cost of mitigation	Responsibility	Start Date	End Date
Construction	Air	The impacts on air are from dust emission caused by earth digging, piling up and transporting of excavated earth and delivery of construction materials (concrete, sand, etc.) The dust emission depends on surface wind speed.	Piling up earth to an existing designated pit and a fenced area for construction material pit, and taking measures to prevent dust emission, such as spraying water, setting shields to minimize the adverse impact, as well as the cement. Particularly during dry windy conditions.	Minor	Contractor	When construction starts	When construction ends
	Water	Domestic water from construction workers	The domestic water will be led to the existing treatment plant instead of discharging directly. since the workers will stay at the power plant dormitory	Minor	Contractor	When construction starts	When construction ends
	Noise	The noise is from grab, bulldozer, road-roller, blender and crane etc. the noise level is 75~93 dB (A).	There's no sensitive site and village within 500m around so the noise would not disturb the residents on some extent and the construction work is arranged in the daytime (7:00AM – 6:00 PM).	Minor	Contractor	When construction starts	When construction ends
	Solid Waste	Disposal of waste construction material	Used to fill existing excavations on the power plant property	Minor	Contractor	When construction starts	When construction ends
Operation	Air	Dust from limestone storage and conveyor	Limestone will be received already ground and stored in sealed containers, which could be connected to the process pipeline directly.	Minor	Laiwu Power Plant, Production Technology Department	When construction ends	Ongoing

Phase	Item	Issue	Mitigating measures	Cost of mitigation	Responsibility	Start Date	End Date
	Water	<p>1. Wastewater from gypsum dewatering process, 5~10t/h. The pollutant: pH (pH=5~6), salt (fluoride, sulphite and sulphate etc.)</p> <p>2. Wastewater of washing FGD equipment when shutdown.</p>	<p>1. Construction of new wastewater treatment system with capacity of 20t/h for the new boiler installation (pH adjustment, settling) it will be reused for spraying landscaping and dust control.</p> <p>2. The wastewater after washing will be collected in drainage and delivered to absorption tower by pumps.</p>	Minor	Laiwu Power Plant, Production Technology Department	When construction ends	Ongoing
	Solid waste	<p>The SO₂ and CaCO₃ in flue gas will combined to CaSO₄·2H₂O through chemical reaction. The purity of the gypsum (CaSO₄·2H₂O) >90%, fineness: 30~60um; Water content <10%. The amount is 83600 T/a (based on design coal)</p>	<p>The desulphurization gypsum will be sold by Shandong FANGXING Industry Co., Ltd to six final customers to produce construction material and cement, in order to avoid secondary pollution, close packaging is necessary.</p>	Minor	Laiwu Power Plant, Production Technology Department	When construction ends	Ongoing
	Noise	<p>Noise from the operation of blender, circulating pump and blower etc. level: □85 dB (A).</p>	<p>Choosing the equipments with low noise and carrying out preventive measures:</p> <p>1. Design stacks straight and use sound absorbing supports for pipelines to reduce noise;</p> <p>2. Planting shrubbery and arbor around the plant for sound absorption.</p> <p>The measures above could eliminate the noise level by 15~20dB (A).</p>	Minor	Laiwu Power Plant, Production Technology Department	When construction ends	Ongoing

4. Environmental Monitoring Plan (Construction Phase)

Phase	Parameter	Site	Method and equipment type	Frequency	Monitoring cost/ Equipment cost	Responsibility	Start Date	End Date
Construction	Dust	Disposal area and construction site	Visual	Weekly or daily during dry weather	Minor	Laiwu Power Plant Production and Technology Department	When construction starts	When construction ends
	Wastewater (PH, SS, COD _{cr} , BOD ₅)	To central treatment plant no monitoring necessary						
	Solid Waste	Dumpsite on plant property	Visual	Monthly or more frequently during major construction activities	Minor	Laiwu Power Plant Production and Technology Department	When construction starts	When construction ends
	Noise (equivalent continuous class-A)	Sensitive site within 150m of construction and (construction worker dormitories) buildings within 50m of piling place	Noise meter	Monthly or if there are complaints	Minor	Laiwu Power Plant Production and Technology Department	When construction starts	When construction ends

Environmental Monitoring Plan (Operation Phase)

Phase	Parameter	Site	Method and equipment type	Frequency	Monitoring cost/ Equipment cost	Responsibility	Start Date	End Date
Operation	Air (limestone dust)	Limestone storage area	Visual	Every month	Minor	Laiwu Power Plant Production and Technology Department	When operation starts	Ongoing
	Wastewater (pH, SS, Cl ⁻ , SO ₄ , fluoride)	Wastewater discharging outlet	Chemical laboratory with a set of monitoring equipments	Every month	Minor	Laiwu plant laboratory	When operation starts	Ongoing
	Waste solid	Gypsum will be sold no monitoring necessary						
	Noise (equivalent continuous class-A)	1m away from the boundary	Noise meter	Quarterly	Minor	Laiwu Power Plant Production and Technology Department	When operation starts	Ongoing

5. Institutional Arrangements

Monitoring

Data collection will be performed by the Production Technology Department for both the construction and operation phases.

Data Analysis

For both construction and operation the environmental staff member of the Production Technology Department will analyze the data

Reporting and Recommendations

Environmental staff of the Production Technology Department will prepare both monthly and quarterly reports to the Vice General Manager, Laiwu EPB, and Luneng Group (parent company)

Action/Decisions

Most of the time it will be the Vice General Manager who will take the necessary action. However, depending on the situation either the Laiwu EPB or Luneng Group Co. will take the necessary actions.

6. Public information

The consultation objects involve the residents and workers from the governments, factories and schools around the project site, the questionnaires were handed out during the consultation.

200 copies of questionnaires were handed out and all of them were filled back.

Here is the detailed information of the participants.

Table 1 Participants Information

Item		Persons	Percentage (%)
Age	< 18	12	6.2
	19□34	70	36.0
	35□54	89	45.9
	> 55	23	11.9
Education	Junior school and below	113	58.2

	Senior school or technical school	62	32.0
	University and above	19	9.8
Occupation	Worker	3	1.5
	Peasant	129	66.5
	Teacher	0	0
	Official	61	31.5
	Merchant	0	0
	Student	1	0.5
	Other	0	0
Distance away from the plant	0□250m	0	0
	250□1000m	65	33.5
	1000□2000m	26	13.4
	> 2000m	103	53.1
Units the participants from	DUI XIAN MEN Village	31	16.0
	DIAO GU SHAN Village	36	18.6
	FU DONG Village	20	10.3
	SHI LI HE & HONG FU LING Village	29	14.9

	LAICHENG District	78	40.2
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2. Opinion analysis

The survey analysis shows that the view on each issue is consistent. The public are active to participate and all of them have some knowledge on environmental impacts of this project. The following table shows the details:

Table 2 Public opinions collection

Questions	Opinions	People who approved	Percentage (%)
1 <input type="checkbox"/> Do you know this project before the public consultation?	A <input type="checkbox"/> Yes	163	84.0
	B <input type="checkbox"/> No	31	16.0
2 <input type="checkbox"/> Your impression on LAIWU Power Plant is:	A <input type="checkbox"/> Excellent	123	63.4
	B <input type="checkbox"/> Above average	37	19.1
	C <input type="checkbox"/> Average	30	15.5
	D <input type="checkbox"/> Poor	2	1.0
	E. Bad	1	0.5
	F <input type="checkbox"/> Don't know	1	0.5
3 <input type="checkbox"/> How do you think the pollution control taken by LAIWU Power Plant?	A <input type="checkbox"/> Good	144	74.2
	B. Fair	42	21.6
	C. Poor	1	0.5
	D <input type="checkbox"/> Don't know	7	3.6
4 <input type="checkbox"/> How do you think about the ambient quality in the LAIWU downtown?	A <input type="checkbox"/> Heavily polluted	29	14.9
	B <input type="checkbox"/> Slightly polluted	22	11.3

	C. Fair	106	54.6
	D. Good	37	19.1
5□How do you think the water quality of LianHua River and MouWen river?	A□Heavily polluted	34	17.5
	B□Slightly polluted	11	5.7
	C. Fair	99	51.0
	D. Good	50	25.8
6□How do you think about the noise pollution around the residential area?	A□Heavily polluted	32	16.5
	B□Slightly polluted	5	2.6
	C. Fair	111	57.2
	D. Good	46	23.7
7□Do you think this project will be helpful for the promotion of LAIWU economic development?	A□Yes	174	89.7
	B□No	1	0.5
	C□Don't know	19	9.8
8□The project construction will follow the “Three-Simultaneous”, that is the planning, construction and employing of environmental protection facilities be carried out simultaneously with ken construction work. Separate	A□Yes	158	81.4
	B□No	3	1.6

construction work. Separate environmental protection department will be set during project construction and relevant facilities for environmental protection will be equipped to minimize the adverse impact to the lowest and the discharging of “Three Wastes” (wastewater, waste gas and waste residue) should be met the state standards. Given the measures mentioned above will be implemented, do you think whether the adverse impact caused by this project would be acceptable/	C <input type="checkbox"/> Don’t know	33	17.0
9 <input type="checkbox"/> Considered all the impact generated by this project, do you think whether the project is necessary or not?	A <input type="checkbox"/> Necessary	176	90.7
	B <input type="checkbox"/> Unnecessary	1	0.5
	C <input type="checkbox"/> Don’t know	17	8.8
10 <input type="checkbox"/> As the project will occupy some land and compensate will be carried out, what is your opinion on resettlement caused by the project?	A <input type="checkbox"/> Agree	65	33.5
	B <input type="checkbox"/> Disagree	0	0
	C <input type="checkbox"/> Don’t know	2	1.0

During the 194 answers participated the survey, 84.0% shows that they have heard this project before; 74.2% thinks that LAIWU Power Plant lays emphasis on its pollution control, 14.9% of the participants think the air in LAIWU city is deeply polluted and 17.5% thinks the water of LIANHUA river and MOUWEN river is deeply polluted also, 16.5% think the noise pollution in the residential area around the project site is heavy, 89.7% think the project will promote local economic development. The public also have clear awareness of the adverse impacts, 81.4% think the project is acceptable if the environmental measures, such as “Three-Simultaneous”, could be carried out accordingly. During the opinions, 90.7% think this project is necessary to be implemented. As to the resettlement, 65 persons of the total 67 participants (of 97.0%) agree to the resettlement.

3. Conclusion

According to the opinion analysis, 176 of the total 194 participants (of 90.7%) support the project implementation, as to the resettlement to DUIXIANMEN villagers, 97.0% of the participants involved agree the resettlement, which shows that the local residents support this project.

Based on the survey results, it shows that most of the public supports this project as:

1. This project will be helpful for LAIWU economic development promotion;
2. The impacts on local environmental caused by the project is easily controlled.

The public raises the following advice and requirements:

1. The project is expected to be constructed as soon as possible to promote local economic development and improving the living level of local residents;
2. The “Three-Simultaneous” should be implemented as planned; the project contractor and the power plant are responsible to reduce the adverse impact on environment to the least to ensure that the air quality in LAIWU city is improved highly.
3. The resettlement plan should be carried out according to the state and local policies.

