

**ACTION PLAN FOR IMPROVING THE**  
**EFFICIENCY OF PARTICULATE ABATEMENT**  
**SYSTEM IN THE POWER PLANT # 4,**  
**ULAANTAATAR**

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## **INTRODUCTION**

As a Part of the Environmental Audit of the Power Plant #4 carried out within a frame of the UNESCAP Regional Programme for Technical Assistance for Trans-boundary Environmental Cooperation in North East Asia, the Action Plan was prepared to address implementation of the recommendations developed in the Environmental Audit report. The recommendations focus on improving Efficiency of the Particulate Abatement Systems in the Power Plant. The recommendations include measures to meet the requirements of the World Bank Standard for the Implementation Schedule and Cost Estimation for the actions were prepared. The Draft Action Plan was presented and discussed at the National Workshop held in Mongolia on 4 June 2004 and on the Subregional Workshop held in China on 7-8 June 2004. Comments and recommendations of the Workshop were incorporated in the Action Plan and the Technical Report of the Audit.

The Action Plan is developed within the Format of the European Bank for Reconstruction and Development as presented in the document 'Environmental and Health & Safety Standard Audit Report Format'.

## **1. SELECT, DESIGN & IMPLEMENTATIONS TECHNOLOGIES**

In accordance to the World Bank Emission Guidelines<sup>1</sup> for existing thermal power plants the following measures for particulate emission control must be incorporated when rehabilitating the power plant: the maximum emissions level for particulate matter is 100mg/nm<sup>3</sup> but the target should be 50 mg/nm<sup>3</sup>. There are only ESPs (flue gas transparency) and Baghouses recommended for effective control of particulate matter in industrial applications. The power plant # 4 is equipped with ESPs. Because age of the equipment and mechanical wear- and-tear the efficiency of the ESPs are considerably lower compare to design efficiency-99.6%. Description of the ESPs status is presented in the Technical Report of the Audit in Appendix. The rehabilitation program is recommended for the ESPs to achieve their efficiency about 99.6%.

The scope of the rehabilitation programme for the ESPs is as follows:

- A. On all eight boilers, replacement of electrode system, repair of electric system, mechanical system, ash removal system. The costs are near US\$ 2 million for the ESP # 7 and US\$ 800,000 per other ESPs for # 1, 2, 3, 4, 6, 8. At present the rehabilitation programme for the ESP # 7, 5 is under way.
- B. Additionally, to ensure that the rehabilitated ESPs will achieve design efficiency 99.6% it is recommended to contract the manufacturer of ESP to update the design of the ESPs and provide supervising of the rehabilitation. The cost is about US\$ 50,000;
- C. For all ESPs replacement of 20 years old distance control systems with new computer based control systems. The cost is about US\$ 250,000 per ESP.

There are 26 Russian type BKZ-75-39 steam boilers under operation in Mongolia. The boilers are 20-40 years old and equipped with wet scrubbers to control particulate matter emissions. The actual efficiency of the wet scrubbers is about 90% and particulate matter emissions are very high in the power plants. Information of the boiler and the wet scrubbers are presented in the Technical Report of the Audit. Due to aging problems of the boilers, it is recommended to implement the modernization programme for the wet scrubbers to improve their efficiency up to 95-97%. Experience for improving efficiency of the wet scrubbers is available from Russia.

Modernization of the wet scrubbers can be implemented in a frame of a major repair of the boilers. It is recommended to train a local specialist group to carry out the modernization of the wet scrubbers around the power plants in Mongolia.

## **2. INVENTORY OF ESSENTIAL SPARE PARTS**

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<sup>1</sup> Pollution Prevention and Abatement Handbook, World Bank Group

To avoid prolonged outages of emission control equipment in a case of technical problems, an inventory of essential spare parts should be maintained. The cost of the inventory for the ESPs of the power plant is about US\$ 1 million.

### **3. OPERATIONAL MANAGEMENT**

In order to ensure that ESPs, boilers, ash removal systems, monitoring equipment are operated and maintained properly the followings is recommended:

- To train personnel for the operation and maintenance of ESPs, boilers, ash removal systems and monitoring equipment in according to manufacturer's recommendations and environmental friendly practice. The cost of training is about US\$ 25,000.
- Improve control for keeping regime of ESPs, boilers, monitoring equipment, upgrading operating instructions, etc.;
- Build the capacity of a local expert group to implement programme for improving the wet scrubber efficiency up to 95-97%. The cost is near US\$ 25,000.

### **4. MONITORING AIR EMISSIONS AND REPORTING**

To keep the requirements of World Bank on monitoring, obtaining the continuous and reliable information on air emissions and comparing them with limits, it is necessary to install at the station the instruments for permanent registration of emission of the following matters in flue gases: carbon, sulfur, and nitrogen oxides, particulate matters, which can be registered by measuring transparency of the flue gases, as well as flow of gases. In order for the staff to be well-informed about air emissions on the power plants and to increase their responsibility for operation of air emission control equipment, there needs to have proper air emission data monitoring, recordkeeping and reporting mechanisms at the power plants. A form of reporting should be developed and adopted. The following actions should be implemented:

- Installation of ash emission monitoring system after ESPs. The cost is around US\$ 20,000 per ESP.
- Installation of air emission monitoring system at the stack (flue gas flow, flue gas transparency, SO<sub>2</sub>, NO<sub>x</sub>, O<sub>2</sub>, Temp.). The cost is around US\$ 100,000.
- Providing two portable flue gas analyzers for boiler testing. The cost is about US\$ 20,000.

### **5. ASSISTING GOVERNMENT WITH INTRODUCTION OF NATIONAL REGULATION OF AIR EMISSION LIMITS FOR POWER PLANTS**

To reduce pollutant emissions from power plants and provide impetus for measure implementation, air emission limits have to be established in the power plants in Mongolia. Together with air emission limits, the mechanism of financing air protection measures should be developed. The technical assistance is proposed for the formulation of a concept paper on national regulation of air emissions limits for the power plants. For capacity building, technical assistance activities of local

environment and energy experts in the field of air emission protection and regulation should be conducted. The cost of the technical assistance component is about US\$ 150,000.



UNESCAP Technical Assistance for Trans-boundary Environmental Cooperation in North East Asia

N	Action	Cost, US\$ th-d	Financing Source	Implementation schedule			
				1 year	2 year	3 year	4 year
<b>4</b>	<b>Monitoring of Air Emission and Reporting:</b>						
	4.1 Installation of ash emission monitoring system after ESPs (flue gas transparency;	160	tbi		ESPs # 5,6,8,7 20x4=80	ESPs # 3,4 20x2=40	ESPs # 1,2 20x2=40
	4.2 Installation of air emission monitoring system at the stack (gas flow, flue gas transparency, SO <sub>2</sub> , NO <sub>x</sub> , O <sub>2</sub> , Temp.)	100	tbi				
	4.3 Training personnel on operation, maintenance and testing monitoring equipment, establishing emission monitoring and reporting	50	TA		50		
	4.4 Providing portable flue gas analyzer for boiler testing.	20	TA		20		
	<b>Total cost:</b>	<b>330</b>			<b>150</b>	<b>140</b>	<b>40</b>
<b>5</b>	<b>Assisting Government with introduction of national air emission limits and monitoring power plants</b>						
	5.1 Capacity building of local experts in a field of air emission limits establishing and monitoring for power plants.	50	TA		50		
	5.1.1 Assisting with establishment of the national air emissions limits and monitoring system for power plants	100	TA		100		
	<b>Total cost</b>	<b>150</b>			<b>150</b>		
	<b>TOTAL COST, Including current Government financing</b>	<b>11,180 4,400</b>			<b>2,850 2,800</b>	<b>1,950 1,600</b>	<b>3,240 3,140</b>

\* Preliminary estimation, excluding freight cost, taxes, interest during construction

\*\* Financing submitted by Government