Wuxiang Hexin Thermal Power Generation Co., Ltd.

Environmental Auditing Report

Wuxiang Hexin Thermal Power Generation Co., Ltd.
June 2011
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1. Introduction

Environmental auditing is intended to have a historic review of existing production facilities in a power plant, identify the existing problems in the power plant with regard to production process, pollution prevention and control measures, environmental management, safety management and social influence, etc., and propose their corresponding solutions.

The environmental auditing can be employed to effectively reveal the problems existing in an enterprise’s environmental management, and urge its relevant departments to strengthen their awareness of environmental protection and strictly implement the policies on environmental protection. It can promote the enterprise to build a favorable and responsible image and put an emphasis on environmental protection from the perspective of own long-term development and social responsibilities, so as to facilitate the intensified awareness of environmental protection in the whole society.

Wuxiang Hexin Thermal Power Generation Co., Ltd. started the construction of two generator units in 2004 and completed the construction by January 2007. The project had the total installed capacity of 4×600MW. In Phase I, two 600MW subcritical air cooling units were constructed with the total investment of RMB5.31 billion. Three main process equipments were manufactured by Wuhan Boiler Factory, Harbin Turbine Co., Ltd. and Harbin Electric Machinery.

Unit 1# was put into power generation on October 7th 2006, while Unit 2# was put into power generation on January 7th 2007.

While Wuxiang Hexin Thermal Power Generation Co., Ltd. converts coal into electric power, it also consumes a large amount of coal and water, and emits a large number of SO₂, soot, NOₓ and other pollutants into the environment.

This Report mainly presents the environmental auditing with regard to the environmental protection and treatment measures and the environmental management measures taken by Wuxiang Hexin Thermal Power Generation Co., Ltd.
2. General

2.1 Enterprise Overview

Wuxiang Hexin Thermal Power Generation Co., Ltd. is located on the first terrace on the north bank of Niehe River in the southwest and around 2Km away from the town of Wuxiang County, Changzhi City, Shanxi Province. Wuxiang County is in the southeast of Shanxi Province and the northernmost part of Changzhi City. It is 130Km away from Taiyuan in the north and 110Km away from Changzhi City in the south. Moreover, it borders Licheng County and Zuoquan County in the east, Qi County in the west, Yushe County in the north, Qin County and Xiangyuan County in the south.

Wuxiang County is an old revolutionary base area and a state-level poverty-stricken county, where made tremendous contributions to Chinese revolution. The county has more than 210,000 populations and a total area of 1610Km². The territory of the county is mostly mountainous, so it is quite barren but rich in mineral resources. Thus, it is one of key coal producing counties in Shanxi Province, and its geological reserve of raw coal is up to 2.86 billion tons. Within the territory of Wuxiang County, there is Wumo Railway (Chengguan-Modeng) connected to Taiyuan-Jiaozuo Railway and Yangquan-Shexian Railway, and some highways such as National Highway No. 208, Nanling-Qinyuan Highway and Yuci-Changzhi Highway, etc. Moreover, it is traversed by Taiyuan-Changzhi Expressway. Therefore, it enjoys advanced traffic and convenient transportation. Within the territory, there a large reservoir-Guanhe Reservoir, which is characterized by sufficient water and favorable water resource. Depending on the aforesaid advantageous conditions, it is basically suitable to build a large thermal power plant. In order to realize the goal of shaking off poverty and setting out on a road to prosperity, it is necessary to give full play to Wuxiang County’s advantageous coal and water resources to drive local economic development.

The construction of Wuxiang Hexin Thermal Power Generation Co., Ltd. can realize the conversion of local coal resource into electric power, so as to realize the integrated utilization and optimized allocation of resources. Thus, this is positively significant to alleviating the lack of electric power in the southeastern regions of Shanxi Province, improving the structure of Shanxi grid, enhancing the power transmission capacity from Shanxi grid to other provinces, and facilitating Shanxi’s
economic development.

The construction of the project was commenced in 2004, and completed in January 2007. The project had the total installed capacity of $4 \times 600$ MW. In Phase I, two 600MW subcritical air cooling units were constructed with the total investment of RMB5.31 billion. Three main process equipments were manufactured by Wuhan Boiler Factory, Harbin Turbine Co., Ltd. and Harbin Electric Machinery.

Unit 1# was put into power generation on October 7th 2006, while Unit 2# was put into power generation on January 7th 2007.

The company attached great importance to management innovation, actively learned the advanced management experience for similar Chinese power generation enterprises and combined it with practices to establish a set of scientific and complete modern enterprise management system composed of safety management, operation management, equipment management, personnel management and business management. It constantly promoted the cultivation of scientific, normalized and standardized management, and strictly implemented 113 work standards, 155 management standards, 30 technical standards and more than 40 various management rules and policies. After being merged into Huadian, the company carefully studied, digested and absorbed various management standards and systems of Huadian Power International and Huadian Shanxi Energy Company, in order to integrate with Huadian’s management in all aspects. On this basis, the company revised its systems and standards in an all-round manner, with an aim to realize the overall integration with the management system of Huadian Power International. Meanwhile, the company, as approved by Huadian Shanxi Energy Company, further improved and optimized its organizational structure and set up 12 departments, namely, General Manager Department, Party & People Relationship Department, Business Planning Department, Finance & Asset Department, Fuel Management Department, Supply Department, Safety, Health and Environmental Department, Equipment Maintenance Department, Power Generation Department, Auxiliary Control Integrated Management Department, Inspection & Repair Department, and Phase II Construction Preparation Department. Currently, the company has 245 employees, of which 90% have the degree of junior college and above. Among them, there are 19 employees with the senior professional title, 73 employees with intermediate professional title and 72 employees with junior professional title.

As for production management, the company is responsible for the technical
management in the operations of main system and auxiliary system. It implements the “five-duty and three-operation system” for the operation management of power generation. Moreover, it carries out the spot check and scheduled repair system, and is transiting from this to the management mode of predictive maintenance (repair based on condition). The company is responsible for the repair and maintenance of thermal control and relay protection and the spot check and scheduled repair of primary boiler, turbine and electrical. In addition, it is also responsible for the spot checks of equipments in the chemical, ash removing, desulfurizing, coal conveying, water taking and ash & slag systems. The auxiliary systems of ash removing, dust removing, desulfurizing, chemical and coal conveying, etc. are manned with the operators from Datong No. 1 Power Plant and their operations are managed by the company’s Auxiliary Control Department. The daily maintenance of main machinery and public systems is entrusted to (Inspection & Repair Department) Shanxi Hexiang Electric Power Engineering Inspection and Repair Co., Ltd., while its (major or minor) overhauls, technical supervision, special performance tests, special inspections and repairs are outsourced to other parties.

The boilers employ the louver structured horizontal rich/lean low-nitrogen coal burner to control the NOx within the standard range. The turbine employs the direct air cooling for the waste steam cooling, and the closed circulation water supply system for the cooling water of auxiliary machinery. The boilers are provided with 4 double-chamber 5-electric-field electrostatic precipitators with the design dust removing capacity of 99.75%. The desulfurization of flue gas employs the limestone-gypsum wet process, and there are two towers for two boilers. The desulfurizing tower is a bubbling tower. The design availability of desulfurizing system and the efficiency of desulfurization are 95%. Two Continuous Emission Monitoring Systems are provided for monitoring the flue gas emission. In September 2009, they had been interconnected with the provincial and municipal environmental protection monitor centers. As required by the provincial and municipal environmental protection departments, it had put CEMS into the management by operators. For disposal of sewage and wastewater, three treatment stations are constructed. After being collected and treated in categories, sewage and wastewater is completely recycled so as to realize the zero discharge of wastewater. The ash removing system employs the dry ash removing and dry ash storage, so as to save the water resource to the maximum.
The company attaches great importance to environmental protection and establishes the environmental protection leading group with its general manager as the group leader and the environmental protection and technical supervision network with the responsible deputy general manager as the group leader, to take charge of supervising the environmental production throughout the plant. Safety, Health and Environmental Department is responsible for the supervision and management of the company’s environmental protection, and a full-time environmental protection engineer is appointed to take charge of the daily work in the environmental protection management and environmental protection supervision. Equipment Maintenance Department and Auxiliary Control Integrated Management Department are equipped with the professional engineers of desulfurization and ash removing respectively. Moreover, it formulates and strictly enforces the Environmental Protection Management Standard, Environmental Protection Technical Supervision and Management Standard, Implementation Rules on Environmental Protection Management Appraisal, Emergency Response Plan of Environmental Protection Accidents, Operation Rules on Ash Removing and Desulfurizing Systems, and other environmental protection management regulations and rules, so as to boost the company’s standardized management of environmental protection.

The company strictly implements the “three-simultaneity” system, handles the complete formalities for examination and approval of environmental protection, passes various environmental protection acceptance inspections timely and smoothly and obtains various certificates of environmental protection, so it plays a leading role among the power generation enterprises in Shanxi.

In November 2007, the company passed the completion acceptance of environmental protection in construction projects, which was organized by Ministry of Environmental Protection;

In July 2007, the company passed the completion acceptance of occupational disease prevention and protection facilities in new projects, which was organized by Department of Public Health of Shanxi Province;

In January 2008, the company passed the cleaner production review report organized by Bureau of Environmental Protection of Shanxi Province;

In August 2008, the company passed the completion acceptance of water and soil conservation facilities in new projects, which was organized by the Ministry of Water Resources;
In October 2008, the company passed the “acceptance of overall qualified environmental protection”, which was organized by Bureau of Environmental Protection of Shanxi Province;

In April 2009, the company obtained the Pollutant Emission Permit issued by Shanxi Environmental Protection Department;

In September 2009, the company was honored with the title of “Green Enterprise of Environmental Behaviors in Shanxi” from Bureau of Environmental Protection of Shanxi Province;

In September 2009, the company’s continuous emission monitoring system and province-wide networking device passed the inspection and acceptance of the Bureau of Environmental Protection of Shanxi Province and Changzhi City, officially put into the province-wide networking operation, and realized the operators maintenance management;

In January 2008, January 2009, January 2010 and January 2011, it had passed the inspections and checks of pollutant emission reduction onsite inspection group organized by the Ministry of Environmental Protection for four consecutive years;

In October 2010, Bureau of Environmental Protection of Changzhi City performed the lead sealing of bypass damper in the desulfurizing system according to the unified requirements of the Ministry of Environmental Protection;

From 2008 to August 2010, the desulfurization feed-in tariff joint inspection group organized by price and supervision departments of Shanxi Province came to the company and performed a general check of the feed-in tariff of power generation with desulfurization, as required by six ministries and commissions including National Development and Reform Commission and Ministry of Environmental Protection, etc. The inspection group believed that the company put the desulfurization facility into normal operation when it had a difficult time, so as to favorably implement the national desulfurization feed-in tariff policy.

The company strictly complied by national and local laws and regulations of environmental protection, implemented the State’s strictest environmental protection requirement for thermal generator units, persisted in the delicacy management, constantly strengthened the technical reform of energy conservation in equipments, intensified the control of various operational indicators in the units, guaranteed the normal input into the pollution prevention and control facilities, realized the accepted emission of pollutants, and reduced the environmental pollution to the maximum.
Since the units were put into production, the company did not engage in any environmental pollution event or environmental effective complaint, and not receive any punishment from the administrative authority of environmental protection. Moreover, it had received various honorable titles including “Green and Environment-friendly Enterprise” in the Blue Sky and Clean Water Program conducted by Social Affairs Investigation Center of the People’s Government of Shanxi Province, “Advanced Enterprise of Energy Conservation and Emission Reduction in Shanxi”, and “Double Civilization Unit” in Changzhi City, etc. In the appraisal of environmental behavior for 64 enterprises conducted by Shanxi Environmental Protection Department, the company was elected into the top level of environmental behavior—“Green” Level.

2.2 Organizational Structure

See Fig. 2.2-1 for organizational structure.

2.3 Explanations on Auditing

2.3.1 Purpose and Significance of Auditing
2.2-1 The Company’s Organizational Structure
2.3.1.1 Purpose

Through the production site survey, documents examination and necessary tests for an enterprise, analyze the enterprise’s status of environmental protection, confirm its level of environmental protection, ascertain the existing problems and loopholes, analyze and compare the potentials in environmental protection, and put forth some practical and feasible measures and proposals of environmental protection, so as to provide the true and reliable information on environmental protection for the government, guide the enterprise’s improvement of its environmental management level, realize the general objectives of environmental protection in the “Twelfth Five-year Plan” and facilitate the sustainable development of economy and environment.

2.3.1.2 Significance

(1) It is the necessity of determining and discharging enterprise environmental responsibility

Enterprise environmental responsibility refers to an enterprise’s responsibility to treat environmental pollution and protect ecological environment. Environmental auditing undertakes the functions of supervising, appraising and verifying an enterprise’s aforesaid responsibility, and takes the fair attitude toward auditing and its unique mode and method to identify and discharge an audited enterprise’s responsibilities, their degrees and natures, so as to protect the enterprise’s legal rights and interests.

(2) It is an inner demand of enterprise’s going concern

In its production, operation and marketing, etc. an enterprise must pay attention to its environmental image and environmental achievement, as any of its mistakes in the environmental decisions may bring challenges to its operator, cause the financial failure, and even lead to bankruptcy and liquidation. Thus, to attach importance to environment and actively participate in the environmental treatment and protection can help the enterprise obtain favorable internal and external environments and guarantee its sustainable development of operation.

(3) It is an important part of enterprise management auditing

In the environmental auditing, periodically supervise and assess an enterprise’s environmental management activities regarding to management plan, control procedure and control method, analyze the internal environmental factors affecting
the enterprise’s management effectiveness and efficiency, perfect the environmental management control system, facilitate the enterprise’s reasonable development and utilization of environmental resources and help the enterprise perform its social responsibilities. From this approach, the environmental auditing that is intended to analyze and assess enterprise environmental management system has become an important part of enterprise management and auditing.

(4) It is a demand in an enterprise’s development of international and domestic markets

Environmental auditing can help Chinese enterprises enter the international market rapidly, and be also helpful to bringing foreign capitals and projects into China’s domestic market, so as to finally realize the global economic integration and make a contribution of auditing to “Earth-the Only Home”.

2.3.2 Auditing Bases

2.3.2.1 Laws, Regulations and Policies


(9) Classified Directory for Environmental Protection Management of Construction Projects, Decree No. 14 of State Environmental Protection
Environmental Auditing Report - Wuxiang Hexin Thermal Power Generation Co., Ltd.

Administration, January 2003.


(11) Provisional Measure of Public Participation in Environmental Impact Assessment, HF [2006] No.28 of State Environmental Protection Administration, March 2006.


2.3.2.2 Relevant Regulations of World Bank


(3) World Bank GP4.01 (Environmental Assessment), January 1999.


2.3.3 Auditing Scope and Period

The environmental auditing scope is the whole plant of Wuxiang Hexin Thermal Power Generation Co., Ltd. and the auditing period is from 2008 to 2010.
2.3.4 Applied Standards

2.3.4.1 Environmental Quality Standards

(1) Ambient Air Quality Standard: The project is located in the blending area of countryside and normal industry, and its functional area of ambient air quality belongs to Category II, so it implements the Class II standard of * Ambient Air Quality Standard* (GB3095-1996). The standard limits are shown in Table 2.3-1.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>TSP</th>
<th>SO₂</th>
<th>NO₂</th>
<th>PM₁₀</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Average</td>
<td>0.20</td>
<td>0.06</td>
<td>0.08</td>
<td>0.10</td>
</tr>
<tr>
<td>Daily Average</td>
<td>0.30</td>
<td>0.15</td>
<td>0.12</td>
<td>0.15</td>
</tr>
<tr>
<td>Hourly Average</td>
<td>—</td>
<td>0.50</td>
<td>0.24</td>
<td>—</td>
</tr>
</tbody>
</table>

(2) Surface Water: The surface water system near the project is Niehe River, which belongs to the Niehe water system of Haihe River Basin, so the surface water assessment implements the Category IV standard in the *Environmental Quality Standards for Surface Water* (GB3838 - 2002). The standard limits are shown in Table 2.3-2.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>pH</th>
<th>NH-N</th>
<th>COD₄</th>
<th>BOD₅</th>
<th>Volatile Phenol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Value</td>
<td>6 ~ 9</td>
<td>1.5</td>
<td>30</td>
<td>6</td>
<td>0.01</td>
</tr>
<tr>
<td>Pollutant</td>
<td>Cyanide</td>
<td>Fluoride</td>
<td>Sulfide</td>
<td>Petroleum</td>
<td></td>
</tr>
<tr>
<td>Standard Value</td>
<td>0.2</td>
<td>1.5</td>
<td>0.5</td>
<td>0.5</td>
<td></td>
</tr>
</tbody>
</table>

Note: No dimension for pH.

(3) Ground Water: The domestic water in this area is from local ground water. According to the classification of ground water in the *Quality Standard for Ground Water* (GB/T14848-93), the ground water “mainly suitable for centralized domestic water source, industry and agriculture based on the benchmark values helpful to human health” belongs to Category III water quality, so the quality of ground water in this assessed area is classified as Category III, and it implements the Category III standard in the *Quality Standard for Ground Water* (GB/T14848-93). The standard limits are shown in Table 2.3-3.
Table 2.3-3 Standard Limits of Ground Water Environmental Quality (mg/L)

<table>
<thead>
<tr>
<th>Item</th>
<th>Standard Value</th>
<th>pH Value</th>
<th>Total Hardness (CaCO$_3$)</th>
<th>Sulfate</th>
<th>Fluoride</th>
<th>Total Coliform Bacteria (piece/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Value</td>
<td>6.5 ~ 8.5</td>
<td>≤450</td>
<td>≤250</td>
<td>≤1.0</td>
<td>≤3.0</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>NH-N</td>
<td>Nitrate</td>
<td>Nitrite</td>
<td>Cr$_6^+$</td>
<td>Total Bacterial Count (piece/ml)</td>
<td></td>
</tr>
<tr>
<td>Standard Value</td>
<td>≤0.2</td>
<td>≤20</td>
<td>≤0.02</td>
<td>≤0.05</td>
<td>≤100</td>
<td></td>
</tr>
</tbody>
</table>

Table 2.3-4 Environmental Noise Standard

<table>
<thead>
<tr>
<th>Classification</th>
<th>Standard Value (dB(A))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day</td>
<td>Night</td>
</tr>
<tr>
<td>Category 2</td>
<td>60</td>
</tr>
</tbody>
</table>

2.3.4.2 Pollutant Emission Standards

(1) Emission Standard for Air Pollutants

According to the requirements in the reply of Bureau of Environmental Protection of Shanxi Province on the desulfurization environmental assessment of Wuxiang Hexin Thermal Power Generation Co., Ltd., it implements the maximum allowed emission concentration of period III for coal-firing boilers in the *Emission Standard of Air Pollutants for Thermal Power Plants* (GB13223-2003). The standard values are detailed in Table 2.3-5.

Table 2.3-5 Emission Standard of Air Pollutants for Thermal Power Plant

<table>
<thead>
<tr>
<th>Boiler Type</th>
<th>Pollutant</th>
<th>Maximum Allowed Emission Concentration at Period III (mg/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal-firing Boiler</td>
<td>Soot</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>SO$_2$</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>NO$_x$</td>
<td>650</td>
</tr>
</tbody>
</table>
Note: $10\% < V_{daf} < 20\%$

(2) Wastewater Discharge Standard

The wastewater discharge implements the Class I standard in Table 4 of the *Integrated Wastewater Discharge Standard* (GB8978 - 1996). The standard values are detailed in Table 2.3-6.

**Table 2.3-6 Integrated Wastewater Discharge Standard**

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Standard Value</th>
<th>Pollutant</th>
<th>Standard Value</th>
<th>Pollutant</th>
<th>Standard Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH</td>
<td>6 ~ 9</td>
<td>Petroleum</td>
<td>5</td>
<td>COD$_{Cr}$</td>
<td>100</td>
</tr>
<tr>
<td>Suspended Matter</td>
<td>70</td>
<td>Fluoride</td>
<td>10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(3) Noise Emission Standard

For noise at boundary of enterprises, it implements the Category III standard in the *Standard of Noise at Boundary of Industrial Enterprises* (GB12348 - 90). The standard limits are shown in Table 2.3-7.

**Table 2.3-7 Standard of Noise at Boundary of Industrial Enterprises**

<table>
<thead>
<tr>
<th>Classification</th>
<th>Standard Value (dB(A))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day</td>
</tr>
<tr>
<td>Category III</td>
<td>65</td>
</tr>
</tbody>
</table>

The disposal of solid wastes implements the *Standard for Pollution Control on the Storage and Disposal Site for General Industrial Solid Wastes* (GB18599 - 2001).
3 Process Flows and Current Status of Environmental Protection

3.1 Geological Location

The project locates 2Km away from the county town in the northeast of the plant site at Shangcheng and on the first terrace on the north bank of Niehe River. In its east, there is a large piece of first terrace to Yuci-Changzhi Highway and Mamu River. In its south, there is Niehe River, across which Yangcheng Village locates. In its west, there is a flat first terrace to hilly land and Xihedi Village. In its north, the northern plant boundary is 9m away from Nanling-Qinyuan Highway, from where Taiyuan-Jiaozuo Railway passes by 141m away in the north. At the northern plant boundary, the closest northeastern point is 30m away from Xiacheng Village, and the closest northwestern point is 161m away from Shangcheng Village. In the north of both villages, there is hilly land. The landform of the plant site is high in the north and low in the south, and high in the west and low in the east. Its elevation ranges from 948.1m to 939.3m.

The plant site at Shangcheng locates in an industrial zone in the county-level plan, so it conforms to the requirements of urban general plan and functional zoning. The project site does not belong to the acid rain control zone and SO2 control zone determined by the State Council.

The geological location of the plant site is shown in Fig. 3.1-1. The general layout of plant site and its relationship with external environmental are shown in Fig. 3.1-2.

This project employs the method of dry ash removing. According to relevant requirements in the Technical Code for Designing Fossil Fuel Power Plants and considering the plant site at Shangcheng, Wanghaigou Ash Yard 3Km away from the site in the south is selected. Changyugou Ash Yard 4Km away from the site in the south is taken as a standby ash yard.

(1) Wanghaigou Ash Yard has the lowly hilly landform, high in the south and low in the north on the whole. It is a valley ash yard with a deep bottom in the shape of “V”.

Wanghaigou Ash Yard has the original embankment elevation of 953.00m at the top and 963.00m at the bottom. The original embankment is 10m tall and the final
ash dump has the elevation of 1025.00m. Its total capacity is $2.165 \times 10^4$ m$^3$. Every year, the sum of ash removing capacity and desulfurization gypsum capacity is $1.239 \times 10^4$ m$^3$. The period of ash storage is around 17.47 years (The period of the selected ash yard in this project is calculated based on the sum of $1.185.5 \times 10^4$ t for the annual discharge of ash, slag and gypsum, converted to the volume of 123.9 m$^3$. The ash and slag are converted at the rate of 1t/m$^3$, while the gypsum is converted at the rate of 1.15t/m$^3$). Thus, it meets the requirement in the *Technical Code for Designing Fossil Fuel Power Plants*, which the selected ash yard should be capable to serve for around 20 years according to the planned capacity. When the ash dump reaches the elevation of 1010m, its storage capacity is $1.050 \times 10^4$ m$^3$ and it can receive ash for 8.47 years. Thus, it meets the requirement in the *Technical Code for Designing Fossil Fuel Power Plants*, which the initial acquired land of an ash yard should be capable to store the amount of ash and slag calculated according to the capacity in the current phase and the design type of coal for around 10 years.

(2) Changyugou Ash Yard has the lowly hilly landform, high in the south and low in the north on the whole. It is a valley ash yard with a deep bottom in the shape of “V”.

The geological locations of plant site and ash yards are shown in Fig. 3.1-1.

### 3.2 Project Overview

Wuxiang Hexin Thermal Power Generation Co., Ltd. plans the installed capacity of 4x300MW condensing coal-fired turbine generator units. In Phase I, two 600MW subcritical air cooling units are constructed with the total investment of RMB5.31 billion. Three main process equipments are manufactured by Wuhan Boiler Factory, Harbin Turbine Co., Ltd. and Harbin Electric Machinery.

In Phase I, the constructed boilers have the total evaporation capacity of 4160t/h. The construction of the thermal power plant was commenced in 2004 and entirely completed in January 2007. Two boilers share a reinforced concrete chimney with the opening diameter of 9m and the height of 240m.

The boilers are provided with 4 double-chamber 5-electric-field efficient electrostatic precipitators. The desulfurization of flue gas employs the limestone-gypsum wet process, and there are two towers for two boilers. The desulfurizing tower is a bubbling tower. Two Continuous Emission Monitoring Systems are provided for monitoring the flue gas emission. In September 2009, they
had been interconnected with the provincial and municipal environmental protection monitor centers. Meanwhile, their operators management was realized. For disposal of sewage and wastewater, three disposal plants are constructed. After being collected and treated in categories, sewage and wastewater is completely recycled so as to realize the zero discharge of wastewater. The boilers employ the louver structured horizontal rich/lean low-nitrogen coal burner to control the NOx within the standard range. The turbine employs the direct air cooling for the waste steam cooling, and the closed circulation water supply system for the cooling water of auxiliary machinery. The ash removing system employs the dry ash removing and dry ash storage, so as to save the water resource to the maximum.

The main equipments and environmental protection facilities of Wuxiang Hexin Thermal Power Generation Co., Ltd. are shown in Table 3.2-1.

3.3 Overview of Occupied Land

Table 3.3-1 lists the occupied land of Wuxiang Hexin Thermal Power Generation Co., Ltd.

Table 3.3-1 Occupied Land of Wuxiang Hexin Thermal Power Generation Co., Ltd.

<table>
<thead>
<tr>
<th>Name</th>
<th>Land Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant Site</td>
<td>50.5</td>
</tr>
<tr>
<td>Coal Yard</td>
<td>3</td>
</tr>
<tr>
<td>Ash Yard</td>
<td>74</td>
</tr>
</tbody>
</table>
Fig. 3.1-1 Geological Location of Plant Site and Ash Yard
Fig. 3.1-2 General Layout of Plant Site and Its Relationship with External Environment
### Table 3.2-1 Main Equipments and Environmental Protection Facilities

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>1#</th>
<th>2#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power and Operation Starting Date</td>
<td></td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>Date</td>
<td></td>
<td>Oct. 2006</td>
<td>Jan. 2007</td>
</tr>
<tr>
<td>Boiler Model</td>
<td></td>
<td>WGZ2080/17.51-1 subcritical, primary intermediate reheat, natural circulation boiler</td>
<td></td>
</tr>
<tr>
<td>Evaporation Capacity</td>
<td>t/h</td>
<td>2080</td>
<td></td>
</tr>
<tr>
<td>Turbine Model</td>
<td></td>
<td>NZK600-16.7/538/538</td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td></td>
<td>Subcritical, single-axle double-cylinder, double-flow, primary intermediate reheating and condensing</td>
<td></td>
</tr>
<tr>
<td>Power</td>
<td>MW</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>Generator Model</td>
<td></td>
<td>QFSN-600-2YHG</td>
<td></td>
</tr>
<tr>
<td>Cooling Mode</td>
<td></td>
<td>Water—Hydrogen—Hydrogen</td>
<td></td>
</tr>
<tr>
<td>Capacity</td>
<td>MW</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>Flue Gas Control Equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desulfurizing Device</td>
<td>Category</td>
<td>Limestone-gypsum wet desulfurization</td>
<td></td>
</tr>
<tr>
<td>Desulfurization Efficiency</td>
<td>%</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>Ash Removing Device</td>
<td>Category</td>
<td>Double-chamber 5-electric-field electrostatic precipitator</td>
<td></td>
</tr>
<tr>
<td>Ash Removing Efficiency</td>
<td>%</td>
<td>99.75</td>
<td></td>
</tr>
<tr>
<td>Chimney Code</td>
<td></td>
<td>Single chimney</td>
<td></td>
</tr>
<tr>
<td>Chimney Type</td>
<td></td>
<td>Reinforced concrete structure</td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>m</td>
<td>240</td>
<td></td>
</tr>
<tr>
<td>Opening Inner Diameter</td>
<td>m</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Cooling Mode</td>
<td>Type</td>
<td>Direct air cooling</td>
<td></td>
</tr>
<tr>
<td>Cooling Area</td>
<td>M²</td>
<td>1494898</td>
<td></td>
</tr>
<tr>
<td>Wastewater Disposal Mode</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial Wastewater</td>
<td>Reused for desulfurization or dry ash wetting after being processed in the industrial wastewater disposal plant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic Sewage</td>
<td>Sprayed in the coal yard after receiving the two-level biochemical treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coal-containing Wastewater</td>
<td>Used to flush conveyed coal after being settled and purified</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ash &amp; Slag Disposal Mode</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fly Ash</td>
<td>Discharged into ash yard after pneumatic ash handling or put into comprehensive utilization after dry ash removing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slag</td>
<td>Transported with vehicle to ash yard or put into comprehensive utilization</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3.4 Layout Plan of Plant Site

From south to north, the plant site is composed of 220kV indoor power distribution equipment, natural ventilation and cooling tower, main building, railway and coal yard. The indoor power distribution equipment is placed on the southernmost
terrace of the plant site and led southward. The layout plan of plant site is detailed in Fig. 3.4-1.
Fig. 3.4-1 Layout Plan of Plant Site
3.5 Energy and Raw Materials

3.5.1 Consumption of Main Energy and Raw Materials in Power Plant

The consumptions of main energy and raw materials in Wuxiang Hexin Thermal Power Generation Co., Ltd. from 2008 to 2010 are shown in Table 3.5-1. The properties of main energy and raw materials are shown in Table 3.5-2.

**Table 3.5-1 Consumptions of Main Energy and Raw Materials from 2008 to 2010**

<table>
<thead>
<tr>
<th>Main Raw and Auxiliary Materials and Energy</th>
<th>Annual Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Year of 2008</td>
</tr>
<tr>
<td>Coal</td>
<td>299.44</td>
</tr>
<tr>
<td>Water</td>
<td>2265</td>
</tr>
<tr>
<td>Electricity</td>
<td>51752</td>
</tr>
<tr>
<td>Diesel</td>
<td>1633</td>
</tr>
</tbody>
</table>

3.5.2 Coal

The consumed coal of the power plant is mainly supplied by local coal mines in Wuxiang and hauled to the plant with vehicle. The remaining part is transported to the plant by train.

The quality of coal actually fired by Wuxiang Hexin Thermal Power Generation Co., Ltd. from 2008 to 2010 is sulfur content 0.9-2.8% and ash content 30-45%. The industrial analysis of average coal quality is shown in Table 3.5-3.

**Table 3.5-3 Average Coal Quality Analysis from 2008 to 2010**

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture trap</td>
<td>Mt</td>
<td>%</td>
<td>5.6</td>
</tr>
<tr>
<td>Ash content as received</td>
<td>A$_{ar}$</td>
<td>%</td>
<td>35.5</td>
</tr>
<tr>
<td>Dry ash-free basis Volatile Matter</td>
<td>V$_{daf}$</td>
<td>%</td>
<td>16.4</td>
</tr>
<tr>
<td>Net calorific value as received</td>
<td>Q$_{net.ar}$</td>
<td>kJ/kg</td>
<td>19152</td>
</tr>
<tr>
<td>Sulfur content</td>
<td>s</td>
<td>%</td>
<td>1.46</td>
</tr>
</tbody>
</table>

3.5.3 Limestone

The power plant employs the limestone-gypsum wet desulfurization process. The desulfurizing agent is limestone. Two units have the limestone consumption of
160,000t/a, which is supplied by Quanxin Company.

### 3.5.4 Water Consumption

The makeup water in this project is supplied by Wuxiang Guanghe Reservoir and Wuxiang Sewage Disposal Plant. The consumption of fresh water is $350 \text{m}^3/\text{h}$. Table 3.5-4 presents the water consumption in the power plant. Table 3.5-1 presents the water balance chart of power plant.
Table 3.5-2 Schedule of Various Properties in Main Energy and Raw Materials of Wuxian Hexin Thermal Power Plant

<table>
<thead>
<tr>
<th>Item</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Coal</td>
</tr>
<tr>
<td>Material Function</td>
<td>Heat supply</td>
</tr>
<tr>
<td>Hazardous Content and Property</td>
<td>Sulfur</td>
</tr>
<tr>
<td>Active Ingredient and Property</td>
<td>Gaseous</td>
</tr>
<tr>
<td>Concentration of Hazardous Content</td>
<td>1.46%</td>
</tr>
<tr>
<td>Unit Price (RMB)</td>
<td>600</td>
</tr>
<tr>
<td>Mode of Transportation</td>
<td>Train, truck</td>
</tr>
<tr>
<td>Method of Storage</td>
<td>Coal yard</td>
</tr>
<tr>
<td>Storage Capacity (t)</td>
<td>50,000</td>
</tr>
<tr>
<td>Method of Internal Transportation</td>
<td>Belt</td>
</tr>
<tr>
<td>Material Function</td>
<td>Limestone</td>
</tr>
<tr>
<td>Hazardous Content and Property</td>
<td>None</td>
</tr>
<tr>
<td>Active Ingredient and Property</td>
<td>Solid</td>
</tr>
<tr>
<td>Concentration of Hazardous Content</td>
<td>—</td>
</tr>
<tr>
<td>Unit Price (RMB)</td>
<td>50</td>
</tr>
<tr>
<td>Mode of Transportation</td>
<td>Truck</td>
</tr>
<tr>
<td>Method of Storage</td>
<td>Limestone bin</td>
</tr>
<tr>
<td>Storage Capacity (t)</td>
<td>800</td>
</tr>
<tr>
<td>Method of Internal Transportation</td>
<td>Belt</td>
</tr>
<tr>
<td>Material Function</td>
<td>Diesel</td>
</tr>
<tr>
<td>Hazardous Content and Property</td>
<td>Flammable and</td>
</tr>
<tr>
<td>Active Ingredient and Property</td>
<td>explosive</td>
</tr>
<tr>
<td>Concentration of Hazardous Content</td>
<td>—</td>
</tr>
<tr>
<td>Unit Price (RMB)</td>
<td>4000</td>
</tr>
<tr>
<td>Mode of Transportation</td>
<td>Train</td>
</tr>
<tr>
<td>Method of Storage</td>
<td>Fuel tank</td>
</tr>
<tr>
<td>Storage Capacity (t)</td>
<td>80</td>
</tr>
<tr>
<td>Method of Internal Transportation</td>
<td>Pipe</td>
</tr>
<tr>
<td>Material Function</td>
<td>Water</td>
</tr>
<tr>
<td>Hazardous Content and Property</td>
<td>None</td>
</tr>
<tr>
<td>Active Ingredient and Property</td>
<td>Liquid</td>
</tr>
<tr>
<td>Concentration of Hazardous Content</td>
<td>—</td>
</tr>
<tr>
<td>Unit Price (RMB)</td>
<td>3</td>
</tr>
<tr>
<td>Mode of Transportation</td>
<td>Pipeline</td>
</tr>
<tr>
<td>Method of Storage</td>
<td>Pool</td>
</tr>
<tr>
<td>Storage Capacity (t)</td>
<td>80</td>
</tr>
<tr>
<td>Method of Internal Transportation</td>
<td>Pipe</td>
</tr>
<tr>
<td>Material Function</td>
<td>Hydrochloric Acid</td>
</tr>
<tr>
<td>Hazardous Content and Property</td>
<td>None</td>
</tr>
<tr>
<td>Active Ingredient and Property</td>
<td>Liquid</td>
</tr>
<tr>
<td>Concentration of Hazardous Content</td>
<td>31%</td>
</tr>
<tr>
<td>Unit Price (RMB)</td>
<td>650</td>
</tr>
<tr>
<td>Mode of Transportation</td>
<td>Tanker</td>
</tr>
<tr>
<td>Method of Storage</td>
<td>Acid tank</td>
</tr>
<tr>
<td>Storage Capacity (t)</td>
<td>900</td>
</tr>
<tr>
<td>Method of Internal Transportation</td>
<td>Pipe</td>
</tr>
<tr>
<td>Material Function</td>
<td>Liquid Caustic Soda</td>
</tr>
<tr>
<td>Hazardous Content and Property</td>
<td>Acide</td>
</tr>
<tr>
<td>Active Ingredient and Property</td>
<td>Liquid</td>
</tr>
<tr>
<td>Concentration of Hazardous Content</td>
<td>40%</td>
</tr>
<tr>
<td>Unit Price (RMB)</td>
<td>900</td>
</tr>
<tr>
<td>Mode of Transportation</td>
<td>Tanker</td>
</tr>
<tr>
<td>Method of Storage</td>
<td>Alkali tank</td>
</tr>
<tr>
<td>Storage Capacity (t)</td>
<td>30000</td>
</tr>
<tr>
<td>Method of Internal Transportation</td>
<td>Pipe</td>
</tr>
<tr>
<td>Material Function</td>
<td>Diamine</td>
</tr>
<tr>
<td>Hazardous Content and Property</td>
<td>None</td>
</tr>
<tr>
<td>Active Ingredient and Property</td>
<td>Liquid</td>
</tr>
<tr>
<td>Concentration of Hazardous Content</td>
<td>40%</td>
</tr>
<tr>
<td>Unit Price (RMB)</td>
<td>780</td>
</tr>
<tr>
<td>Mode of Transportation</td>
<td>Tanker</td>
</tr>
<tr>
<td>Method of Storage</td>
<td>Acid tank</td>
</tr>
<tr>
<td>Storage Capacity (t)</td>
<td>98%</td>
</tr>
<tr>
<td>Method of Internal Transportation</td>
<td>Pipe</td>
</tr>
</tbody>
</table>

Fig. 3.5-1 Water Balance Chart of Power Plant
Guanhe Reservoir Pumping House

Makeup Water Pretreatment Station

Guancheng Water Works Sprayed in Coal Yard

Water Balance Chart of Wuxiang Thermal Power Plant from January to June in 2007
### Table 3.5-4 Water Consumption of Power Plant

<table>
<thead>
<tr>
<th>Type of Water Source</th>
<th>Usage</th>
<th>Unit</th>
<th>Auxiliary Circulating Water Consumption</th>
<th>Makeup Fresh Water Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Water</td>
<td>Cooling Water</td>
<td>m³/h</td>
<td>4000</td>
<td>1579</td>
</tr>
<tr>
<td></td>
<td>Boiler Makeup Water</td>
<td></td>
<td></td>
<td>194</td>
</tr>
<tr>
<td></td>
<td>Industrial Water</td>
<td>m³/h</td>
<td></td>
<td>1303</td>
</tr>
<tr>
<td></td>
<td>Domestic Water</td>
<td>m³/h</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>m³/h</td>
<td>4000</td>
<td>350</td>
</tr>
</tbody>
</table>

The industrial wastewater, coal-containing wastewater and domestic sewage of power plant are processed respectively in the industrial wastewater treatment station, coal-containing wastewater treatment station and domestic sewage treatment station respectively, and then reused in the coal conveying system, for spraying in coal yard and as desulfurization water. The wastewater is completely reused after being processed, and not discharged.

### 3.6 Ash & Slag Disposal Mode and Overview of Ash Yard

This project employs the positive pressure dense pneumatic conveying system. To be specific, an ash conveyor is placed under each ash hopper in the ash collector. The ash discharged from ash hopper is conveyed by ash conveyor through pipeline to ash silos. There are three ash silos, of which two are coarse ash silo and one is fine ash silo. Each silo has the capacity of 2280m³ and the diameter of 15m. The ash from the electric field 1# in the ash collector is discharged into coarse ash silos, while the ash from the electric fields 2#, 3#, 4# and 5# is discharged into fine ash silo. The total capacity of two coarse ash silos can be sufficient to receive the ash discharged from 2×600MW boilers under full load with designed type of coal for firing for around 36 hours. Under the ash silos, there are two facilities for preparing wet ash and dry ash loading. When it is necessary to take dry ash for comprehensive utilization, dry ash can be directly loaded into tankers under ash silos, while the remaining ash is wetted in a blender by water spraying and then hauled with dump truck to ash yard.
3.6.1 Slag Removing System

It is planned to provide a scraper slag salvaging machine for each boiler, which discharges slag from one side. The slag discharged from boiler is fetched by scraper slag salvaging machine and dewatered at its ramp dewatering section. After that, the slag is directly discharged into a slag crusher outside the boiler house for crushing, and then sent into a bucket conveyer, which vertically conveys the slag into a slag silo. A slag silo is provided for each boiler, and its effective volume is 220m³. A slag silo can store the slag from a boiler under full load with the designed type of coal for firing for around 31 hours. Under the slag silo, the slag is loaded into dump truck and hauled to ash yard or for comprehensive utilization.

The annual ash & slag production of power plant from 2008 to 2010 is shown in Table 3.6-1. The geological location of ash yard is presented in Fig. 3.1-1.

Table 3.6-1 Schedule of Ash and Slag Generated by Power Plant from 2008 to 2010

<table>
<thead>
<tr>
<th>Year</th>
<th>Dust Removing Ash Generation (10,000t/a)</th>
<th>Boiler Slag Generation (10,000t/a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>98</td>
<td>9.8</td>
</tr>
<tr>
<td>2009</td>
<td>102</td>
<td>10.2</td>
</tr>
<tr>
<td>2010</td>
<td>105</td>
<td>10.5</td>
</tr>
</tbody>
</table>

3.7 Process Flow and Pollutant Disposal of Power Plant

Wuxiang Hexin Thermal Power Generation Co., Ltd. employs the pulverized coal fired boiler for coal-fired power generation. Its process flow is as follows: feed pulverized fuel and hot air into boiler for combustion, convert chemical energy into heat energy, heat the processed water into high-temperature and high-pressure steam that expands inside turbine to convert heat energy into mechanical energy, and the turbine drives the generator to generate the electric power, so as to convert mechanical energy into electric energy. Fig. 3.7-1 shows the schematic diagram of process flow of the power plant.

The process flow is roughly divided into: fuel conveying system, firing system, ash & slag removing system, chemical water treatment system, water supply &
drainage system, heat system, electrical system, dust removing in flue gas, desulfurizing and cooling system. The main pollutants generated include waste gas, wastewater, ash & slag and noise. The specific measures for pollution prevention and control are detailed in Chapter III. The pollutant discharge is shown in Fig. 3.7-2.
Fig. 3.7-1 Schematic Diagram of Process Flow of Power Plant
Fig. 3.7-2 Schematic Diagram of Pollutant Discharge of Power Plant
4 Discharge, Prevention and Control Measures for Main Pollutants of Power Plant

4.1 Discharge, Prevention and Control Measures Atmospheric Pollutant

4.1.1 Boiler Flue Gas

4.1.1.1 Dust Removing and Ash Removing System

The boilers are equipped with 4 double-chamber 5-electric-field electrostatic precipitators with the design dust removing capacity of 99.75%. The dry ash removing and wet slag removing methods are employed for boilers. The dry ash and slag are hauled with special vehicles to dry ash yard for storage. The ash yard has the designed storage period of 18 years.

4.1.1.2 Flue Gas Desulfurizing System

The flue gas desulfurizing system employs the limestone-gypsum wet desulfurization process. There are two boilers and two towers. The bubble desulfurizing tower is adopted to improve the effect of desulfurization. The designed desulfurization efficiency is 95%. It is designed by China BoQi Environmental Solutions Technology (Holding) Co., Ltd. The main equipments in the desulfurizing system include boater, ball mill slurry maker, flue gas cooler, flue gas cooling pump, and dewatering system, etc. The desulfurizing agent is local limestone. The gypsum, a byproduct of desulfurization is transported with special vehicle to ash yard for storage.

4.1.1.3 Continuous Emission Monitoring Systems

Two sets of continuous emission monitoring systems were constructed and installed to monitor the emission of soot, SO2, NOX, 02 and flue gas in a real-time manner. According to the unified requirements of provincial and municipal environmental protection departments, the continuous online flue gas monitoring devices were put into province-wide networking operation and operators management in July 2009.

4.1.1.4 NOx Reduction Device

The company’s fired coal has the dry ash-free basis volatile matter of 17.5%.
According to the period III standard in GB13223—2003, the emission concentration limit of nitrogen oxide is 650mg / m³. In order to guarantee the realization of standard limit, the rich/lean separation low-nitrogen combustion technology is employed for boilers to control the emission concentration of \( \text{NO}_x \) within 650mg / m³.

4.1.1.5 Sewage and Wastewater Treatment and Reuse Facilities

The project employs the surface water of Guanhe Reservoir as its main water source. In order to save water and realize zero discharge of wastewater, it is equipped with industrial wastewater treatment system, coal-containing wastewater treatment system and domestic sewage treatment and reuse system. The wastewater is classified, collected and processed, and then reused according to their categories, and it is not discharged.

(1) Domestic Sewage Treatment System

Domestic sewage is collected into independent domestic sewage pipe network, and then enters the domestic sewage treatment system for two-level biochemical treatment. After it meets the standard through biochemical treatment, the sewage is sprayed in the coal yard or used for greening at the plant site.

(2) Industrial Wastewater Treatment System

The industrial wastewater treatment system can be classified into the treatment system for common wastewater containing suspended substance or petroleum and the treatment system for acid-alkali wastewater in terms of water quality. After being collected into the water collecting pipeline, the wastewater is directed to the lift pump sump at industrial wastewater treatment station, and regulated in the wastewater regulation tank. After being processed in the flotation, settlement and filtration techniques, it is used to wet dry ash or as desulfurization water.

(3) Coal-containing Wastewater Treatment System

The flushing water on the ground of coal conveying system is boosted by self-control self-priming pump in each collection sump. Through the “relay conveying” pipes, the coal-containing wastewater is conveyed to the
coal-containing wastewater treatment station. After being processed in settlement and filtration, it is reused for the coal supply and conveying system.

Industrial wastewater treatment station is equipped with sludge thickening tank and receives the sludge water from makeup water pretreatment workshop, domestic sewage treatment station and coal-containing wastewater treatment workshop. The clean water is recycled, while the sludge is dewatered by sludge dewatering equipment and then made into mud cakes for transport outward. The sludge is hauled by special vehicle in accordance with relevant regulations to the designated place for storage.

The project employed the aforesaid wastewater and sewage treatment. After the units were put into production, it carried out a series of water conservation restructuring, so as to guarantee the “zero” discharge of wastewater and save water resource to the maximum. In the original design, the water consumption was 0.15 m$^3$/s, equivalent to 0.125 m$^3$/s for a 1000MW unit. The actual water consumption was 350t/h, reaching the advanced level among the similar plants in China.

(4) Sewage Disposal Plant

The sewage disposal project in Wuxiang County is an auxiliary urban construction project set up and approved by Wuxiang County Government. It is invested, constructed, operated and managed by Wuxiang Hexin Thermal Power Generation Co., Ltd. with the designed daily urban sewage treatment capacity of 8000t/d. It sends the deeply processed normal water to the power plant as makeup water and desulfurization water. In the past two years, its capacity had basically reached the designed level, and its processed water quality had completely met the national discharge standard, so its acceptable discharge percentage was 100%.

The acceptable sewage treatment and discharge in the past two years are shown in the following table.

<table>
<thead>
<tr>
<th>Year</th>
<th>Treatment Amount (10,000t)</th>
<th>Reuse Amount (10,000t)</th>
<th>Acceptable Discharge (10,000t)</th>
<th>Acceptable Discharge Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>133.6</td>
<td>18.7</td>
<td>111.4</td>
<td>100</td>
</tr>
<tr>
<td>2010</td>
<td>159.6</td>
<td>49.5</td>
<td>93.2</td>
<td>100</td>
</tr>
</tbody>
</table>
The process flow chart of desulfurization is shown in Fig. 4.1-1.

**Fig. 4.1-1 Schematic Diagram of Desulfurization Process Flow**

### 4.1.1.6 Monitoring Results of Boiler Flue gas

In September 2007, State Environmental Protection Administration entrusted Shanxi Environment Monitoring Central Station to monitor the boiler flue gas in the
power plant (Table 4.1-1). As shown in the monitoring results, the emission concentrations of soot, \( \text{SO}_2 \) and \( \text{NO}_x \) from two boilers met the requirements of Period III in the *Emission Standard of Air Pollutants for Thermal Power Plants* (GB13223-2003). (According to the reply on environmental impact assessment, the air pollutant emission followed the requirements of Period III in the *Emission Standard of Air Pollutants for Thermal Power Plants* (GB13223-2003). There were mistakes in the standard GB18918-2002 before amendment.)

**Table 4.1-1 Schedule of Actual Emission from Waste Gas Sources in Wuxiang Thermal Power Plant**

<table>
<thead>
<tr>
<th>Plant Source</th>
<th>Environmental Protection Facility</th>
<th>Number of Exhaust Funnels</th>
<th>Operating Hours (h/a)</th>
<th>Waste Gas Emission</th>
<th>Emission Rate (kg/h)</th>
<th>Annual Emission (t/a)</th>
<th>Whether to Meet the Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Boiler</td>
<td>Electrostatic Precipitator (ESP)</td>
<td>1</td>
<td>6500</td>
<td>1806305</td>
<td>0.184</td>
<td>--</td>
<td>Yes</td>
</tr>
<tr>
<td>2nd Boiler</td>
<td>ESP</td>
<td>1</td>
<td>6500</td>
<td>106522</td>
<td>0.184</td>
<td>--</td>
<td>Yes</td>
</tr>
<tr>
<td>Transfer Station</td>
<td>DSX-13 Wet Dust Collector</td>
<td>6</td>
<td>5600</td>
<td>7985</td>
<td>0.099</td>
<td>--</td>
<td>Yes</td>
</tr>
<tr>
<td>Coal Pulverizer Room</td>
<td>DSX-14 Wet Dust Collector</td>
<td>1</td>
<td>5600</td>
<td>8396</td>
<td>0.204</td>
<td>--</td>
<td>Yes</td>
</tr>
<tr>
<td>Top of Coal Silo</td>
<td>JMC-100-B Pulse Cloth-Bag Dust Collector</td>
<td>5</td>
<td>5600</td>
<td>9884</td>
<td>0.191</td>
<td>--</td>
<td>Yes</td>
</tr>
<tr>
<td>Roof of Ash Warehouse</td>
<td>DMC-108(II) Pulse Cloth-Bag Dust Collector</td>
<td>2</td>
<td>8100</td>
<td>10022</td>
<td>0.122</td>
<td>--</td>
<td>Yes</td>
</tr>
<tr>
<td>Limestone Dump</td>
<td>DMC-160B-XT Bag-type Dust Collector</td>
<td>1</td>
<td>1600</td>
<td>18662</td>
<td>0.540</td>
<td>--</td>
<td>No</td>
</tr>
<tr>
<td>Limestone Silo</td>
<td>JBC-32 Bag-type Dust Collector</td>
<td>1</td>
<td>3500</td>
<td>4174</td>
<td>0.121</td>
<td>--</td>
<td>Yes</td>
</tr>
<tr>
<td>Total Emission</td>
<td></td>
<td>32</td>
<td>370192</td>
<td>238130</td>
<td>1440</td>
<td>9305</td>
<td>--</td>
</tr>
<tr>
<td>Emission When Meeting the Standard</td>
<td></td>
<td></td>
<td>388330</td>
<td>2380144</td>
<td>1435</td>
<td>926</td>
<td>--</td>
</tr>
<tr>
<td>Acceptable Emission Standard (%)</td>
<td></td>
<td></td>
<td>99.9</td>
<td>99.7</td>
<td>100</td>
<td>99.9</td>
<td>--</td>
</tr>
</tbody>
</table>

Note: In the limestone dump, DMC-160B-XT bag-type dust collector had the
emission that did not meet the standard, but the alleviation measure had been listed in the “Table of Main Environmental Impacts and Alleviation Measures” in the environmental management plan.

4.1.2 Dust Pollution Prevention and Control Measures

The existing dust prevention and control projects for the project mainly include the coal yard, coal conveying system, ash & slag removing system and desulfurizing system, etc. The coal yard is provided with the wind-proof and dust suppressing wall. In order to reduce the pollution of raised dust in the coal yard in the ambient environment, the power plant erected the wind-proof and dust suppressing wall around the coal yard in May 2007, and provided the spraying facilities. In this way, it could reduce the raised dust in the coal yard by more than 70%. At the roof of fly ash yard, the bag-type dust collector is provided. The bag-type dust collector is employed to eliminate the dust for the belt in the coal conveying room of main building and the raw coal hopper between coal silos. The coal conveying bridge employs wet dust collector, while the limestone powder silo is provided with bag-type dust collector. When hauling coal, the enclosed vehicle or the vehicle with roof covered by cloth is employed to prevent raised dust during transport.

4.1.3 Total Emission of Air Pollutants

The total emission of pollutants in the boiler flue gas of Wuxiang Hexin Thermal Power Generation Co., Ltd. from 2008 to 2010 met Changzhi City’s requirements of total amount control. It is specified in Table 4.1-2.

Table 4.1-2 Total Emission of Main Pollutants from Wuxiang Hexin Thermal Power Generation Co., Ltd. from 2008 to 2010 (t/a)

<table>
<thead>
<tr>
<th>Year</th>
<th>Pollutant</th>
<th>SO₂</th>
<th>NO₂</th>
<th>Soot</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>Annual Emission</td>
<td>5300</td>
<td>8600</td>
<td>1200</td>
</tr>
<tr>
<td></td>
<td>Total Amount Control</td>
<td>8000</td>
<td>—</td>
<td>1600</td>
</tr>
<tr>
<td>2009</td>
<td>Annual Emission</td>
<td>5600</td>
<td>8600</td>
<td>1500</td>
</tr>
<tr>
<td></td>
<td>Total Amount Control</td>
<td>8000</td>
<td>—</td>
<td>1600</td>
</tr>
<tr>
<td>2010</td>
<td>Annual Emission</td>
<td>6500</td>
<td>8600</td>
<td>1600</td>
</tr>
<tr>
<td></td>
<td>Total Amount Control</td>
<td>7500</td>
<td>—</td>
<td>1600</td>
</tr>
</tbody>
</table>
4.1.4 Problems in Existing Air Pollution Prevention and Control Measures and Their Solutions

Since its two units were put into production in 2007, Wuxiang Hexin Thermal Power Generation Co., Ltd. has been strictly implemented national and local laws and regulations of environmental protection. Although all its environmental protection facilities have been completely put into operation, its emission of pollutants has met the standard. Among these pollutants, the average emission concentration of sulfur dioxide, which is a major index of national assessment, is 210-230mg/m³ (for which the national standard of 400mg/m³ is followed), so its total emission is lower than the total amount control index of 8000t/a. Moreover, its wastewater monitoring percentage, treatment percentage and reuse percentage reach 100%, and it realizes zero discharge of wastewater. The noise monitoring pass rate is 100%. Thus, it fulfills the total amount control target of pollutants and makes contributions to improving local environment. The acceptable emission of main pollutants from 2009 to 2010 is shown in the following table:

<table>
<thead>
<tr>
<th>Year</th>
<th>SO₂</th>
<th>Soot</th>
<th>Wastewater</th>
<th>Noise</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Emission Concentration (mg/m³)</td>
<td>Acceptable Emission Percentage (%)</td>
<td>Emission Concentration (mg/m³)</td>
<td>Acceptable Emission Percentage (%)</td>
</tr>
<tr>
<td>2009</td>
<td>220</td>
<td>100</td>
<td>46</td>
<td>100</td>
</tr>
<tr>
<td>2010</td>
<td>210</td>
<td>100</td>
<td>45</td>
<td>100</td>
</tr>
</tbody>
</table>

The year of 2011 is the first year in China’s Twelfth Five-year Plan. As the new and more strict standard for flue gas emission of thermal power plants is about to be promulgated and enforced in China, Wuxiang Hexin Thermal Power Generation Co., Ltd. plans to construct the flue gas denitrification facility and flue gas demercuration facility during the period of Twelfth Five-year Plan. Meanwhile,
it will restructure the existing desulfurizing facility, further improve the desulfurization serviceability and efficiency, and considerably reduce the emission of pollutants. So far, the company is working on the plan and will implement it when it is finalized.

(1) Mercury Emission

The main pollutants of smoke and gas emission comprise SO2, NOX, PM, CO and CO2, as well as a small amount of heavy metal, such as mercury (Hg), which has the significant adverse effect on the environment. Currently, Chinese Government has attached great importance to the control of mercury pollution. In 2009, the State Council printed and issued *Guiding Suggestions on Strengthening Prevention and Control of Heavy Metal* and has listed the mercury as the key control pollutant. In May 2010, the State Council further published The Guiding Suggestions on Promoting Joint Prevention and Control of Air Pollution and Improving Regional Air Quality, putting forward the joint control demonstration projects of sulfur, nitrification, dust and mercury for coal-fired generating units. On December 3, 2010, the Office of the Ministry of Environmental Protection issued the *Letter on Recommending Pilot Coal-fired Power Plants to Implement Mercury Pollution Control (EP [2010]1314)*, indicating the start-up of mercury removal project in China. In the General Planning on Prevention and Control of Heavy Metal that is submitted to State Council for Approval and the 12th *FYP Planning on Joint Prevention and Control of Air Pollution in Key Regions* that is being prepared, the control of pollutant emission is stipulated.

In 2009, the special fund for public welfare industry of the Ministry of Environmental Protection has been allocated to carry out the studies on emission reduction trend of harmful pollutants including mercury, as well as mercury pollutants list and its countermeasures, and a certain achievements have been obtained so as to supply the technical support for further mercury pollution control in coal-fired power plants.

On November 11, 2010, under the requirement of the Ministry of Environmental Protection, Shanxi Environmental Protection Bureau issued *The Notification on*
Implementing Mercury Pollution Control Pilot Work in Coal-fired Power Plants (Shanxi EP [2010] 383), and Wuxiang Hexin Power Plant was selected as pilot plant to implement mercury pollution control. In October 2011, the Mercury Continuous Emission Monitoring System (CEMS) will be installed in the plant so as to obtain the first-hand information on the emission concentration of mercury and to determine whether to install mercury removal device or not. In accordance with air emission standard for coal-fired power plants, the mercury emission standard is 0.3mg/m³. The existing pollution control facilities (ESP+WFGD), in addition to denitrification facilities (SCR) those will be installed in 2012 shall meet the aforesaid emission standard.

During March 22 and 23, 2011, the Ministry of Environmental Protection organized the training class on atmospheric mercury pollution prevention and control technology in Beijing.


The pollution control facilities those are widely used in coal-fired plants such as EPS, WFGD, in addition to SCR that will be promoted during 12th FYP will increase mercury removal efficiency to more than 70%. After the installation of denitrification facilities in 2012, the mercury removal efficiency will be further enhanced.

(2) Energy Efficiency and Greenhouse Gas Emission

The emission of greenhouse gas (CO2) mainly depends on fuel types and efficiency of generating units; for the coal-fired power plants, it mainly depends on the efficiency of generating units. During recent years, Wuxiang Hexin Power Plant has adopted the following measures to improve the efficiency of generating units:

a. In August 2009, B-level overhaul was carried out in #1 generating unit, and the turbine’s efficiency was enhanced. After the overhaul, the heat consumption was lowered by 120KJ/KWh, amounting to 27KJ/KWh for annual heat consumption reduction.
b. In 2010, the internal leakage of valves for #1 and #2 generating units was solved; the logic of air-cooling and antifreeze was optimized; the seals of air preheaters were replaced; the sealing air of coal pulverizers and air ducts of boilers were retrofitted.

c. In August 2011, the A-level overhaul will be implemented in #2 generating unit and it will be completed in October. It is estimated that the heat consumption be lowered by 200KJ/KWh, amounting to 27KJ/KWh for annual heat consumption reduction. By then, the peaking cooling project for #2 generating unit will be also completed.

d. In 2012, the peaking cooling system for #1 and #2 generating units will be put into operation; by then, the annual heat consumption will be reduced by 88KJ/KWh.

e. In 2013, the routine repair will be carried out in #1 and #2 generating units, which has a minor impact on the efficiency of generating units.

The peaking cooling system that will be put into operation in 2012 will further improve generating efficiency.

Through the implementation of aforesaid measures, the coal consumption of generating units will be lowered to 343g/KWh in 2012 from 363g/KWh in 2007; the efficiency of generating units will be increased to 39.9% from 39.2%; the emission of greenhouse gas will be lowered to 780kg/Mwh from 830kg/Mwh. After the operation of peaking cooling system in 2012, annually 13,000 tons of coal equivalent will be saved and 31,000 tons of greenhouse gas will be reduced.

(3) NOx Emission

The designed fired coal of Wuxiang Power Plant is lean coal, the volatile of which is 17.5%. Its emission concentration shall not exceed the maximum emission concentration- 650mg/m³ at the time III stipulated in *Emission Standard of Air Pollutants for Thermal Power Plants* (GB13223-2003).

The boiler adopts rich/lean separation shutter low nitrogen burner, which could control the concentration of NOx within the qualified range.

According to 12th FYP planning, the SCR shall be installed in existing coal-fired power plants. Currently, the company has started the prophase design and by then
the emission concentration of NOx shall be lowered than 100mg/m³.

4.2 Main Wastewater Pollution Sources and Prevention and Control Facilities

This project takes water from Guanhe Reservoir at the volume of 358 m³/h and its annual water consumption is 3.13 million tons. The water consumed in this project is mainly used to make up the circulating cooling water for auxiliary machinery. The circulating water consumption is 5761m³/h, and its circulating utilization is 93.8%. The consumption of fresh water is 358m³/h. After being processed, all production wastewater and domestic sewage is reused and not discharged. The water balance chart is shown in Table 3.5-1.

The plant site is provided with industrial wastewater treatment station, domestic sewage treatment station and coal-containing wastewater treatment station. After be classified, the wastewater from the plant site is sent to corresponding wastewater treatment systems for treatment. The processed wastewater is conveyed to clean water pond for reuse. After being processed separately, the desulfurization wastewater is directly used for wetting dry ash. The chemical acid-alkali wastewater is sent to neutralization tank and then conveyed to the front bank of industrial wastewater treatment station. After being processed, it is discharged into the clean water pond for reuse. No wastewater from the power plant is discharged. The process flow of each wastewater treatment station is presented as follows:

(1) Domestic Wastewater

After being collected in an independent domestic sewage pipe network, the domestic sewage enters into the domestic sewage treatment system for two-level biochemical treatment. After the biochemically treated sewage meets the standard, it is used to spray the coal yard and as the greening water in the plant site.

The domestic water consumption of the plant site is 11m³/h. Besides the sporadic consumption of around 10%, 90% of the domestic sewage (10 m³/h) is collected and conveyed through pipeline to sewage treatment facility for two-level biochemical treatment. The treatment process flow of domestic sewage is shown in Fig. 4.2-1.
Fig. 4.2-1 Two-level Biological Contact Oxidation Process Flow of Domestic Sewage

(2) Industrial Wastewater

The industrial wastewater treatment system collects the common wastewater in the main building, including the overflow water from scraper slag salvaging machine, the ground flushing water, the resin-containing water from condensed water fine treatment, the discharged circulating cooling water, and the discharged wastewater in ditches and catch pits, etc. After being collected into the collective pipe system, the wastewater is sent to the lift pump sump at industrial wastewater treatment station, and regulated in the wastewater regulation tank. After being processed in the flotation, settlement and filtration techniques, it is used to as desulfurization water. The treatment process flow of industrial wastewater is shown in Fig. 4.2-2.
Fig. 4.2-2 Process Flow Chart of Industrial Wastewater Treatment System

(3) Coal-containing Wastewater

The flushing water on the ground of coal conveying system is boosted by self-control self-priming pump in each collection sump. Through the “relay conveying” pipes, the coal-containing wastewater is conveyed to the regulation and preliminary sedimentation tank at coal-containing wastewater treatment station. After being processed in the sedimentation and filtration techniques, it is supplied to the coal conveying system for reuse. The treatment process flow of coal-containing wastewater is shown in Fig. 4.2-3.

![Fig. 4.2-3 Process Flow of Coal-containing Wastewater Treatment System](image)

Fig. 4.2-3 Process Flow of Coal-containing Wastewater Treatment System

(4) Desulfurization Wastewater

The desulfurization wastewater is separately processed in the desulfurization system, and its process flow is shown in Fig. 4.2-4.

![Fig. 4.2-4 Process Flow Chart of Desulfurization Wastewater Processing System](image)

Fig. 4.2-4 Process Flow Chart of Desulfurization Wastewater Processing System

(5) Chemical Acid-alkali Wastewater

The chemical acid-alkali wastewater generated in the resin regeneration process of anion cation exchange enters the neutralization tank and then the front tank of industrial wastewater treatment station. After being processed, it is discharged into clean water pond for reuse. The treatment process flow is shown in Fig. 4.2-5.
4.3 Noise Prevention and Control Measures

The main noise sources in this project include large equipments in main building, e.g. turbine generator units, coal pulverizers, blowers and water feed pumps, etc.; the steam discharge of boilers; and other large equipments outside main building, e.g. air cooling fans, ID fans and large water pumps, etc.

As for noise prevention and control in this project, the measures are taken from the approaches of noise source, noise transmission route and party affected by noise to prevent and reduce noise. Firstly, the noise sources are controlled. Secondly, effective control measures of damping, vibration reduction, sound insulation, noise elimination and sound absorption, etc. are taken. In addition, Wuxiang Thermal Power Plant, during its actual construction, follows the proposals in the environmental impact assessment to move the auxiliary cooling tower, which is the major noise source and located in the northern side of the power plant (near Xiacheng Village), more than 200m southward, in order to reduce the effect of noise on Xiacheng Village.

Meanwhile, the air cooling fans employ the advanced “Balcke-Durr” adjustable low-noise vane produced in German.

The prevention and control measures of main noise sources in this project are shown in Table 4.3-1.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Noise Level dB(A)</th>
<th>Prevention and Control Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiler Body</td>
<td>85</td>
<td>Foundation vibration reduction</td>
</tr>
<tr>
<td>Turbine</td>
<td>98</td>
<td>Provision of radiator case, lined acoustical board, foundation vibration reduction</td>
</tr>
<tr>
<td>Generator</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Air Compressor</td>
<td>85</td>
<td>Installation of muffler at inlet and outlet, sound absorbing material for wall surface, enclosed building</td>
</tr>
</tbody>
</table>
Boiler Exhaust Port | 110 | Installation of efficient muffler
|---|---|---
| ID Fan | 90 | Installation of muffler, construction of special fan house, foundation vibration reduction
| Blower | 85 | Foundation vibration reduction, enclosed building
| Pulverizer | 96 | Foundation vibration reduction, enclosed building
| Water Feed Pump | 85 | Foundation vibration reduction, enclosed house

4.4 Disposal Measures of Solid Wastes

(1) Disposal and Generation of Solid Wastes

The solid wastes discharged in this project mainly include fly ash, slag and desulfurization gypsum. Moreover, there is a little domestic garbage in the plant site. All these belong to common industrial solid wastes. The domestic garbage is collected at a designated point and timely cleaned off and sent to the urban domestic garbage dump.

This project employs the dry ash removing method that separates ash from slag. There are three ash silos, of which two are coarse ash silos and one is fine ash silo. Each silo has the volume of 2280m$^3$ and the diameter of 15m. A slag silo is provided for each boiler, and its effective volume is 220m$^3$. A proportion of ash and slag is directly loaded inside the plant for sale, while the remaining part is hauled with special vehicle to the ash yard for compaction and storage. After being put into two-level dewatering, the desulfurization gypsum is sent to the ash yard for piling separately.

The solid wastes of Wuxiang Hexin Thermal Power Generation Co., Ltd. mainly include fly ash, slag and desulfurization gypsum. From January to December 2007, its generation of fly ash was 950,000t in total, of which 600,000t was sold and the remaining was completely sent to the ash yard. The comprehensive utilization of fly ash was 63 %. Its generation of slag is 180,000t in total, of which 100,000t was hauled to the ash yard. Its generation of gypsum was 280,000t in total, of which 80,000t was sold and the remaining part was hauled to the ash yard for separate storage. Its generation of chemical station sludge and water treatment sludge were 10t and 300t respectively, which were totally sent to the urban domestic garbage dump. Its generation of waste thermal insulation material (asbestos) was 100kg, recycled by construction unit.
(2) Ash Yard

This project employs the method of dry ash removing. According to relevant requirements in the *Technical Code for Designing Fossil Fuel Power Plants* and considering the plant site at Shangcheng, Wanghaigou Ash Yard 3Km away from the site in the south is selected.

Wanghaigou Ash Yard has the lowly hilly landform, high in the south and low in the north on the whole. It is a valley ash yard with a deep bottom in the shape of “V”. The ash yard has the original embankment elevation of 953.00m at the top and 963.00m at the bottom. The original embankment is 10m tall and the final ash dump has the elevation of 1025.00m. Its total capacity is $2165 \times 10^4 \text{m}^3$. Every year, the sum of ash removing capacity and desulfurization gypsum capacity is $123.9 \times 10^4 \text{m}^3$. The period of ash storage is around 17.47 years. The main technical indicators of ash yard are shown in Table 4.4-1.

<table>
<thead>
<tr>
<th>Table 4.4-1 Technical Indicators of Ash Yard</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wanghaigou Ash Yard</strong></td>
</tr>
<tr>
<td>Bottom Elevation of Ash Yard (m)</td>
</tr>
<tr>
<td>Embankment Top Elevation (m)</td>
</tr>
<tr>
<td>Embankment Height (m)</td>
</tr>
<tr>
<td>Type of Embankment</td>
</tr>
<tr>
<td>Quantity of Work for Embankment Top</td>
</tr>
<tr>
<td>$(10^4 \text{m}^3)$</td>
</tr>
<tr>
<td>Volume $(10^4 \text{m}^3)$</td>
</tr>
<tr>
<td>Ash Storage Period (year)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Original Embankment</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Ash Storage Indicators</td>
</tr>
<tr>
<td>Embankment Top Elevation (m)</td>
</tr>
<tr>
<td>Volume $(10^4 \text{m}^3)$</td>
</tr>
<tr>
<td>Ash Storage Period (year)</td>
</tr>
<tr>
<td>Final Occupied Land Projection Area of Ash Yard $(10^4 \text{m}^2)$</td>
</tr>
<tr>
<td>Drainage Gallery Length (m)</td>
</tr>
<tr>
<td>Drainage Shaft Height (m)</td>
</tr>
<tr>
<td>Cut-off Ditch Length (km)</td>
</tr>
<tr>
<td>Surface Drain Channel Length (m)</td>
</tr>
<tr>
<td>Quantity of Work Flood Control Dam $(10^4 \text{m}^3)$</td>
</tr>
<tr>
<td>Distance from Plant Site (km)</td>
</tr>
<tr>
<td>Quantity of Work for Dry Ash Slop (final)</td>
</tr>
<tr>
<td>$$(10^4 \text{m}^3)$$</td>
</tr>
<tr>
<td>Building Area of Management Station $(\text{m}^2)$</td>
</tr>
</tbody>
</table>

Before putting into service, the ground of ash yard is leveled and compacted. Its bottom and slopes are covered with anti-seepage fabric. Dry ash is watered at the proportion of 15-30% before transport and then hauled with enclosed special vehicle to the ash yard. After it is unloaded at the designated place, it is timely leveled, watered and compacted. There is a flood-control dam in the upper reaches of the ash
yard. At the bottom of the flood-control dam, there are flood discharge pipes and rainwater collecting pipes and water seepage shafts. Around the ash yard and on both sides of ash conveying road, there are favorable artificial and natural vegetations and dense trees and flowers, which form a natural shelterbelt. The ash yard is provided with a management station and managed by special persons in a united manner. Moreover, it is equipped with spraying and compacting facilities and a complete set of management system.

**4.5 Summary**

(1) Wuxiang Thermal Power Plant attaches importance to environmental protection, works out corresponding environmental management systems, constructs various environmental protection facilities in quite a standardized manner, is well-equipped and in good operation, and arranges its waste gas exhaust funnels and waste water discharge opening in quite a standardized manner.

(2) Wuxiang Thermal Power Plant completely recycles its industrial wastewater and domestic sewage after treatment, so as to realize zero discharge of wastewater.

(3) Wuxiang Thermal Power Plant has 32 waste gas exhaust funnels. The waste gas emission from those acceptable funnels is 23.80144 billion m³/a, accounting for 99.9% of the total waste gas emission of 23.83130 billion m³/a. The flue gas (dust) emission acceptable is 929.6t/a, accounting for 99.9% of its total emission of 930.5t/a. The SO₂ emission acceptable is 5285t/a, accounting for 100% of its total emission of 5285t/a. The NOₓ emission acceptable is 8489t/a, accounting for 100% of its total emission of 8489t/a. Thus, Wuxiang Hexin Thermal Power Generation Co., Ltd. realizes the emission that meets the standard from the waste gas pollution sources.

(4) The rate of boundary noise up to standard at Wuxiang Thermal Power Plant is 100% in the day and 100% at night.

(5) Wuxiang Thermal Power Plant can reasonably dispose of its solid wastes basically in accordance with requirements.

(6) Wuxiang Thermal Power Plant has the flue gas (dust) emission of 930.5t/a and the SO₂ emission of 5285t/a, which both meet the total quantity indexes of
pollutant emission determined by the environmental protection departments.

**Recommendations**

(1) Strengthen the operation management of environmental protection facilities throughout the plant, guarantee the steady operation of environmental protection facilities and ensure the long-term and steady emission of various pollutants up to standard.

(2) Strengthen the management of industrial wastewater throughout the plant, improve the repetitive utilization of water and guarantee no discharge of wastewater.

(3) Strengthen the management of ash yard and avoid the secondary pollution of raised dust. Further strengthen the comprehensive development and utilization of fly ash and slag and improve the comprehensive utilization of solid wastes.
5. Environmental Management and Monitoring

Environmental management and environmental monitoring are important parts of enterprise management. To establish and perfect the environmental protection structure, strengthen the environmental management, carry out the in-plant environmental monitoring and supervision and include the environmental protection into production management, is of great significance to reducing an enterprise’s discharge of pollutants, facilitating its reasonably consumption and recycle of resources and enhance its economic benefits and environmental benefits.

Since Wuxiang Hexin Thermal Power Generation Co., Ltd. was put into production in 2007, it has formed a set of complete top-down environmental management system, worked out the Standards for Environmental Management, and realized a high level of environmental management. In order to facilitate the plant-wide environmental management, the environmental management in this energy conservation restructuring project is included and carried out in the effective environmental management system.

5.1 Environmental Management
5.1.1 Environmental Management Structure

The daily environmental management during operation is mainly responsible by Bureau of Environmental Protection of Changzhi City. Bureau of Environmental Protection of Changzhi City is responsible to implement the laws, regulations and standards of environmental protection, formulate the regulations and rules on environmental protection and supervise their implementation, learn about the environmental conditions of the project, set up the environmental quality control objectives convenient for appraisal, put forth the treatment measures, and report them to the superior environmental protection department and relevant departments. The specific tasks are performed by Wuxiang Hexin Thermal Power Generation Co., Ltd.
According to the requirements of environmental protection for power plant, the company has now established an environmental protection leading group with general manager as its group leader, deputy general manager as its deputy group leader, and persons in charge of relevant departments as its members. The office of environmental protection leading group is set up in the Safety, Health and Environmental Department. A three-level technical supervision network of plant, department and shift is established. Safety, Health and Environmental Department is the management department of plant-wide environmental protection technical supervision, and responsible to organize, implement and supervise the daily environmental management in the plant. The department is provided with 2 full-time environmental protection personnel. Each department is provided with part-time environmental protection personnel.

According to the requirements of Regulations on Environmental Monitoring and Management in Thermal Power Industry and Technical Code of Environmental Monitoring in Thermal Power Plants, Wuxiang Hexin Thermal Power Generation Co., Ltd. establishes an environmental monitoring station affiliated to the Power Generation Department. Technically, the station follows the order of superior environmental monitoring station. The station is equipped with 6 professional technicians of environmental protection and analytical chemistry, etc. of which 1 is the station head and 2 are monitoring personnel.
5.1.2 Specific Responsibilities and Powers

(1) General Manager: Be the top manager of the company’s environmental protection and fully in charge of the environmental protection throughout the plant. Undertake the tasks of environmental protection from the superior competent authorities and local governments, include them into the tenure objectives and the economic contracting, and perform them.

(2) Deputy General Manager: Be responsible for coordinating the relationships between environmental protection and production and construction, operation management and other relevant departments, review the annual plans and long-term plans of environmental protection, make decisions on the technical schemes of environmental treatment and their implementation measures, and handle serious environmental pollution events or disputes.

(3) Safety, Health and Environmental Department: Be responsible for the daily environmental protection supervision and management throughout the plant. Supervise the operation and monitoring of environmental protection facilities and organize the arrangement of in-plant “Environmental Protection Supervision Network” activities. Master the discharge of “three wastes” throughout the plant, put forth the environmental protection work plan, and well sum up the work of
environmental protection. Collect the data of environmental protection, well prepare the statistics and archives, periodically submit the environmental protection statements, and settle the payment of charges for disposing pollutants. Participate in the review of environmental protection design, the preliminary acceptance of environmental protection and the completion acceptance. Organize the investigation and analysis of in-plant environmental pollution accidents and the environmental quality assessment. Organize and promote the advanced experience and technologies of environmental protection.

(4) Environmental Monitoring Station: Be affiliated to the Power Generation Department, be responsible for the task of in-plant environmental monitoring, implement the *Technical Code of Environmental Monitoring in Thermal Power Plants*, and guarantee the quality of monitoring. When there is any abnormality in the measurement results, timely find out the reasons and timely report it to the superior. Sort out and analyze various monitoring data and establish the environmental monitoring archives. Strengthen the maintenance, care and inspection of environmental monitoring apparatuses and equipments, and guarantee the normal operation of monitoring. Participate in the investigation of environmental pollution events in the plant.

(5) Power Generation Department: Carefully perform the combustion investigation of boilers; be responsible for the operation of oil-containing wastewater treatment facilities to realize the discharge up to standard; be responsible to check the operation of equipment vibration and noise reduction devices and timely contact the relevant repair shop to solve any problems discovered; be responsible for the normal operation of desulfurizing system; and reasonably balance the water consumption and guarantee the 100% recycle and reuse of wastewater.

(6) Electrical: Be responsible for the maintenance of oil feeding equipments under its jurisdiction in the electrical workshop, and particularly pay attention to the pollution caused by the oil leakage of oil feeding equipments such as transformer, etc.; and strictly control the discharge beyond standard due to the improper disposal of waste oil, water fluid and other wastes during the period of inspection and repair.

(7) Thermal Control: Strictly control the discharge beyond standard due to the improper disposal of waste oil, water fluid and other wastes during the period of inspection and repair; and be responsible for DCS maintenance of desulfurizing system.
(8) Engine and Boiler: Strictly control the discharge beyond standard due to the improper disposal of waste oil, water fluid and other wastes during the period of inspection and repair; well control the equipments, reduce and keep their noise within the allowed range; be responsible for the maintenance and repair of oil system under its jurisdiction in the engine and boiler workshop so as to prevent any pollution caused by oil leakage of oil feeding equipments such as auxiliaries and oil cooler, etc.; be responsible for the repair and maintenance of oil-containing wastewater treatment equipments; be responsible to control the pulverization system and air & flue gas system in order to reduce the environmental pollution caused by leakage of coal, powder, air, ash and flue gas, etc.

(9) Auxiliary Control Department: Strictly control the discharge beyond standard due to the improper disposal of waste oil, water fluid and other wastes during the period of inspection and repair; well control the equipments, reduce and keep their noise within the allowed range; be responsible for the maintenance and repair of oil system for equipments under its jurisdiction so as to prevent any pollution caused by oil leakage of oil feeding equipments such as auxiliaries and oil cooler, etc.; be responsible to control the pulverization system and air & flue gas system in order to reduce the environmental pollution caused by leakage of coal, powder, air, ash and flue gas, etc.; be responsible for the repair and maintenance of ash removing and slag removing systems, and guarantee the good condition of equipments in the ash removing and slag removing systems; be responsible for the repair and maintenance of mechanical and electrical parts in the desulfurizing system, and guarantee the normal operation of desulfurizing system; be responsible for the ash removing and slag removing systems, the serviceability and removal efficiency of established dust removing electric field, and relevant operation management system, and strictly control the leakage of cloth-bag dust collector, so as to ensure that the discharge concentration of dust meets the standard and prevent the ash and slag from causing environmental pollution.

(10) Coal Conveying: Strictly control the discharge beyond standard due to the improper disposal of waste oil, water fluid and other wastes during the period of inspection and repair; and be responsible for the maintenance and repair of environmental protection facilities under its jurisdiction. Especially, guarantee the normal operation of belt wetting device, water shocking dust collector, cloth-bag dust collector, coal yard spraying device, etc.; be responsible for the management of coal
yard, spray water in the coal yard all the time, and prevent the raised coal powder in dry seasons and the spontaneous combustion of coal pile.

(11) Chemical: Strictly control the discharge beyond standard due to the improper disposal of waste oil, water fluid and other wastes during the period of inspection and repair; be responsible for the normal operation of water treatment neutralization tank, fine treatment neutralization tank, wastewater recycle tank, and other facilities as well as the monitoring of water quality, so as to guarantee the discharge and recycle up to standard; be responsible for the analysis, testing and supervision of coal quality fed into boilers, in order to guarantee that the ash content and sulfur content in the coal meet the requirements of environmental protection; be responsible for the laboratory tests related to desulfurizing system to guarantee the acceptable efficiency of desulfurization.

(12) Property Company: Be responsible to supervise and manage the disposal of domestic garbage, and guarantee the burial of garbage without causing secondary pollution; and be responsible for the company’s environmental greening plan management to develop the thermal power plant into a gardenlike plant.

(13) Fuel Department: Be responsible for the supervision, management and maintenance of coal hauling and unloading facilities, and establish the relevant system to eliminate the environmental pollution caused by the spill and leakage of coal; be responsible for the transportation and handling management of oil and materials, and establish the relevant system to prevent the environmental pollution caused by oil leakage; and be responsible for the management of incoming coal quality and guarantee that the ash content and sulfur content of coal meet the requirements of environmental protection.

(14) Quanxin Company: Be responsible for the hauling of fly ash, slag and gypsum, and the site management to prevent any secondary pollution.

5.2 Environmental Monitoring

The environmental monitoring of Wuxiang Hexin Thermal Power Generation Co., Ltd. is jointly undertaken by Environmental Monitoring Station of Changzhi City and In-plant Environmental Monitoring Station.

5.2.1 Flue Gas Online Monitoring

Wuxiang Hexin Thermal Power Generation Co., Ltd. installed two M6000
Continuous Emission Monitoring Systems (CEMS) synchronously. According to the unified requirements of the provincial and municipal bureaus of environmental protection, it installed two desulfurization automatic monitoring alarm systems in 2009. In September 2009, the automatic monitoring systems passed the acceptance of environmental protection departments, and were officially interconnected with environmental protection departments. Meanwhile they were handed over to operators for maintenance and management. In 2010, they passed the certification of Shanxi Bureau of Technical Supervision. Currently, the systems are in normal operation and data transmission. The principal and municipal monitoring centers perform the monitoring and inspection of CEMS irregularly on a monthly basis.

5.2.2 Monitoring of In-plant Environmental Monitoring Station

5.2.2.1 Responsibilities and Main Equipments of In-plant Environmental Monitoring Station

Environmental Monitoring Station is affiliated to the Power Generation Department and responsible to perform the environmental monitoring in the plant and implement the *Technical Code of Environmental Monitoring in Thermal Power Plants* to guarantee the quality of monitoring. When there is any abnormality in the measurement results, it is necessary to find out its reasons and report it to the superior timely. Sort out and analyze various monitoring data and establish the environmental monitoring archives. Strengthen the maintenance, care and inspection of environmental monitoring apparatuses and equipments, and guarantee the normal operation of monitoring. Participate in the investigation of environmental pollution events in the plant.

The apparatuses and equipments provided at the Environmental Monitoring Station of Wuxiang Hexin Thermal Power Generation Co., Ltd. according to the requirements of environmental monitoring are shown in Table 5.2-1.
<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Quantity (unit)</th>
<th>Amount (RMB10,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Electronic Analytical Balance (one ten-thousandth)</td>
<td>1</td>
<td>2.0</td>
</tr>
<tr>
<td>2</td>
<td>Electronic Analytical Balance (one hundred-thousandth)</td>
<td>1</td>
<td>4.0</td>
</tr>
<tr>
<td>3</td>
<td>pH Meter</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>4</td>
<td>Spectrophotometer</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>5</td>
<td>Ultraviolet Spectrophotometer</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>6</td>
<td>Ionic-activity Meter</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>7</td>
<td>COD Meter</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>8</td>
<td>Biochemical Incubator</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>9</td>
<td>BOD₅ Meter</td>
<td>1</td>
<td>1.2</td>
</tr>
<tr>
<td>10</td>
<td>Oil Element Measuring Instrument</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>11</td>
<td>Power Frequency Electromagnetic Field Testing Apparatus</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>12</td>
<td>Continuous Emission Monitoring System</td>
<td>1</td>
<td>168</td>
</tr>
<tr>
<td>13</td>
<td>Precision Sound Level Meter</td>
<td>2</td>
<td>0.7</td>
</tr>
<tr>
<td>14</td>
<td>Flow Measuring Instrument</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>15</td>
<td>Fridge</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>16</td>
<td>Computer</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>182.8</strong></td>
</tr>
</tbody>
</table>

In accordance with the *Regulations on Environmental Monitoring and Management in Thermal Power Industry*, Wuxiang Hexin Thermal Power Generation Co., Ltd. has installed the continuous emission monitoring system for boilers.

**5.2.2.2 Main Monitoring Items and Frequencies**

Wuxiang Hexin Thermal Power Generation Co., Ltd. formulates the Implementation Rules on Technical Supervision of Environmental Protection and works out detailed environmental monitoring plans as shown in Table 5.2-3.

Wastewater:
Table 5.2-2 Schedule of Wastewater Monitoring Methods

<table>
<thead>
<tr>
<th>No.</th>
<th>Monitoring Item</th>
<th>Analytic Method</th>
<th>Method Source</th>
<th>Minimum Level (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>pH</td>
<td>Glass electrode method</td>
<td>GB/T6920–1986</td>
<td>0.1pH Unit</td>
</tr>
<tr>
<td>2</td>
<td>COD</td>
<td>Dichromate titration</td>
<td>GB/T11914–1989</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Petroleum</td>
<td>Infrared spectrophotometry</td>
<td>GB/T16488-1996</td>
<td>0.01</td>
</tr>
<tr>
<td>4</td>
<td>Suspended Substance</td>
<td>Weight method</td>
<td>GB/T11901–1989</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Fluoride</td>
<td>Fluorine reagents spectrophotometry</td>
<td>GB 7483-87</td>
<td>0.05</td>
</tr>
<tr>
<td>6</td>
<td>Arsenic</td>
<td>Automatic continuous-flow hydride atomic absorption spectrometry</td>
<td>Analytic Methods for Water Quality &amp; Wastewater Monitoring</td>
<td>0.0001</td>
</tr>
<tr>
<td>7</td>
<td>Sulfide</td>
<td>Methylene blue spectrophotometry</td>
<td>GB/T16489-1996</td>
<td>0.005</td>
</tr>
</tbody>
</table>

Monitoring time and frequency: once every ten days for H, SS and COD, and once every month for arsenic, fluoride, sulfide, hardness, petroleum and water volume.

Moreover, the recycled water in the plant is monitored at any time so as to guarantee that the recycled water meets the requirements of recycling. It mainly includes 2 oil tests at the oil-containing wastewater outlet every month;

Dust, noise and toxic and hazardous gases are monitored by Changzhi Municipal Work Safety Supervision Bureau once a year, and all have met the standards. The specific testing indicators and frequencies have been included into the environmental monitoring plan.

(1) Mercury Emission
The main pollutants of smoke and gas emission comprise SO2, NOX, PM, CO and CO2, as well as a small amount of heavy metal, such as mercury (Hg), which has the significant adverse effect on the environment. Currently, Chinese Government has attached great importance to the control of mercury pollution. In 2009, the State Council printed and issued Guiding Suggestions on Strengthening Prevention and Control of Heavy Metal and has listed the mercury as the key control pollutant. In May 2010, the State Council further published The Guiding Suggestions on
Promoting Joint Prevention and Control of Air Pollution and Improving Regional Air Quality, putting forward the joint control demonstration projects of sulfur, nitrification, dust and mercury for coal-fired generating units. On December 3, 2010, the Office of the Ministry of Environmental Protection issued the Letter on Recommending Pilot Coal-fired Power Plants to Implement Mercury Pollution Control (EP [2010]1314), indicating the start-up of mercury removal project in China. In the General Planning on Prevention and Control of Heavy Metal that is submitted to State Council for Approval and the 12th FYP Planning on Joint Prevention and Control of Air Pollution in Key Regions that is being prepared, the control of pollutant emission is stipulated.

In 2009, the special fund for public welfare industry of the Ministry of Environmental Protection has been allocated to carry out the studies on emission reduction trend of harmful pollutants including mercury, as well as mercury pollutants list and its countermeasures, and a certain achievements have been obtained so as to supply the technical support for further mercury pollution control in coal-fired power plants.

On November 11, 2010, under the requirement of the Ministry of Environmental Protection, Shanxi Environmental Protection Bureau issued The Notification on Implementing Mercury Pollution Control Pilot Work in Coal-fired Power Plants (Shanxi EP [2010] 383), and Wuxiang Hexin Power Plant was selected as pilot plant to implement mercury pollution control. In October 2011, the Mercury Continuous Emission Monitoring System (CEMS) will be installed in the plant so as to obtain the first-hand information on the emission concentration of mercury and to determine whether to install mercury removal device or not. In accordance with air emission standard for coal-fired power plants, the mercury emission standard is 0.3mg/m³. The existing pollution control facilities (ESP+WFGD), in addition to denitrification facilities (SCR) those will be installed in 2012 shall meet the aforesaid emission standard.

During March 22 and 23, 2011, the Ministry of Environmental Protection organized the training class on atmospheric mercury pollution prevention and control technology in Beijing.


The pollution control facilities those are widely used in coal-fired plants such as EPS,
WFGD, in addition to SCR that will be promoted during 12th FYP will increase mercury removal efficiency to more than 70%. After the installation of denitrification facilities in 2012, the mercury removal efficiency will be further enhanced.

(2) Energy Efficiency and Greenhouse Gas Emission

The emission of greenhouse gas (CO2) mainly depends on fuel types and efficiency of generating units; for the coal-fired power plants, it mainly depends on the efficiency of generating units. During recent years, Wuxiang Hexin Power Plant has adopted the following measures to improve the efficiency of generating units:

a. In August 2009, B-level overhaul was carried out in #1 generating unit, and the turbine’s efficiency was enhanced. After the overhaul, the heat consumption was lowered by 120KJ/KWh, amounting to 27KJ/KWh for annual heat consumption reduction.

b. In 2010, the internal leakage of valves for #1 and #2 generating units was solved; the logic of air-cooling and antifreeze was optimized; the seals of air preheaters were replaced; the sealing air of coal pulverizers and air ducts of boilers were retrofitted.

c. In August 2011, the A-level overhaul will be implemented in #2 generating unit and it will be completed in October. It is estimated that the heat consumption be lowered by 200KJ/KWh, amounting to 27KJ/KWh for annual heat consumption reduction. By then, the peaking cooling project for #2 generating unit will be also completed.

d. In 2012, the peaking cooling system for #1 and #2 generating units will be put into operation; by then, the annual heat consumption will be reduced by 88KJ/KWh.

e. In 2013, the routine repair will be carried out in #1 and #2 generating units, which has a minor impact on the efficiency of generating units. The peaking cooling system that will be put into operation in 2012 will further improve generating efficiency.

Through the implementation of aforesaid measures, the coal consumption of generating units will be lowered to 343g/KWh in 2012 from 363g/KWh in 2007; the efficiency of generating units will be increased to 39.9% from 39.2%; the emission of greenhouse gas will be lowered to 780kg/Mwh from 830kg/Mwh. After the operation of peaking cooling system in 2012, annually 13,000 tons of coal equivalent will be saved and 31,000 tons of greenhouse gas will be reduced.

(3) NOx Emission

The designed fired coal of Wuxiang Power Plant is lean coal, the volatile of which is 17.5%. Its emission concentration shall not exceed the maximum emission
concentration-  650mg/m$^3$ at the time III stipulated in *Emission Standard of Air Pollutants for Thermal Power Plants* (GB13223-2003).

The boiler adopts rich/lean separation shutter low nitrogen burner, which could control the concentration of NOx within the qualified range. According to 12$^{th}$ FYP planning, the SCR shall be installed in existing coal-fired power plants. Currently, the company has started the prophase design and by then the emission concentration of NOx shall be lowered than 100mg/m$^3$.

### 5.3 Summary

Wuxiang Hexin Thermal Power Generation Co., Ltd. can basically perform the environmental management of the power plant in accordance with the requirements of Environmental Protection Management System.

(1) Since it was put into production in 2007, Wuxiang Hexin Thermal Power Generation Co., Ltd. has formed a set of complete top-down environmental management system, worked out the Standards for Environmental Management, and realized a high level of environmental management.

(2) Wuxiang Hexin Thermal Power Generation Co., Ltd. has established an environmental protection leading group with general manager as its group leader, and set up an environmental monitoring station affiliated to the Power Generation Department.

(3) Wuxiang Hexin Thermal Power Generation Co., Ltd. should arrange the Environmental Monitoring Station of Changzhi City or In-plant Environmental Monitoring Station to periodically monitor the main pollution sources in the plant in accordance with the Implementation Rules on Technical Supervision of Environmental Protection that the power plant formulates, in order to learn about the discharge of pollutants.
### Table 5.2-3 Schedule of Environmental Monitoring Plans of Wuxiang Hexin Thermal Power Generation Co., Ltd.

<table>
<thead>
<tr>
<th>No.</th>
<th>Environmental Element</th>
<th>Monitoring Point</th>
<th>Monitoring Item</th>
<th>Monitoring Frequency</th>
<th>Entrusted Unit</th>
<th>Supervision Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Waste Gas</td>
<td>Chimney (flue)</td>
<td>SO$_2$, CO, NOx</td>
<td>Continuous monitoring 1 period/quarter, 1 day/period</td>
<td>M6000 CEMS</td>
<td>Supervision and monitoring by Environmental Monitoring Station of Changzhi City</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(fly) ash</td>
<td>1 period/quarter, 2 days/period, twice/day</td>
<td>Routine monitoring by In-plant Environmental Monitoring Station</td>
<td>Supervision and monitoring by Environmental Monitoring Station of Changzhi City</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 monitoring point for each of coal yard, coal pulverizer, coal feeder, belt conveyor, etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Wastewater</td>
<td>Quality of reused water</td>
<td>pH, SS, COD, petroleum</td>
<td>4 times per month for reused water</td>
<td>In-plant Environmental Monitoring Station</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Noise</td>
<td>1m away from plant boundary, in-plant office area</td>
<td>Leq</td>
<td>Once a year</td>
<td>Routine monitoring by In-plant Environmental Monitoring Station</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Solid Waste</td>
<td>In-plant</td>
<td>Name, generation and disposal of solid wastes</td>
<td>One statistic per month</td>
<td>In-plant Environmental Monitoring Station</td>
<td></td>
</tr>
</tbody>
</table>
6 Company Production Safety Management

6.1 Production Safety Management Status

For the purpose of strengthening the production safety management, Wuxiang Hexin Thermal Power Generation Co., Ltd fully complies with the Production Safety Law of the People's Republic of China, earnestly implements the safety instructions and regulations issued by the State Electricity Regulatory Commission and the State Administration of Work Safety. In order to prevent and reduce production safety accidents, ensure the long-period, safe and stable operation of machine units, and guarantee the life and property security, the enterprise specially developed Production Safety Management System, and carries out production activities in strict accordance with the Management Standards and Work Standards, and actively conducts production safety inspections during the routine production process, makes timely rectification if some problems are found, thus continuously improving production safety management and reducing security incidents.

6.2 Production Safety Management System

In order to seriously implement the principle of "safety first, prevention first", standardize the work safety supervision work, give full play to the role of safety supervision system, fully implement the production safety responsibility system, enhance the company's production safety level, according to the need of production safety management, Wuxiang Hexin Thermal Power Generation Co., Ltd has established Production Safety Committee, and general manager acts as the chairman of the committee, and the Production Safety Committee office is set at Health Safety Environment (HSE) Department. Specific organizational structure is shown in Figure 6.2-1.

The enterprise has developed strict and detailed Production Safety Management System with a view to strengthening and standardizing the management of production safety. The system included the following 15 articles: (1) Safety education management system; (2) Safety inspection system; (3) Production safety reward and punishment rules; (4) Management regulations on security technology, labor protection measures, and anti-accident technical measures; (5) Safety evaluation work management system; (6) Dangerous chemicals safety management system; (7) Low-voltage temporary power source and leakage protector management system; (8)
Implement provisions relevant to "two-ticket" system; (9) Special operation personnel safety management regulations; (10) Outsourcing project safety management regulations; (11) Requirements on accident (disorder) investigation, analysis and reporting; (12) Special equipment safety regulations; (13) Safety equipment use regulations; (14) Electric tools use regulations; (15) Production workplace facilities safety regulations. See Table 6.2-1 for brief content of management system.
Figure 6.2-1 Organizational Structure of Production Safety Committee of Wuxiang Hexin Thermal Power Generation Co., Ltd
Table 6.2-1 Overview of Production Safety Management System of Wuxiang Hexin Thermal Power Generation Co., Ltd

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Theme Content and Applicable Scope</th>
<th>Specific Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Safety education management system</td>
<td>Formulate the company’s safety education mode, content, examination management work, applicable to the company’s safety education management.</td>
<td>① The company’s production personnel, production managers and the leaders at all levels must conscientiously study and implement various power generation-relevant laws and regulations promulgated by the state and the ministries. ② The company’s Production Safety Committee should conduct various forms of regular safety education on staff, and organize staff to take exams on Safety Code of Electric Power Industry.</td>
</tr>
<tr>
<td>2</td>
<td>Safety inspection system</td>
<td>Formulate contents and requirements on safety inspection activities, applicable to each department of the company.</td>
<td>① Each department should organize special safety inspection and rectification at regular or irregular basis according to the actual situation of the company, combined with the accident occurrence law. ② The safety inspection focuses on weak links in the safety management work, the inspection contents involves leadership, ideas, rules and systems, equipment defects and hazards, violation of regulations and disciplines, and the rectification situation. ③ Safety inspection activities include three forms: joint inspection, professional inspection and seasonal inspection.</td>
</tr>
<tr>
<td>3</td>
<td>Production safety reward and punishment rules</td>
<td>Provides production safety incentive and punishment assessment contents, applicable to each department.</td>
<td>① The company implements production safety objective management, practices the production safety three-level control objectives, gives reward to the departments and individuals making outstanding contributions in the process of achieving security objectives, and punishes the departments where accidents occur and responsible individuals. ② Implement the reward and punishment system, and adhere to the combination of spiritual encouragement and material reward, and the combination of ideological education and administrative punishment.</td>
</tr>
<tr>
<td>4</td>
<td>Management regulations on security technology, labor protection measures, and anti-accident technical measures</td>
<td>Provides regulations on the preparation, implementation and inspection of security work plans and anti-accident measure plans, suitable for various production departments and related departments.</td>
<td>Security work plans and anti-accident measure plans are important means for actively carrying out anti-accident campaigns, eliminating as planned the personal and equipment accidents, and ensuring safety in production. The preparation of work plans and anti-accident measure plans is aimed to improve the staff’s working environment and working conditions, ensure their safety and health in the production, prevent the occurrence of personal casualty accidents, and make a planned, focused and systematic extermination of accidents.</td>
</tr>
<tr>
<td>No.</td>
<td>Name</td>
<td>Theme Content and Applicable Scope</td>
<td>Specific Contents</td>
</tr>
<tr>
<td>-----</td>
<td>-------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>5</td>
<td>Safety evaluation work management system</td>
<td>Provides organizational measures, duties, work procedures and items, measures rectification, inspection and assessment with regard to safety evaluation work.</td>
<td>① Safety evaluation work is an important method that the enterprise uses to make comprehensive security diagnostics and detect the weak links in safety production, latent danger of accidents, and risk factors; through carrying out safety evaluation work, hidden dangers existing in various aspects should be scored according to the influence extent and certain standards, the current security level should be clarified in order to lay a foundation for better carrying out production safety work. Safety evaluation work is a concrete manifestation of &quot;prevention first&quot; and the shift from &quot;post-accident safety management&quot; to &quot;proactive safety management&quot;. ② Safety evaluation work is conducted twice a year, usually in April and October respectively. The safety evaluation work in April focuses on the safety assessment items, as well as the inspection and supervision over measures and rectification; The safety evaluation work in October conducts comprehensive evaluation.</td>
</tr>
<tr>
<td>6</td>
<td>Dangerous chemicals safety management system</td>
<td>Provides related contents concerning the purchase, transportation, storage, use and management of hazardous chemicals, applicable to company-wide use of flammable, explosive, toxic, harmful and corrosive chemicals which may cause injury or damage to personnel, facilities, and environment.</td>
<td>① Engaging in hazardous chemicals work must strictly comply with Regulations on the Safety Administration of Dangerous Chemicals issued by the State Council and other relevant regulations. Where accident occurs, the company's emergency response plan should be implemented. ② The hazardous chemicals which forms a significant source of danger should be monitored, controlled, and assessed regularly, the hidden dangers should be eliminated timely, and effective measures should be taken to prevent major accidents. ③ Clarify the requirements on dangerous chemicals operation and transportation personnel. ④ formulate requirements on hazardous chemical storage and usage.</td>
</tr>
<tr>
<td>7</td>
<td>Low-voltage temporary power source and leakage protector management system</td>
<td>This article is designed to further strengthen and improve the production safety equipment management, improve operation personnel's safety protection awareness, and prevent physical shock and fire accident. Applicable to all operation personnel in the company’s production and non-production areas.</td>
<td>① Where low-voltage temporary power supply is used at production site, the corresponding conditions stipulated in the system must be met. ② Power and lighting distribution box must be consistent with the corresponding conditions stipulated in the system. ③ Leakage protector is an effective measure for preventing physical shock and ensuring personal safety, so the use of low-voltage electrical equipment must be accompanied with the use of leakage protector, and strictly complies with relevant rules and regulations.</td>
</tr>
<tr>
<td>No.</td>
<td>Name</td>
<td>Theme Content and Applicable Scope</td>
<td>Specific Contents</td>
</tr>
<tr>
<td>-----</td>
<td>------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>8</td>
<td>Implement provisions relevant to &quot;two-ticket&quot; system</td>
<td>In order to ensure production safety and prevent accidents, each department must strictly enforce the two-ticket system when eliminating defects, repairing and installing equipment system at the production site.</td>
<td>① Equipment department should be responsible for implementing the work ticket system and the security system management work. Operation and Management Department should be responsible for implementing the operation ticket system and the safety system management work. Workshop should be responsible for implementing the &quot;two-ticket&quot; system; the persons in charge of operation in Operation and Management Department and Workshop are mainly responsible for implementing and making statistics of work ticket system. Safety Supervision Department is responsible for supervising and assessing the implementation of &quot;two-ticket&quot; system. ② Leaders at all levels should have strict requirements on the implementation of &quot;two-ticket&quot; system, and seriously analyze and investigate the problems occurred, no matter whether the problems are serious in nature, or cause severe consequence, strictly abide by the production safety-relevant regulations stated by the government.</td>
</tr>
<tr>
<td>9</td>
<td>Special operation personnel safety management regulations</td>
<td>Provides the definition of special operation personnel, and qualification, reexamination and training of special operation personnel. Applicable to the professional engaging in boiler and pressure vessel operation, electricity, lifting, welding, motor-driven vehicle driving within factory, erecting, water treatment, refrigeration, etc.</td>
<td>① Special operations refer to the operations which easily cause casualties in the labor process, and impose major hazards to the safety of others and surrounding facilities. The professional who are engaged in special operations are called special operation personnel. ② Special operation personnel shall strictly implement the national relevant provisions on special operation personnel and special equipment operation procedures; Workshop is responsible for managing special operation personnel, the Personnel and Labor Department is responsible for training special operation personnel, and the Safety Supervision Department is responsible for supervising special operation personnel. All special operation personnel must hold Special Operation Certificate before taking posts, and their qualification reexamination must be conducted once every two years.</td>
</tr>
<tr>
<td>10</td>
<td>Outsourcing project safety management regulations</td>
<td>Provides safety regulations on outsourcing projects, applicable to the company’s all outsourcing projects.</td>
<td>① Management should proceed after the outsourcing project is outsourced, the company’s administrative personnel at all levels are the first principal is responsible for production safety, and take overall responsibility for security matters of the outsourcing project. ② HSE Department is the company’s functional department in charge of production management, and the safety management work of outsourcing projects should be generally responsible for Safety Supervision Department. ③ The qualification of outsourced engineering units should be reviewed. ④ Safety assessment on the outsourcing project should be made. ⑤ Safety assessment should be made on the contracting department, equipment-owned units or the persons in charge of engineering projects.</td>
</tr>
<tr>
<td>No.</td>
<td>Name</td>
<td>Theme Content and Applicable Scope</td>
<td>Specific Contents</td>
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<tr>
<td>11</td>
<td>Requirements on accident (disorder) investigation, analysis and reporting</td>
<td>Provides the development of regulations on accident (fault) investigation, analysis and reporting, applicable to the Production Departments and related departments.</td>
<td>① Accident (fault) investigation, analysis and reporting are important means for the company to adhere to “four not-let-off” principle, seriously investigate accidents and absorbing lessons, and actively carry out anti-accident campaigns, eliminate the hidden personal and equipment accidents according to plan, and to ensure safe production. ② The preparation of regulations on accident (fault) investigation, analysis and reporting is aimed to put priority to the cause investigation and the implementation of prevention measures during the accident investigation, improve the staff’s working environment and labor conditions, ensure workers’ safety and health in production, prevent the occurrence of personal casualty accidents, and make a planned, focused, systematic extermination of accidents. ③ Accident (fault) investigation, analysis and reporting should be based on Code of Investigation for the Electric Power Production Accidents DL558-94 issued by the Ministry of Power Industry of PRC, Interim Regulations for the Investigation Procedures of Major Accidents issued by the state, power industrial technology management laws and regulations released by the higher authorities, electrical safety procedures, anti-accident instructions and production safety bulletins.</td>
</tr>
<tr>
<td>12</td>
<td>Special equipment safety regulations</td>
<td>Provides the relevant contents on purchase, installation, use and inspection (testing), maintenance, management of special equipment, applicable to the company-wide use of boilers, pressure vessels, pressure pipes, lifting equipment, motor vehicles within factory.</td>
<td>① Special equipment refers to pressure vessels, pressure pipes, lifting equipment, motor vehicles and other equipment which are involved in life safety and imposes greater risk. The inspection on lifting equipment is conducted once every two years, and those special equipment having not been inspected shall not be put into use. The accessories of special equipment should be checked and repaired regularly. ② The production and use of special equipment must strictly comply with Production Safety Law, and Regulations on Safety Supervision over Special Equipment, sound management system and accountability system. Operators must have certificates before taking their posts. Accidents, once occurs, should be immediately reported to the safety supervision department, and be disposed in accordance with the company’s emergency rescue plan. ③ Own the special equipment workshop, the work team should be equipped with full-time or part-time security management personnel, with special safety equipment technical archives.</td>
</tr>
<tr>
<td>No.</td>
<td>Name</td>
<td>Theme Content and Applicable Scope</td>
<td>Specific Content</td>
</tr>
<tr>
<td>-----</td>
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<td>---------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>13</td>
<td>Safety equipment use regulations</td>
<td>Provides the contents on purchase, use, inspection and maintenance of safety tools, applicable to the company-wide use of helmets, anti-shock equipment, anti-fall climbing equipment, insulation appliances, leakage protectors, high-voltage electro scope, ground lines, and other tools and appliances.</td>
<td>① Purchase, use and disposal of security tools and instruments must be made after obtaining approval of the Safety Supervision Department. ② Workshops and work teams must build archives for safety tools and instruments, make regular inspection and test, and put the examination and test results into archives. ③ Security appliances (anti-shock equipment, anti-fall climbing equipment, insulation appliances, etc.) should be examined and tested regularly in accordance with the safety regulations. ④ Helmets should be subject to casual inspection once a year within operating life.</td>
</tr>
<tr>
<td>14</td>
<td>Electric tools use regulations</td>
<td>Provides regulations on the purchase, use, inspection, maintenance and management of electric tools and equipment, applicable to company-wide use of hand-held electric tools, electric mobile tools and so on.</td>
<td>① The use of electric tools and instruments must be accompanied with the use of corresponding leakage protectors, isolation transformers and protection facilities. ② Leakage protectors should be used when using all repair power supply boxes, temporary power supplies, temporary outlets, temporary low-voltage electrical appliances, measuring test equipment, and hand-held power tools. ③ Electric tools should be regularly checked by the high-voltage division of electric workshop once every six months. ④ Electric tools management departments should implement the principle of “centralized management of workshops and work teams”.</td>
</tr>
<tr>
<td>15</td>
<td>Production workplace facilities safety regulations</td>
<td>Provides the regulations on the use, maintenance and inspection of safety facilities at workplace, and other related content under the jurisdiction applicable to company-wide use of grid panels, railings, guards, stairs, platforms, channels and other facilities.</td>
<td>① Safety facilities should remain intact, are fixed solidly, and comply with the safety requirements. Within the jurisdiction scope of various departments, the operating personnel are responsible for daily checks, maintenance personnel are responsible for regular inspection, maintenance and replacement, and notify the maintenance staff to handle abnormal situations. ② Where safety facilities requires to be removed and changed temporarily, the temporary fencing and warning signs should be set in accordance with relevant provisions, and some persons are assigned to wait at the site until the work ends, or restore the safety facilities to normal status after the work ends. ③ Installation of temporary facilities and drilling holes on the structures should be subject to approval.</td>
</tr>
</tbody>
</table>
6.3 Implementation of Production Safety Management System


The Report summarizes the problems found during the security check and further improvements needed, mainly including the following:

(1) Conscientiously implement the documents issued by State Electricity Regulatory Commission on strengthening device management and preventing equipment accidents, enhance the management of power generation equipment.

(2) Strengthen the management of dangerous sources.

(3) Improve emergency management work.

(4) On the management of special equipment.

(5) Respond to the electricity consumption peak in summer, adverse weather and other natural disasters.

(6) Flood control work.

(7) Strengthen the contract engineering safety management.

(8) Enhance the daily security management of work teams.

(9) Strengthen the safety supervision of technical transformation projects, ensure the projects to be conducted in a safe and orderly way.

(10) Adhere to the "four not-left-off" principle in investigating and dealing with accidents (incidents).

Major problems found during inspection include:

(1) High labor turnover rate of the operation team makes some job skills can not meet the safety requirements.

(2) Staff needs to be organized to study the implementation of No. 23 file.

(3) Management on operation against rules should be further strengthened, and the anti-violation organization management system should be rationalized.

(4) According to requirements of China Huadian Corporation, equip the primary production sectors with full-time safety officer as soon as possible.
(5) Implement the security work plans and anti-accident measure plans, and conduct technical transformation towards security weak links, and towards the equipment whose operation at full load is affected during peak time.

The above problems should be summarized in combination with the inspection of higher authorities, see Table 6.4-1 for the specific rectification measures.

6.4 Safety Inspection Conducted by Higher Authorities

In 2010, Shanxi Administration of Work Safety and the Shanxi Electricity Regulatory Office under the State Electricity Regulatory Commission held a joint investigation on electrical safety hazards, China Huadian Corporation conducted a safety evaluation assessment, the relevant departments in Changzhi City and Shanxi Province organized the inspection and acceptance of the enterprises with Inherent safety, and performed comprehensive inspection of the production safety work of Wuxiang Hexin Thermal Power Generation Co., Ltd, and make summary and rectification. The main problems identified and rectifications made are shown in Table 6.4-1.

Table 6.4-1 Problems identified by higher authorities in production safety inspection and rectification status

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Problems</th>
<th>Rectification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Production safety management and safety education</td>
<td>Production safety regular meetings at all levels should be carried out as per the relevant state regulations.</td>
<td>Re-amend and perfect the production safety regular meetings. Production safety regular meetings at all levels shall be held at regular basis in accordance with relevant state laws and regulations as well as corporate system. The main responsible persons should make timely analysis and decisions to address the problems existing in safety work and rectification measures, and make corresponding meeting minutes on which the participants should perform the signing procedures. The content of meetings should be detailed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Some grass-roots work teams do not have the pre-shift and after-shift meetings.</td>
<td>Grass-roots work team should hold the pre-shift and after-shift meetings to analyze the risk factors at the current day and discuss corresponding control measures, make safety summary of the work at that day, and make good records.</td>
</tr>
<tr>
<td>2</td>
<td>Outsourcing project security management</td>
<td>Outsourcing project management is not standardized: ① Building materials are scattered at the site; helmets that construction workers wear do not meet safety standards. ② High-altitude operation personnel do not wear safety</td>
<td>Should issue a rectification notice to construction unit, increase the punishment, to regulate their operations at the site. The company’s desulfurization project department should urge the supervision company to rationalize the relationship between safety, quality and progress, to enhance</td>
</tr>
<tr>
<td>3</td>
<td>Management of dangerous chemicals</td>
<td>The hazard sources are not well marked at the site, e.g., hydrogen station has not indicated the quantity and hazardous characteristics of hydrogen storage tanks.</td>
<td>Hazard identification should reflect the storage capacity of hazardous materials, hazardous properties and protective measures. Specific content should include warning words, concentration, overview of hazards, safety measures, and fire fighting methods.</td>
</tr>
<tr>
<td>5</td>
<td>Routine work</td>
<td>After viewing the minute of Wuxiang company’s monthly safety analysis meetings and safety network regular meetings from January to April, 2010, no discussions were found to be made for drawing lessons of the following accidents: in January 11, 2010, Fujian Huadian Kemen Power Generation Company’s boiler furnace scaffolding personal suffered casualty due to fall from height; on March 16, 2010, four persons suffered casualty due to burn and suffocation at Raw Coal Silo of Shaanxi Pucheng Power Generation Company. The drawing of lessons from the above personal injury and death is only reflected in the weekly publication of Wuxiang Company, such practice does not comply with No. [2004] 23 Document Safety Work Regulation issued by Huadian Power International Corporation.</td>
<td>Safety analysis meeting and safety network regular meetings should check the implementation of security work tasks. Make comprehensive analysis of the production safety situation, timely sum up the lessons from the accidents and security weaknesses, and study the countermeasures.</td>
</tr>
<tr>
<td>6</td>
<td>Safety Inspection</td>
<td>On-site fire control devices fail to be inspected on timely basis.</td>
<td>Annual inspection work should be carried out according to Fire-fighting Equipment Management System, the fire extinguisher whose pressure indicator is in lower limit should be replaced to ensure that fire fighting devices are in good condition.</td>
</tr>
<tr>
<td>7</td>
<td>Control of anti-violation work and safety operation environment</td>
<td>Boiler equipment management system is not well implemented: ① Site inspection did not provide boiler emission test records. ② The safety gate hot-state setting test did not be conducted until May 24 after 3# furnace repair was ended on April 28, nearly a month’s lag.</td>
<td>① Conduct the boiler emission test according to provisions, make good records for filing. ② Strictly implement the relevant requirements. After the boiler starts, carry out boiler security door hot-state setting test, the boiler can be put into use after being confirmed qualified, so as to ensure the intrinsic safety of the boiler.</td>
</tr>
</tbody>
</table>
Implementati
on of anti-accident measures

Technical management of security appliances is to be further strengthened: written examination reports on ground wire, electroscope, brake pull-rod and insulated shoes are not issued.

After safety equipment check, a written report should be issued, and be filed for record after being signed and review.

Management Standards

Strength the management of power generation equipment

Strength the management of hazard sources

Improve emergency management

On the management of special equipment

Strength contracting projects safety management

Strength the daily safety management of work teams

Management Standards

Strengthen the management of security appliances is to be further strengthened: written examination reports on ground wire, electroscope, brake pull-rod and insulated shoes are not issued.

After safety equipment check, a written report should be issued, and be filed for record after being signed and review.

Anti-season accident

Respond to the electricity consumption peak in summer, adverse weather and other natural disasters

Flood control work.

The company organizes various departments to revise their management standards in accordance with the standards promulgated by Huadian.

Technical Retrofit

Strength the safety supervision of technical transformation projects, to ensure the projects to proceed safe and orderly.


"Four not-left-off" requirements

Adhere to the "four not-left-off" principle, conduct the accident (incident) investigation treatment

1. Analyze the causes; 2. Strengthen education; 3. Develop the targeted preventive measures; 4. Investigate the responsibility.

The company's internal inspection

(1) Conscientiously implement the documents issued by State Electricity Regulatory Commission on strengthening device management and preventing equipment accidents, enhance the management of power generation equipment.


Management on operation against rules should be further strengthened, and the anti-violation organization management system should be rationalized.

1. The company issued the anti-violation management file; 2. Establish anti-violation archives; 3. Establish the anti-violation management review system.

According to requirements of China Huadian Corporation, equip the primary production sectors with full-time safety officer as soon as possible.

The main production departments are equipped with full-time safety officers, and have developed work standards.

Implement the security work plans and anti-accident measure plans, and conduct technical transformation towards security weak links, and towards the equipment whose operation at full load is affected during peak time.

1. Develop the safety measures and counter-measures plan; 2. Implement the spring inspection, repair and maintenance, and technical transformation; 3. Conduct impact evaluation; 4. Review the departments and individuals which do not well implement the safety measures and counter-measures plans.

6.5 Statistics of Power Plant Accidents over the Years

(1) Abnormal outage

From 2008 to 2010, unplanned generator units outage accidents occurred in Wuxiang Hexin Thermal Power Generation Co., Ltd for 12 times, see Table 6.5-1 for detail.
## Table 6.5-1 Summary of unplanned generator units outage accidents occurred in Wuxiang Hexin Thermal Power Generation Co., Ltd

<table>
<thead>
<tr>
<th>No.</th>
<th>Generator Unit</th>
<th>Occurrence Time</th>
<th>Duration</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1#Generator Unit</td>
<td>2008-04-12 14:50</td>
<td>84</td>
<td>Outage due to leakage from water cooled wall of #1 furnace.</td>
</tr>
<tr>
<td>2</td>
<td>1#Generator Unit</td>
<td>2008-05-08 02:34</td>
<td>8</td>
<td>The burning of dishevelled coal in raw coal silo rapidly deteriorated during the adjustment process and especially when the machine unit load is decreased to 350MW, resulting in fire extinguishment in the boiler.</td>
</tr>
<tr>
<td>3</td>
<td>2#Generator Unit</td>
<td>2008-06-30 07:24</td>
<td>88</td>
<td>Water cooled wall pipe under the lower part of the burner is abraded severely by washing of ash-containing secondary air, resulting in leakage of water cooled wall pipe at the place.</td>
</tr>
<tr>
<td>4</td>
<td>1#Generator Unit</td>
<td>2008-11-5 11:50</td>
<td>3</td>
<td>The protective tripping device of primary air fan tripped out and resulted in fire extinguishment in Fire #1 furnace.</td>
</tr>
<tr>
<td>5</td>
<td>1#Generator Unit</td>
<td>2008-12-17 21:56</td>
<td>3</td>
<td>Due to fault in the control board, precision processing programmable power supply suffered short-term loss of electricity, condensed water supply suspension resulted in the outage of #1 machine unit.</td>
</tr>
<tr>
<td>6</td>
<td>1#Generator Unit</td>
<td>2009-3-12 11:16</td>
<td>2.5</td>
<td>The lighting waterline used in #1 machine unit air-cooled flushing work fell from the crack of No.7 column of windshield of #1 air-cooled unit, and bumped the C-phase outgoing line at #1 main transformer high-voltage side, this directly causes the at #1 main transformer differential protection action, and trip-out of #1 machine unit.</td>
</tr>
<tr>
<td>7</td>
<td>1#Generator Unit</td>
<td>2009-4-11 5:43</td>
<td>2</td>
<td>#1 transformer unit tripped out due to pollution flashover of main transformer outgoing line.</td>
</tr>
<tr>
<td>8</td>
<td>1#Generator Unit</td>
<td>2009-06-15 14:38</td>
<td>77.5</td>
<td>Due to the long-term purge, wear and tear of soot blower, the pipe wall becomes thin, which is the main cause of final pipe burst.</td>
</tr>
<tr>
<td>9</td>
<td>2#Generator Unit</td>
<td>2009-10-11 22:27</td>
<td>82</td>
<td>Soot blower damaged the water-cooled wall tube, leading to leakage.</td>
</tr>
<tr>
<td>10</td>
<td>1#Generator Unit</td>
<td>2010-03-08 03:09</td>
<td>158</td>
<td>Due to poor coal quality, the overheat system of #1 machine unit has over-temperature, combined with the serious leakage of #1 furnace electric throttle valve for main water feed, desuperheating water flow can not be regulated as normal, and the running adjustment caused increase in furnace pressure, and the shutdown was caused by the successive burst of soft connection of secondary air fan at right side of furnace.</td>
</tr>
<tr>
<td>11</td>
<td>1#Generator Unit</td>
<td>2010-04-12 18:23</td>
<td>5.5</td>
<td>6B belt #2 motor ground fault occurred during startup, 6B belt motor did not perform the zero-sequence protection, protection overstepping movement caused trip-out of #2 unit.</td>
</tr>
<tr>
<td>12</td>
<td>1#Generator Unit</td>
<td>2010-5-29 09:19</td>
<td>74.5</td>
<td>At 9:19p.m on May 29, #1 furnace shut down due to leakage as a result of pipe explosion of #1 furnace.</td>
</tr>
</tbody>
</table>
(2) Personal casualty accidents
No work injury accident occurred from 2008 to the end of 2010 in Wuxiang Hexin Thermal Power Generation Co., Ltd.

6.6 Summary
To avoid occurrence of accidents, Wuxiang Hexin Thermal Power Generation Co., Ltd developed a more mature and effective production safety management system, established accident emergency plans, strictly monitors the warning measures to timely find the hidden danger of accidents, so as to take effective response measures and to ensure the safety of workers and production.

To further prevent accidents and reduce the occurrence of equipment faults, it is recommended that the company should further strengthen the safety education on workers, carry out production safety inspection work, develop detailed rectification measures against the problems detected, and actively implement these rectification measures.
7. Management of Hazardous Chemicals in Power Plant

7.1 Hazardous Analysis of Toxic, Harmful and Flammable Substances

The hazardous chemicals used in the production process of Wuxiang Hexin Thermal Power Generation Co., Ltd include hydrochloric acid, liquid caustic soda, hydrogen, diesel, ammonia water and diamine, etc., physical and chemical characteristics of hazardous materials are described below.

(1) Hydrochloric acid

It is colorless or slightly yellow fuming liquid with pungent sour; Vapor pressure 30.66kPa (21 ℃), melting point -114.8 ℃/pure, boiling point: 108.6 ℃/20%, relative density (water = 1) 1.20. It can be miscible with water and soluble in alkali liquor.

It can react with some active metal powder to release hydrogen, react with cyanide to produce highly toxic hydrogen cyanide gas. It can have the neutralization reaction with alkali to release a lot of heat. Be strongly corrosive. Its hazardous chemical number is No. 81013. According to List of Hazardous Chemicals (2002 edition), hydrochloric acid belongs to Class 8 corrosive substance.

Toxicity: LD50900mg/kg (test on rabbit, per os), LC503124ppm, 1 hour (inhaled by rat). Exposure to vapors or fumes may cause conjunctivitis, burning sensation in nasal and oral mucosa, epistaxis and gingiva bleeding, and bronchitis; irritate the skin to cause dermatitis, chronic bronchitis and other diseases. Mistaken oral intake of hydrochloric acid leads to poisoning, can cause gastrointestinal burns and ulcers, and may cause gastric perforation and peritonitis.

(2) Liquid caustic soda

Pure product is colorless transparent crystal, relative density: 2.130, melting point: 318.4 ℃, boiling point: 1390 ℃. Pure liquid caustic soda is colorless and transparent liquid. Solid caustic soda has very strong hygroscopicity. Soluble in water, release heat during dissolution, aqueous solution presents alkaline, with soapy feeling; soluble in ethanol and glycerin; insoluble in acetone and ether. Highly corrosive, have...
corrosive effect on fiber, skin, glass, ceramics and others. Can react with metallic aluminum and zinc, and non-metallic boron and silicon to release hydrogen; have disproportionation reaction with chlorine, bromine, iodine and other halogen; have neutralization reaction with acids to generate salt and water.

It is highly corrosive. If its solution or dust is splashed on skin, especially on mucous, it can cause soft scab, and penetrate into deep tissue. Scar will be left after the burn. If it is splashed into eyes, it not only damages the cornea, but also damages deep tissue of the eyes. If accidentally splashed on skin, immediately wash the skin with water for 10min; if splashed into eyes, immediately rinse eyes with water or physiological saline for 15min, and then drip 2% novocaine into eyes. In severe cases, the sufferer should be hurriedly taken to hospital for treatment. The highest Caustic soda dust Air maximum acceptable concentration of caustic soda dust is 0.5mg/m3. During work, operators must wear work clothes, masks, protective glasses, rubber gloves, rubber aprons, long rubber boots and other appliances for labour protection protective clothing. The operators should apply neutral and hydrophobic ointment on the skin. Workshop should be well ventilated.

(3) Ammonia water

Colorless transparent liquid, with irritant odor; ammonia is explosive, with explosive limit of 16% -25%, especially when it is heated or exposed to the light, it easily decomposes and releases ammonia. The higher the temperature is, the faster the decomposition speed is, leading to an explosive atmosphere. In case of high heat, the inner pressure within containers increased, with the risk of cracking and explosion. Fire and explosion prevention shall be paid with more attention.

Strong ammonia water has the irritant effect on the respiratory tract and skin, and can damage the central nervous system. It presents alkalescent.

The inhalation of ammonia irritates nose, throat and lung, and causes cough, hard breath and asthma, may cause death by suffocation due to laryngeal edema or
due to pulmonary edema. If ammonia water is splashed into eyes, if emergency measure is not taken, it can cause corneal ulcers and perforations, and further cause intraocular inflammation, eventually leading to blindness due to atrophy of eyeball.

(4) Hydrazine

Colorless fuming liquid with ammonia odor; relative density: (water = 1) 1.01; relative density (Air = 1): 1.11; vapor pressure: 92kPa/25 ℃, flash point: 38 ℃; Can be miscible with water, soluble in alcohol, liquid ammonia and many other organic solvents; melting point: 1.4 ℃, boiling point: 113.5 ℃; flammable liquid, toxic.

Toxicity: Medium toxic level. Acute toxicity: LD5060mg/kg (test on rabbit, per os); 91mg/kg (test on rabbit, percutaneous); LC50746mg/m³, 4 hours (inhaled by rat); subacute and chronic toxicity: animal reactions towards subacute and chronic toxicity include respiratory tract irritation, weight loss, anemia, increased white blood cells, as well as lung, liver and kidney damage; Mutagenicity: microsomal mutagenicity: Salmonella typhimurium 12g/L; wine yeast 200mmol/L. Mutation in mammalian somatic cells: mouse lymphocytes 1mmol/L; reproductive toxicity: The Toxic Dose Lowest (TDL0) in the enterocoelia of mice: 50mg/kg (without medication for 6~16 days after pregnancy starting), embryo toxicity is showed. The Toxic Dose Lowest (TDL0) in the enterocoelia of mice: 48mg/kg (with medication for 6~9 days after pregnancy starting), embryo toxicity is showed, bone and muscle system are affected.

It is a kind of flammable, strong reducing agent. Its steam can combine with air to form explosive mixture with a broad explosive range. It easily burns and explodes in case of open fire and high heat. Affected by the heat, it decomposes and releases the toxic nitric oxide gas. When burning, it releases high heat, and may explode. It may burn spontaneously when meeting dust, soil, asbestos, wood and other porous substances. It may burn spontaneously when being exposed to hydrogen peroxide, nitric acid and other oxidants. In contact with various metal oxides, it will decompose and burn automatically. It is highly corrosive.
(5) Diesel:

It is a mixture mainly consisting of alkanes, alkenes, cycloalkanes, aromatic hydrocarbons, polycyclic aromatic hydrocarbons and a small amount of sulfur (2 ~ 60g/kg), nitrogen (<1g/kg) and additives. The brown, slightly viscous liquid, melting point: -18 ℃, boiling point: 282 ~ 338 ℃, relative density: (water = 1) 0.87 ~ 0.9, flash point: 38 ℃, ignition temperature: 257 ℃. Used as diesel fuel.

It is flammable and irritant. In case of fire, heat or contact with oxidants, it may cause fire and explosion. In case of high heat, pressure within containers increases, presenting the risk of cracking and explosion.

Health hazards: skin contact can be the main absorption route, and may cause acute kidney damage. Diesel oil can cause contact dermatitis and oil acne. Inhalation of such substance in mist or liquid form may result in aspiration pneumonia. It can enter the fetal blood through placenta. Diesel exhaust can irritate eye and nose, cause dizziness and headache.

(6) Hydrogen

It is a kind of colorless and odorless gas. Melting point: -259.2 ℃, boiling point: -252.8 ℃, relative density: (water = 1) 0.07 (-252 ℃), relative vapor density: (air = 1) 0.07, critical pressure: 1.3MPa, critical temperature: -240 ℃, ignition temperature: 400℃, explosion limit: 4.1% ~ 74.1% (v/v). Insoluble in water, ethanol and ether. Used in synthesis ammonia and methanol, petroleum refining, organic hydrogenation and as rocket fuel.

It is flammable. It can mix with air to form explosive mixtures, and will explode when being exposed to heat or open fire. Such gas is lighter than air. When it is used or stored indoors, when leakage occurs, it will rise and stay at room roof, and is not easy to discharge. It will explode when meeting sparks. Hydrogen reacts violently with fluorine, chlorine, bromine and other halogen. Its hazardous chemical number is No. 21001. According to Classification and Labels of Dangerous Chemical
Substances Commonly Used (GB13690-92), it belongs to Class 2.1 flammable gas.

(7) Chlorine dioxide (ClO₂)

It is with pungent odor similar to chlorine, volatile, easy to explode. It easily explode when its concentration in air is greater than 10% or its concentration in aqueous solution is greater than 30%. Affected by the light, it easily decomposes or explodes. Soluble in water, when heated, it is decomposed into hypochlorous acid and oxygen, so it should be sealed and kept in a cool, dark place.

(8) Fungicide

It is divided into solid and liquid forms. The main constituent of solid is calcium hypochlorite; the main constituent of liquid is isothiazolinone. The purpose of fungicide is to kill live organism, so many fungicide products impose significant threats to human health. When using fungicide products, one must be very careful, wear protective clothing and use the relevant protection tools.

<table>
<thead>
<tr>
<th>Name of Material</th>
<th>Property</th>
<th>Explosive limit (%)</th>
<th>Flash Point (°C)</th>
<th>Fire Hazard Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel</td>
<td>Flammable liquid</td>
<td>1.5     4.5</td>
<td>50-90</td>
<td>C1</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>Flammable liquid</td>
<td>/       /</td>
<td>&lt;50</td>
<td>A</td>
</tr>
<tr>
<td>Hydrazine</td>
<td>Flammable liquid</td>
<td>/       /</td>
<td>38°C</td>
<td>B</td>
</tr>
</tbody>
</table>

7.2 Risk Identification

7.2.1 Fire, explosion hazard identification

Wuxiang Hexin Thermal Power Plant involves diesel, hydrogen, hydrazine and other combustible materials, with certain fire and explosion risk. The enterprise
adopts various safety compensation measures against accident occurrence: ① according to relevant provisions of the state, the ministries and the industry, develop and improve rules, regulations and operation procedures; ② Install combustible gas detection and alarm device in the operation area; ③ The periphery of the devices is equipped with fire control and water supply system, and will be installed with fire-fighting equipment.

7.2.2 Toxicity Hazard Identification

Toxic hazard standard is mainly based on *Occupational Exposure Limit for Hazardous Agents in the Workplace* (GBZ2-2002), see Table 7.2-1 for detail.

**Table 7.2-1 Summary of Hazard Evaluation Criteria of Major Toxic Substances of Device (mg/m³)**

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of Harmful Substances</th>
<th>Evaluation Criteria</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hydrochloric acid</td>
<td>7.8</td>
<td>Maximum allowable concentration</td>
</tr>
<tr>
<td>2</td>
<td>Liquid caustic soda</td>
<td>2</td>
<td>Maximum allowable concentration</td>
</tr>
</tbody>
</table>

Physical hazard index uses the following formula:

\[
Hi = \frac{Qi}{C_{0i}}
\]

Where:  
- \(Hi\) --- Hazard index of toxic substance \(i\);  
- \(Qi\) --- processing or storage capacity of the \(i\)th substance (kg);  
- \(C_{0i}\) --- allowable concentration of the \(i\)th substance (mg/m³).

**Table 7.2-2 Amount of storage and transportation of main toxic substances**

<table>
<thead>
<tr>
<th>No.</th>
<th>Toxic Pollutant</th>
<th>Storage Amount (ton/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hydrochloric acid</td>
<td>600</td>
</tr>
<tr>
<td>2</td>
<td>Liquid caustic soda</td>
<td>500</td>
</tr>
</tbody>
</table>

See Table 7.2-3 for hazard index of main substances derived from the above
formula.

Table 7.2-3 Hazard Index of Main Substances

<table>
<thead>
<tr>
<th>No.</th>
<th>Toxic Pollutant</th>
<th>Hazard Index Hi</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hydrochloric acid</td>
<td>$2.19 \times 10^5$</td>
</tr>
<tr>
<td>2</td>
<td>Liquid caustic soda</td>
<td>$9.98 \times 10^5$</td>
</tr>
</tbody>
</table>

As seen from Table 7.2-3, according to the above method, Wuxiang Hexin Thermal Power Plant judges the toxic substances and materials involved in the production process, liquid caustic soda is the primary hazard, followed by hydrochloric acid.

7.2.3 Summary of major risk factors identification

Wuxiang Hexin Thermal Power Plant uses coal and water as main raw materials used in the production process. The production process involves hydrochloric acid, liquid caustic soda, ammonia water, hydrazine, diesel and other hazardous substances. Because the amount of these substances is small, under the premise of adopting various preventive measures, the toxicity hazardous effect as well as fire and explosion hazards are not significant.

7.3 Status Quo of Dangerous Chemicals Management

In order to strengthen and standardize the safety management of hazardous chemicals, ensure the lives and property safety, and protect environment, according to Regulation on the Management of Hazardous Chemicals issued by the State Council, Wuxiang Hexin Thermal Power Generation Co., Ltd specially formulated Dangerous Chemicals Safety Management System which covers the purchase, transportation, storage, use and management of Hazardous Chemicals. The system includes the following aspects:
(1) Applicable scope of this system

This system is applicable to company-wide use of flammable, explosive, toxic, harmful and corrosive chemicals which may cause injury or damage to personnel, facilities and environment, such as hydrochloric acid, alkali, hydrogen, ammonia water, gasoline, diesel, toxic chemicals.

(2) Management content and requirements

① Engaging in hazardous chemicals work must strictly comply with Regulations on the Safety Administration of Dangerous Chemicals issued by the State Council and other relevant regulations. Where accident occurs, the company’s emergency response plan should be implemented.

② The hazardous chemicals which forms a significant source of danger should be monitored, controlled, and assessed regularly, the hidden dangers should be eliminated timely, and effective measures should be taken to prevent major accidents.

③ Requirements on dangerous chemicals operation personnel.

a. The leaders of the departments with dangerous chemicals should be responsible for the safety of hazardous chemicals in their respective departments.

b. The personnel engaging in the transportation, storage and use of dangerous chemicals activities must receive the training on relevant laws, regulations, rules and safety knowledge, expertise, occupational health protection and emergency rescue knowledge. They must pass the examination before taking their posts.

④ Requirements on dangerous chemicals transportation personnel.

The transport drivers, loading and unloading management personnel, and transportation escorts who engage in hazardous chemicals transportation must receive the training on relevant safety knowledge, master the safety knowledge on hazardous chemicals transportation, must pass the examination by the municipal transportation department and obtain the qualification certificate before taking their posts.
transportation, they need firstly understand the nature and hazardous properties of hazardous chemicals, usage characteristics of containers and accident emergency measures, and meanwhile should also be equipped with the necessary emergency equipment and protective appliances.

⑤ Requirements on hazardous chemicals storage and usage

a. Storage of hazardous chemicals must meet the following conditions:

i. Storage methods and facilities meet national standards.

ii. The peripheral protection distance of warehouses comply with the national standards and regulations.

iii. The management and technical personnel who are responsible for storage and use of hazardous chemicals should be equipped with reliable personal protective appliances.

iv. Establish an effective security management archive which covers: the number of workers at workplace, name of hazardous substances, total warehouse area (m), storage tank volume (m$^3$), number of storage tanks, actual volume of storage tank (t), monitoring methods, main monitoring and control facilities, fire control facilities, protection facilities, inspection, notes, etc.

v. The storage of highly toxic chemicals and other dangerous chemicals should be subject to the approval to the Safety Supervision Bureau, and the relevant registration formalities should be handled with the industrial and commercial administrations.

vi. Without the approval of the public security departments, storage warehouse for dangerous chemicals shall not be set freely.

vii. Smoking and the use of fire is prohibited within the buildings and regions where hazardous chemicals are stored.

viii. Stored dangerous chemicals should be clearly marked. Hydrogen tanks in the hydrogen generation station should be examined regularly in accordance with *Supervision Regulation on Safety Technology for Pressure Vessel, Pressure Vessels*.
Periodical Inspection Regulation (R7001-2004), Administrative Measures for the Registration for Use of Boilers and Pressure Vessels (guozhijianguo [2003] No. 207), Gas Cylinder Safety Supervision Code and other requirements, so as to ensure the safety valve to function normally, prevent over-pressure and over-temperature operation.

b. Storage and use of hazardous chemicals

i. The storage and use of hazardous chemicals should be responsible for by specific personnel. The departments which store and use dangerous chemicals should establish effective safety management systems and archives. Detailed record should be made timely on the purchase of hazardous chemicals and the inspection on safety facilities.

ii. The departments which use and store highly toxic chemicals must have a strict management system and establish safety management archives. Highly toxic chemicals must be stored separately, and implement the system of “highly toxic chemicals are received and dispatched by two persons, stored by two persons”. Specific personnel are responsible for highly toxic chemicals, and make accurate record on the quantity, flow, storage amount and usage of highly toxic chemicals, adopt necessary security measures to prevent the toxic chemical items from being stolen, lost and misused. Once highly toxic chemicals are found stolen, lost or misused, such situation should be immediately reported to the security department and fire control department as well as the local public security department.

According to the types and characteristics of hazardous chemicals, the departments using hazardous chemicals, storage warehouses and other places are equipped with safety facilities and equipment used for monitoring, ventilation, sun protection, temperature adjustment, fire control, fire extinguishment, anti-explosion, pressure relief, anti-poison, disinfection, neutralization, moistureproof, lightning protection, anti-static, anti-corrosion, anti-leakage, protection dike or isolated operation. These safety facilities and equipment should be maintained in accordance
with national standards and relevant state regulations, so as to ensure compliance with safety operation requirements.

7.4 Problems Existing in Hazardous Chemicals Management and Solutions

7.4.1 Problems Existing in Hazardous Chemicals Management

The power plant's current dangerous chemicals management is basically in accordance with *Dangerous Chemicals Safety Management System* formulated by the enterprise, but some improvements still need to be made. For example, some warehouses storing hazardous chemicals are not well marked.

7.4.2 Solution

The enterprises should strictly follow *Dangerous Chemicals Safety Management System*, and the labels of hazardous chemicals should reflect the storage amount of hazardous materials, hazardous properties and protective measures. Specific content should cover warning words, concentration, hazard description, safety measures, fire fighting methods, etc.

7.5 Summary

As for hydrochloric acid, liquid caustic soda, ammonia water, hydrazine, diesel and other hazardous substances which are involved in the production process of Wuxiang Hexin Thermal Power Generation Co., Ltd, because the storage and usage amounts of these substances are small, under the premise of adopting various preventive measures, the toxicity hazard effect as well as fire and explosion hazards can be effectively controlled.
8. Overview of Power Plant Occupational Health

8.1 Occupational Disease Prevention and Control System


The company also established Production Safety Committee, and Occupational Disease Prevention Working Committee, with General manager as the director of the committees; the company also established a company-wide safety network; HSE Department exercises the functions of labor safety and occupational health management and supervision, and makes the company to form complete system of labor safety and environmental safety and management and safety oversight functions, the company has formed a complete system of labor safety and occupational health management system. Daily anti-poison and anti-dust work as well as chemical damage inspection and testing are responsible for by the company’s environmental protection monitoring station. The examination on occupational hazards at the workplace is conducted by Changzhi Safety Equipment Testing Center which issues evaluation reports.

8.2 Occupational Disease Prevention and Management Program

Main occupational hazards existing in power plants are dust, toxin and noise.

(1) Dust
Dust hazards mainly exist in the coal transportation, storage, feed, grinding and in the
dust-removal system. The antidust measures adopted are:

1. The leather belt of coal-transmission system is equipped with sprinkler system to increase humidity and suppress dust.
2. In terms of equipment, adopt the ring-hummer type coal crusher with good antidust and dust suppression effect and small volume of blast, the roller stacker-reclaimer with water-spraying and dust-suppression device, and the bridge-vane type coal feeder with water mist sprayer.
3. The coal field is equipped with independent spraying and anti-dust device which is mainly used to spray water on the surface of coal pile so as to suppress the dust spread, prevent environmental pollution and reduce the fire coal loss in the non-frozen seasons.
4. Each coal placement point at each transfer station is equipped with DSX-14-type wet dust collector to suppress dust.
5. The top of bunker bay is installed with JMC-100-B pulse bag-type dust collector. 1#, 2# furnaces share a total of 16 coal bunker bays, with four cloth bag filters, each bag-type dust collector interlocks with coal plough.
6. The workers exposed to dust should wear dust-proof mask, dust-proof overalls, gloves and so on.

(2) Noise

Thermal power plants have comprehensive noise sources, including all kinds of fans, water pumps, coal crushers, steam turbine generator unit and boiler and so on. The anti-noise measures taken are:

1. The boiler ignition and exhaust pipes, re heater ignition and exhaust pipes, main steam safety valve, re heater outlet safety valve, exhaust inlet of blower, are equipped with silencers.
2. Coal mills should be installed with sound-insulation enclosures, the carbon brush of exciter should have fan covered with sound-proof shield; the heat-insulation material used in steam turbine head also has the acoustic insulation effect; the inlet of control room is equipped with door gate, and aluminum alloy single-fan automatic
soundproof door. Decoration materials which use good sound-absorbing properties should be used indoors, and indoor air conditioning unit should have a silencer;

③ Workers exposed to noise should wear earplugs.

(3) Poisonous substance
Toxic hazards are present in the storage and feeding points of hazardous substances such as carbon monoxide, sulfur dioxide, nitrogen oxides, ammonia, hydrochloric acid, sulfuric acid, sodium hydroxide, etc. Anti-virus measures taken include:

① The places where corrosive media are stored and harmful gases are generated all use the granite ground surface to prevent corrosion, the outer surface of equipment, columns, beams and escalators adopt the glass-lined steel and are coated with chlorosulfonated polyethylene so as to prevent corrosion. As for the acid gas within the workshop, the liquid sealing and acid mist absorber are adopted. Alkaline gas tank uses forced ventilation equipment. The equipment and valves exposed to acid-base system all use the rubber-lined Polytetrafluoroethene to prevent corrosion. In order to prevent personnel from suffering burns by acid and alkali, and the acid and alkali unloading station should have the spray measures to respond to accidents.

② Water analysis room of Chemical Building is equipped with ventilation cabinet, and the toxic drugs are stored in a dedicated drug cabinet. Chlorination room and chlorine bottles should both be equipped with atmospheric chlorine detector and forced ventilation equipment. In case of chlorine leakage accident, the outdoor chlorine absorber is used to absorb chlorine; chlorination room should be furnished with gas masks. The ammonification room and the hydrazine room at zero-meter layer at tail of Centralized Control Building should be equipped with forced ventilation equipment, The ammonification equipment and hydrazine-adding equipment should be of closed type.

③ The operation room of domestic sewage treatment station should be installed with mechanical ventilation equipment which changes air no less than six times per hour,
and the indoor air recirculation is not allowed.

④ Further strengthen the maintenance work for protective facilities so as to prevent the flowing, dripping, leaking phenomenon.

⑤ Strengthen workers personal protection work. The workers exposed to acid and alkali should wear the acid-base anti-acid clothes.

(4) Non-ionizing Radiation

The generator-transformer-circuit unit is connected to 500KV distributor. The distributor adopts one-and-a-half breaker configuration and there are 6 intervals in total, forming 2 complete strings and 1 incomplete string. The width of interval is 30m, and the spacing is 7.5m. The tank SF6 circuit breaker is adopted.

During the design and planning of Phase-I project, the mitigation measures of electromagnetic radiation has been considered. After the Phase-I project was put into operation, on the premise of reliable power supply for electric equipment and generating units operation, the following safety rules has been formulated to ensure the safety of electromagnetic field:

① The unattended duty is assigned in booster station. The electric equipment is remotely operated and monitored so as to minimize the numbers and time of entering electromagnetic fields.

② The electromagnetic filed is shielded to lessen electromagnetic leakage. The generating units, substation equipment and distributing equipment shall be protected with shell. The transmission overhead lines are arranged to reduce electromagnetic radiation. The electrical and control cables are grounded with protection and shield layers.

③ The promotion and education are strengthened. The training on electromagnetic knowledge and its prevention knowledge are given to improve prevention consciousness.

④ During the repairing and maintenance of electric equipment, the power off permit shall be obtained. In case of work without power off, the safe distance from electric equipment shall be kept and the shield clothing shall be worn, in addition to insulating measures.
⑤ The occupational disease prevention mechanism shall be constructed. The electric workers shall periodically receive the physical examination and the results shall be recorded. In case of any problem, the prevention measures shall be carried out promptly.

⑥ In regions with strong electromagnetic radiation, the warning signs shall be hanged to remind workers’ attention. On the work permit in areas with strong electromagnetic radiation, the radiation points and control measures shall be stated.

(5) Heat

Since the 2×600MW direct air-cooling generating units were put into operation, high-temperature and high-pressure equipments have been insulated to ensure that the surface temperature of insulation is lower than 50℃. During the operation of generating units, the production staffs mainly check the outward of main steam pipes, reheating steam pipes, water supply pipes, boilers, steam drums, turbine and its extraction pipes. During the overhaul of generating units, in accordance with Code on Electrical Work Safety, the system is isolated and the work shall be started after the safe measures have been arranged according to requirements of work permit; therefore, the company has adopted the following measures:

① The pressure vessels and pipes shall be regularly checked and maintained. The inspection personnel from electric power research institute shall be invited to launch the annual outward inspection on pressure vessels and pipes, as well as inward inspection every 4 years. In case of any defect, such problems shall be promptly solved; meanwhile, the accessories such as safety valves and pressure gauges shall be regularly calibrated.

② The operators shall regularly vent and discharge the pressure vessels. In case of any defect or damage of insulation, the maintenance staffs shall promptly eliminate such defect. During the repairing period, the accessories such as valves shall be disassembled and repaired.

③ When checking the inward of vessels, the ventilation shall be guaranteed. After the manhole is opened, the air is exhausted by axial fan. In case of any harmful gas, after
extraction, the inward vessels shall be checked with special instruments to ensure the qualified work environment; meanwhile, the qualified temperature and humidity shall also be ensured.

④ In case of necessary work in high-temperature vessels and pipes, the monitoring person shall be assigned and the drinking water shall be prepared. The check staff cannot is not allowed to stay inside such vessels and pipes for too long time. The check staff shall have a break and drink enough water after certain time so as to avoid dehydration.

⑤ In case of working in high-temperature vessels, the voltage of electric equipment shall not be higher than 36V and lighting voltage shall not be higher than 24V; meanwhile, anti short circuit measures shall be adopted. In case of working on high-temperature pipes, the power cable of electric equipment and lighting cable shall not contact the pipes to prevent short circuit.

⑥ In case of work near the high-temperature surface, the warning signs shall be hanged to prevent scalding others; meanwhile, the workers shall wear insulated gloves and shoes to prevent burning.

(6) Enclosed Space
Wuxiang Hexin Power Plant has 2 sets of domestic coal-fired turbine generators. The turbine is manufactured by Harbin Turbine Co., Ltd., model: NZK600-16.7/538/538, which is sub-criteria, pressure impulse, intermediate reheating, single axle, three-cylinder (one high and medium pressure combined cylinder and two low pressure cylinders), four-drainage direct air-cooling condense turbine. The boiler is manufactured by Wuhan Boiler Co., Ltd., adopting four-corner tangential combustion, single chamber†type arrangement, intermediate reheating, balancing ventilation, total steel structure, semi-enclosed arrangement, scraper slag conveyor for continuous slag discharge.

The enclosed space refers to chamber, flue, steam drum, high and medium pressure heaters, oil tank and oil storage tank. The following measures shall be adopted during the repairing and maintenance in aforesaid enclosed spaces:

① General
a. The work permit shall be handled in case of repairing in enclosed spaces.
b. All of necessary switching work shall be completed before repairing; the water, oil and gas inside the vessels shall be discharged so as to ensure the safe partition between enclosed space and other spaces.
c. Any repairing work is forbidden in pressurized enclosed space.

② Cautions on Working in Boiler, Flue and Milling System

a. In the enclosed space where gas existed before, the gas pipes under operation shall be reliably partitioned (closing valves and installing blind plates); and then inert gas or steam shall be used to blow the pipe and replace the residue gas. After ventilation, the small animals and instruments shall be used to testify that there is no gas residue and qualified oxygen content.
b. The following rules shall be complied with in case of repairing in gas-contained places:

The workers shall wear gas masks and work at upwind location.
There shall be at least 2 workers, 1 worker as the monitor person.
When working inside pipes or at the places where the rescue is difficult to organized, the safety belt shall be used. One end of belt shall be held by monitor person. The monitor person shall keep communicating with the worker inside pipes.
The bronze tools shall be used to avoid spark (in case of steel tools, the butter shall be applied).
The shoes with iron spikes shall be forbidden.
In case of any uncomfortable feeling, all the workers shall immediately evacuate from workplace and take a rest in ventilated place.
The first-aid medicines such as oxygen, ammonia and cotton shall be prepared.

③ In case of working in enclosed spaces where oil is stored, in addition to related rules stipulated herein, the fire prevention measures shall be adopted.
The welding is forbidden in enclosed space where oil is stored.

④ The ventilation shall be strengthened in enclosed space, while the oxygen supply is not allowed.
a. In case of any harmful gas or residue that is possible to generate harmful gases, the enclosed space shall be ventilated; workers cannot enter into such space before
clearing such harmful gases and residues. Workers shall work and rest in rotation.
b. Workers who work in the enclosed space shall learn the professional knowledge (cautions on using electric tools, gas poisoning and first-aid measures of choking). There shall be at least two workers, 1 worker as monitor person. In case that harmful gases might be generated, there shall be at least three workers, 2 workers as monitor persons.
c. In case that a ladder is needed in enclosed space, workers shall wear safety belt, one end of which shall be fastened to a firmly position.
d. In case of rubber lining, painting and coating of epoxy fiberglass, the manhole and pipe valves shall be opened and ventilation shall be ensured. In the workplace, the fire prevention tools such as foam extinguisher and dry sand shall be provided and fire is forbidden. The workers who are allergic to such environment are not allowed to attend.

(7) Electrical Hazards
Wuxiang Hexin Power Plant has 2 sets of 600MW coal-fired direct air-cooling generators. Generators adopt Three-phase synchronous turbo-generator, with water and hydrogen cooling, rated voltage: 20KV, rated power: 600MW. The master transformer unit comprises 3 sets of single-phase two-winding transformers. The main electric wiring adopts generator-transformer unit wiring connecting to 500KV power distribution units; the generator lead-out and sub-feeder adopt self-cooling enclosure-continuous isolated phase bus; high-voltage auxiliary power is at 10.5KV, with middle impedance; low-voltage auxiliary power adopts 0.4/0.23KV neutral grounding.

Wuxiang Hexin always adheres to the safe production principle of “Safety First and Prevention Upmost”; carefully fulfills post safety responsibility system; regulates safe production management; strengthens site management; and formulates various safety rules. In order to prevent, lessen and control electric risk, the following measures have been adopted:

① The electric workers must be in normal mental condition, without and disease that will hinder their work. They shall receive the training on electric theories and safety knowledge and pass the examination before work. In addition, they shall learn the first aid knowledge, especially first aid for electric shock.
② During work on electric equipment, work permit system, operation permit system, work license system, work monitoring system, as well as work intermittence, transfer and termination system shall be strictly followed.

③ The design and construction quality of electric engineering projects shall be guaranteed, with reasonable design and correct type selection. The quality of electric equipment shall be in compliance with related state standards and provisions. The maintenance and installation shall follow the related procedures.

④ When working on electric equipment or lines those are completely or partly powered off, the technical measures such as power off, power off check, grounding connection, hanging warning sign and railing shall be adopted.

⑤ During work, the distance between work position and energized equipment shall meet the requirement on the minimum distance.

⑥ Electrical safety equipment. In order to prevent electrical shock, arc burns, and other high-altitude crash accident, electric workers must use a qualified electric security tools, such as insulating rod, insulated clamps, insulation baffles, insulated gloves, insulated boots, insulated shoes, insulating platforms, insulating mats, electroscope, high-pressure nuclear phase detector, high and low-voltage ammeter, etc.; general protective safety equipment shall also be used, such as portable ground wire, temporary masking, warning signs, goggles, belts and so on.

⑦ All metal casing of electrical equipment shall be well grounded, and grounding device is not allowed to disconnect (remove).

⑧ On-site Emergency Treatment of Occupational Disease
Some occupational disease are acute, especially acute chemical poisoning, on-site emergency treatment must be well done, because it is the most important step for saving lifes, giving best treatment, preventing disease deterioration and promoting early recovery. The specific issues should be dealt with according to Special Emergency Plan on Dangerous Chemicals Leakage Accident, Productive Acute Poisoning On-site Disposal Plan, and Occupational Disease Prevention and Control Management Standards.
8.3 Fund for Occupational Disease Prevention and Control

Wuxiang Hexin Thermal Power Generation Co., Ltd offers about 510,000 RMB of occupational disease prevention and control fee, mainly including:

(1) 200,000 RMB in labor protection special fee needed by prevention each year.
(2) Annually average 110,000 RMB used for medical examination of workers. (Comprehensive physical examination on workers is made once per year, special medical examination is made on workers who are engaged in special job (by the job type exposure to dust and toxicants)
(3) 200,000 RMB used in health protective equipment and facilities.

8.4 Implementation of Occupational Health Prevention and Control

In the beginning of production, in July 2007, Department of Health of Shanxi Province organized the inspection team consisting of members from Changzhi Municipal Health Bureau, Changzhi Municipal Center for Disease Control & Prevention, Wuxiang County Health Bureau and other units and the experts, and inspected the occupational disease protective facilities under our company’s generator unit newly-constructed project. Subsequently, the company made rectification of the problems detected during the inspection.

In recent years, our company entrusted Changzhi Equipment Safety Monitoring Center to conduct regular inspection on power plant’s operation environment every year, and made timely rectification of problems raised in the inspection results. After recent years of efforts, Wuxiang Hexin Thermal Power Plant can meet various norms and standards with regard to labor safety and industrial hygiene, so far, the company has no employee who suffers occupational disease onset.

8.5 Summary

In combination with occupational health characteristics of power generation enterprises, given that various unsafe and unhealthy factors affect employee safety and health during the production process, Wuxiang Hexin Thermal Power Generation Co., Ltd has adopted various precautionary measures, and done a lot of work in terms of standardized management, project control, staff education and training, personal protective equipment, and dust monitoring. In practical work, the company effectively
ensures the safety and health of workers.

8.6. Community Health and Safety

8.6.1. Water Consumption

The production water of the power plant is supplied by Guanhe Reservoir, with designed water consumption: 648m³/h, actual water consumption: 358m³/h, annual water consumption: 3.13 million tons. The engineering water is mainly the supplementary circulating cooling water for auxiliary machine, with water circulation rate: 5,761m³/h, water circulation ratio: 93.8%, fresh water consumption: 358m³/h. All of the production water and sewage can be reused after treatment; therefore, there is no wastewater effluent outside.

The exhaust steam of turbine is directly cooled by air. The closed circulating water supply system is adopted to supply cooling water to auxiliary machine. The dry ash removal and dry ash deposit are adopted to save water resource at the largest extent.

For this retrofit project, the facilities and equipment such as condenser, circulating pump station and mechanical-draft cooling tower shall be constructed and installed. The northern site of Phase-I auxiliary machine cooling tower (formerly designed for Phase-II auxiliary machine cooling tower) can be utilized to construct mechanical-draft cooling tower. According to calculation and site layout, the circulating water amount shall be 2×6000 m³/h; the size shall be 38×23.2m; the total water consumption shall be 264m³/h. The increasing water consumption needs to be approved by related government authorities and will affect the water source of Phase-II project, but the peaking cooling system will be mainly used during 12:00 and 18:00 in summer time; in case of water shortage, the peak cooling system can be shutdown to ensure the necessary water supply; therefore, this retrofit project will not impact the water consumption of individual sanitation, agriculture, leisure facilities and communities.

8.6.2. Traffic Safety

There are several cars in the company, without obvious impact on the local normal traffic. The company has formulated Management Method on Vehicle and
Drivers and Drivers Code of Wuxiang Hexin Thermal Power Generation Co., Ltd to ensure the traffic safety. Since the establishment of the company, there is no traffic accident.

The main materials are transported by social vehicles; meanwhile, there is a dedicated road to transport ash, slag and gypsum, without any impact on social traffic.
9. Power Plant Emergency Plan

9.1 Preparation of Power Plant Emergency Plan

In April 2007, Wuxiang Hexin Thermal Power Generation Co., Ltd set about organizing relevant production department to prepare the production safety emergency rescue plan, and set up a leadership group which is responsible for review, modification and coordination work. After the plan was completed in June of the same year, it was issued and implemented and after examination and approval.

In December 2008, Wuxiang Hexin Thermal Power Generation Co., Ltd made amendment and internal review of Production Major Accident Emergency Rescue Plan according to Guidelines for Preparation of Contingency Plans issued by State Administration of Work Safety. On December 20, 2008, the emergency office of Shanxi Provincial Work Safety Bureau organized experts to review the company’s Production Major Accident Emergency Rescue Plan, and put the plan on record after approving the plan. In April 2010 and February 2011, the company made revision and internal review of the Emergency Rescue Plan twice, it also invited the emergency office of Shanxi Provincial Work Safety Bureau to organize experts to conduct external review.

9.2 Overview of Power Plant Emergency Plan

The company’s contingency plan is: major emergency comprehensive contingency plan, 15 special emergency plans and 30 on-site disposal programs.

9.2.1 Major Production Emergencies Comprehensive Contingency Plan

(1) Purpose and role of preparation: effectively control the occurrence and development of emergencies, eliminate the threat of accidents on people and equipment as soon as possible, and reduce to the loss to a minimum.


(3) This plan applies to the enterprise-level on-site emergency response work within the region of Wuxiang Hexin Thermal Power Generation Co., Ltd.

(4) Emergency plan system is shown in Figure 9.2-1.

(5) Hazard source and risk analysis

According to identification and analysis of hazards and risks existing in the company’s production and business activities, referring to the relevant definitions of emergencies as stated in the national and industrial emergency response plans, Wuxiang Hexin Thermal Power Generation Co., Ltd determined the risk objectives to be as follows: personal injury, fire disaster, destructive earthquakes, environmental pollution, major floods, major equipment accidents, natural disasters, major public health emergencies and so on.
Major hazard sources include boiler room and hydrogen storage tank. The possible explosion of hydrogen generation station, boiler explosion and other accidents will affect the personnel safety, the company’s normal production order and property loss.

(6) Emergency organization system is shown in Figure 9.2-2.
Figure 9.2-2 The Company’s Emergency Organization System

武乡和信发电公司重大突发事件综合预案

自然灾害类

破坏性地震专项预案

重大洪灾专项预案

事故灾难类

交通事故专项预案

人身伤亡专项预案

机械伤害现场处置方案

触电事故现场处置方案

高空坠落现场处置方案

生产性急性中毒现场处置方案

窒息性化合物中毒现场处置方案

设备损坏专项预案

汽机大轴弯曲现场处置方案

发电机组超速现场处置方案

机组轴系断裂现场处置方案

汽机叶片断裂现场处置方案

机组烧瓦现场处置方案

锅炉管壁爆漏现场处置方案

锅炉大面积结焦现场处置方案

制氢系统爆炸现场处置方案

变压器火灾现场处置方案

发电机火灾现场处置方案

油系统火灾现场处置方案

燃油区火灾现场处置方案

重大火灾专项预案

储灰场溃坝专项预案

制氢系统爆炸现场处置方案

变压器火灾现场处置方案

发电机火灾现场处置方案

油系统火灾现场处置方案

燃油区火灾现场处置方案

重大火灾专项预案

储灰场溃坝专项预案

重大火灾专项预案

储灰场溃坝专项预案

全厂停电专项预案

危险化学品泄露专项预案

燃料供应紧缺专项预案

环境污染专项预案

脱硫设备损坏专项预案

极端低温天气专项预案

网络信息系统安全专项预案

事故灾难类

公共卫生专项预案

群体性食物中毒现场处置方案

群体性不明原因疾病现场处置方案

公共卫生专项预案

传染性疾病爆发现场处置方案

群体性食物中毒现场处置方案

群体性不明原因疾病现场处置方案

公共安全事故类

破坏性地震专项预案

重大洪灾专项预案

重大火灾专项预案

储灰场溃坝专项预案
武乡和信发电公司重大突发事件综合预案 Major emergencies comprehensive plan of Wuxiang Hexin Thermal Power Generation Co., Ltd

自然灾害类 Natural disasters
破坏性地震专项预案 Destructive earthquake special contingency plan
重大洪灾专项预案 Major flood special contingency plan
交通事故专项预案 Traffic Accident special contingency plan
人身伤亡专项预案 Personal injury specific contingency plan
机械伤害现场处置方案 Mechanical damage on-site disposal program
触电事故现场处置方案 Electric shock accident on-site disposal program
高空坠落现场处置方案 High-altitude fall on-site disposal program
生产性急性中毒现场处置方案 Productive acute poisoning on-site disposal program
窒息性化合物中毒现场处置 Suffocation-induced compound poisoning on-site disposal program
设备损坏专项预案 Equipment damage specific plan

汽机大轴弯曲现场处置方案 Turbine shaft bending on-site disposal program
发电机组超速现场处置方案 Generator unit overspeed on-site disposal program
机组轴系断裂现场处置方案 Machine unit shafting fracture on-site disposal program
汽机叶片断裂现场处置方案 Turbine vane fragment on-site disposal program
机组烧瓦现场处置方案 Machine unit burning on-site disposal program
锅炉管壁爆漏现场处置方案 Boiler pipe wall explosion and leakage on-site disposal program
锅炉大面积结焦现场处置方案 Boiler large-area coking on-site disposal program
制粉系统爆炸现场处置方案 Pulverizing system blast on-site disposal program

公共卫生类 Public health
公共卫生专项预案 Public health special plan

极端低温天气专项预案犯案 Extreme cold weather special contingency plan
燃油区火灾现场处置方案 Fuel region fire on-site disposal program
输煤系统火灾现场处置方案 Coal handling system fire on-site disposal program
控制室火灾现场处置方案 Control room fire on-site disposal program
电子设备间火灾现场处置方案 Electronic equipment room fire on-site disposal program
电缆火灾现场处置方案 Cable fire on-site disposal program
档案室火灾现场处置方案 Archives room fire on-site disposal program
办公场所火灾现场处置方案 Office place fire on-site disposal program
全厂停电专项预案 Whole-plant blackout specific contingency plan
危险化学品泄露专项预案 Hazardous chemical leakage special contingency plan
燃料供应紧缺专项预案 Fuel supply shortage special contingency plan
环境污染专项预案 Environmental pollution special contingency plan
脱硫设备损坏专项预案 Desulphurization equipment special contingency plan

Figure 9.2-1 The Company’s Emergency Plan System

(7) Early warning and prevention

① Early warning

Hazards sources are monitored by the remote computer and inspected by persons on duty. Abnormal situation, once found, should immediately be reported to the relevant departments.

② Prevention

Make rational design and scientific management in accordance with Twenty-five Key Requirements on Preventing Serious Accident and Failure in Electric Power Generation, essentially eliminate security risks and hazardous factors. Safety evaluation should be carried out annually; risk and hazardous factors identification should be made, and the appropriate rectification work should be carried out.

According to the principle of “early detection, early reporting, and early disposal”, predict possible accidents, and timely report to emergency command center, and notify relevant departments.

Preventive measures include materials reserve, emergency drills, etc.

③ Early warning action

As for equipment, as well as hydrogen generation stations, fuel pump, dry ash tank, dry ash field, residue field and other facilities, if there are risks such as fire,
explosion, casualty, collapse, destructive earthquakes and floods, whole-plant blackout, power grid accidents, the person who finds the above risk should immediately report by phone to the shift supervisor and relevant command departments, and the command departments should immediately report to the company’s command headquarters. The command center should issue emergency rescue order according to specific situation. If emergency shelter, expansion of the emergency response, and outward rescue is needed, the command center should appoint the corresponding office, security, fire control, heath departments to make emergency response.

(8) Emergency response

① Response classification

Based on the hazardous levels for the accident, warning grade is usually divided into four groups: Grade I (particularly severe), Grade II (severe), Grade III (heavier) and Grade IV (general), indicated by red, orange, yellow and blue respectively.

Red Level (Grade I): personal casualties, whole-plant blackout, destructive earthquakes, major fire disaster, major floods, dam collapse due to flooding, etc.

Orange Level (Grade II): severe (Grade II) or more accident is expected to occur, when accident is approaching, the situation may be aggravated.

Yellow Level (Grade III): heavier (Grade III) or above accident is expected to occur, when accident is approaching, the situation may be aggravated, e.g. power grid accident, fire occurs in elevator and personnel trapped in elevator.

Blue Level (Grade IV): general (Grade IV) or above accident is expected to occur, when accident is approaching, the situation may be aggravated.

In accordance with the above warning level classification criteria, the early warning level of emergencies should be refined in their respective emergency plans.

The early warning level should be proposed firstly by the emergency commander-in-chief in accordance with the plans for different categories of
emergencies, and the proposal should be submitted to the emergency command center for approval.

② Response procedures

Emergency response includes primary response, response procedures, emergency response expansion, emergency response expansion, information dissemination, post-stage disposal.

(9) Training and drill

① Training

The training on emergency rescue knowledge should be included in the annual work plan. The human resources department should organize first aid training at least once per year, if necessary, experts are invited to impart rescue knowledge to workers, and train the commander-in-chief, members of command teams, rescue personnel, personnel on their posts, and other personnel in terms of safety technology, self-help and mutual aid and other basic emergency response knowledge.

② Drill

The workshops should organize training at least once a year, improve the commanding level and rescue ability. Emergency drill program should be developed in line with plans the company’s emergency plan.

9.2.2 Production Major Accident Special Emergency Rescue Plan

In order to ensure the company's emergency plan to be feasible in the accident, the emergency plan lists 13 specific contingency plans. See details in Table 9.2-1.

9.3 Summary

Wuxiang Hexin Thermal Power Generation Co., Ltd has developed Production Major Accident Special Emergency Rescue Plan according to the relevant requirements, so as to effectively control the occurrence and development of emergencies, eliminate the threat of accidents on people and equipment as soon as possible, and reduce to the loss to a minimum when the emergency occurs.
Table 9.2-1 Overview of Production Major Accident Special Emergency Rescue Plan issued by Wuxiang Hexin Thermal Power Generation Co., Ltd

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Responsible Dept</th>
<th>Determination of Accident Type and Hazard Level</th>
<th>Emergencv Level</th>
<th>Emergency Disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Personal injury specific contingency plan</td>
<td>HSE Dept</td>
<td>Electric shock, high-altitude fall, burn, mechanical injury, injury due to lifting, object strike, drowning, productive poisoning, pressure vessel explosion, and other personal injuries at workplaces of the company.</td>
<td>III Level</td>
<td>① In case of personal casualty, the person who knows the accident first must keep calm, when conditions permit, firstly make emergency treatment, and remove the injured from the hazardous source, meanwhile use the rapidest, the most convenient method to report it to the shift supervisor, and the shift supervisor should start the emergency rescue plan organization within the shortest time to make rescue response. ② When the personal casualty is confirmed to occur, in accordance with the requirement of “unified command and professional disposal”, the shift supervisor should make immediate rescue response, and establish the on-site command center consisting of emergency office members, and identify early warning grades, and report it to the emergency command department. According to the actual situation, the shift supervisor commands and coordinates the technical support team, operation emergency team, fire control and prevention emergency team, logistics medical guarantee team, materials and equipment guarantee team and other emergency response teams to carry out emergency operations. ③ According to the situation, make on-site isolation, do a good job in evacuation, emergency rescue and resettlement of injured personnel. Full efforts should be made to prevent the further expansion of the accident. After the emergency rescue team in Wuxiang People's Hospital identifies the reasons for personal injury, they firstly make on-site treatment of injured personnel, and then take appropriate measures and send the wounded to hospital. According to the number and range of personal injury, do a good job in contacting a professional medical institution or Changzhi Municipal Emergency Center for assistance in rescue.</td>
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<tr>
<td>2</td>
<td>Fire specific contingency plan</td>
<td>HSE Dept</td>
<td>Pulverized coal under combustion system suspended in the air will have risk of explosion when reaching a certain concentration; fuel oil has the combustible characteristics; high temperature and high pressure pipes are placed intensively, which easily ignites combustibles; hydrogen used in generator cooling is highly explosive and combustible.</td>
<td>III Level</td>
<td>① After site personnel (on duty) finds fire, he should immediately organize personnel to fight fire, meanwhile timely report the fire to the county fire control department, and to the responsible person on duty. The responsible person on duty shall immediately report the fire to the leaders of the company. ② After executive leaders or the company's responsible person on duty receives the alarm call, they should immediately report it to company leaders, and start fire fighting emergency plan. Executive leaders or the company's responsible person on duty are responsible for reporting the fire situation, fire control, and production situation in time to company leaders. ③ All personnel participating in fire control must be subject to a unified command, and fight fire in a calm and composed manner. The coordination in fire control should be paid attention to. The personnel involved in fire control at fire site should wear personal protective appliances so as to avoid unnecessary casualties. Injured personnel, once found, must be immediately rescued. ④ After the fire occurring in the company's main workshop is put out, should pay attention to cooling</td>
</tr>
<tr>
<td>3</td>
<td>Major equipment damage specific contingency plan</td>
<td>Equipment Maintenance Dept</td>
<td>Turbine overspeed, shaft bending, breaking, high-temperature and high-pressure pipes, pressure vessels blasting accident.</td>
<td>III Level</td>
<td>① When the accident (failure) occurs, the different departments and units under the company should immediately start the related emergency plans, go to the scene to carry out emergency rescue work and implement emergency measures. ② Under the state of emergency, the company and the accident unit should mobilize all forces to make efforts to control and minimize equipment damage. ③ After the accident occurs, on-site personnel should take immediate steps to cut off or isolate hazard sources, so as to prevent secondary disaster from occurring during the rescue process. ④ After emergency personnel rush to the scene, should immediately take further measures to completely isolate hazard source and set the alarm line, creating a safe rescue environment for other persons’ emergency relief work.</td>
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<tr>
<td>4</td>
<td>Factory power interruption and whole-plant power failure specific contingency plan</td>
<td>Power Generation Dept</td>
<td>① Single machine power interruption refers to that after one machine outage, the stand-by transformer does not work due to some reason, resulting in total electricity loss of 10KV bus and its load of the stopped machine unit, and of the low-voltage transformer. ② Whole-plant power failure refers to 500KV booster station loses power, or although the booster station is electrified but two machine units both stop operation, and stand-by transformer is not put into operation. ③ The large unit outage causes the system’s power supply tension, and even affects the system stability. ④ Auxiliary power interruption damages the equipment and especially the host device. After it is handled improperly, the misuse or accident personal injury will occur.</td>
<td>III Level</td>
<td>After the plant-wide power outage occurs, the operator on duty firstly should ensure safe shutdown of the machine, then proceed with the operation of the system equipment in accordance with the provincial unified dispatch and the provincial and network dispatch requirement. The operator on duty arranges special personnel to examine the relay protection action, make preliminary determination of the nature of the fault and the point of failure, report scheduling, wait for the scheduling order, and report to the emergency headquarters, meanwhile assist the responsible person to organize the operations for machine unit safe shutdown, and make the necessary adjustment of another unit. The responsible person should make emergency shutdown according to the emergency handling principle and relevant procedures.</td>
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<td>5</td>
<td>Destructive earthquake specific contingency plan</td>
<td>HSE Dept</td>
<td>The main risks of destructive earthquake disaster which may occur in the company’s jurisdiction: personal injury, facilities, equipment damage which are caused by destructive earthquake; the secondary effects and accidents in power supply, communications, heating, gas supply, roads and load-bearing structure, falling objects from height, so as to prevent injury due to the collapse of workshops. ③ After the fire arising from combustion system and pulverized coal fire is put out, should try to adopt the atomized water and spread water, (solid stream nozzle is not preferred), so as to avoid that coal powder floats in the air due to the impact, and causes explosion, and avoid the splash of fuel oil and equipment deformation.</td>
<td>III Level</td>
<td>① When earthquake comes, the company’s earthquake rescue team should rush to the factory site, arrange security personnel to make evacuation preparations at any time. ② The personnel in relevant departments examine the steam, water, heat network pipelines, water supply pipelines, ash outlet pipeline facilities on the ground and below the surface, to check whether there are dangerous situation. If fracture occurs, should take timely isolation measures, and report such situation directly to the relevant departments and take urgent ant-crack measures to avoid further expansion.</td>
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<tr>
<td>Step</td>
<td>Anti-flood Specific Contingency Plan</td>
<td>Equipment Maintenance Dept</td>
<td>III Level</td>
<td></td>
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<td>6</td>
<td>Anti-flood Specific Contingency Plan</td>
<td>Windy thunderstorm type is characterized by localized strong winds, lightning, heavy rain, water level rise within short time, causing waterlogging. It results in that the production area pump pits, valve wells, cable trenches and other equipment in the production area are flooded, causing short-circuit of electrical equipment, equipment outage, equipment damage and trip-out, ash dam collapse, etc., affecting the normal operation of machine unit equipment, or even personal injury and equipment accidents. Continuous rainfall is characterized by a wide range of rainfall, large rainfall and long time, causing the water level rise and the formation of waterlogging, foundation sinking of buildings and equipment, the pump pits, valve wells, cable trenches and other equipment are flooded, causing short-circuit of electrical equipment, equipment outages, equipment damage and trip-out, ash dam collapse, etc., affecting the normal operation of the unit equipment or even result in personal injury and equipment accidents.</td>
<td>① After receiving strong wind and heavy rain forecast of meteorological department, the emergency office should issue the early-warning alarm, and the relevant departments should take preventive measures. After receiving the report of the disaster, the emergency headquarters should start the anti-flood emergency plan according to the disaster situation and disposal situation, and the rescue personnel of relevant departments should rush to the site to implement the emergency rescue. ② The commander in chief at site should comprehensively organize and direct the disaster emergency rescue work, and report to the local government as necessary, and start the corresponding plan to implement the emergency rescue. ③ Do a good job in implementing coal transmission underground corridor anti-flood control measures, and drain water at coal field before the arrival of rainy season. Heighten the security channel exit, prevent the backward flow of rain water from submerging the underground corridor equipment, strengthen the inspection of water leakage, and timely open drainage pump; ④ Before the arrival of rainy season, use the bucket wheel machine and coal bulldozer to pile the coal at the open-air coal field, and dredge the buffer ditch at both sides of coal field to prevent the coal pile collapse from submerging the track of bucket wheel machine ⑤ Organization personnel clean the cesspool sat transfer stations surface drain ditches, and so as to ensure smooth discharge of water in flood season.</td>
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<td>8</td>
<td>Dangerous chemicals leakage specific contingency plan</td>
<td>Auxili ary Contro l Integr ated Manag ement Dept</td>
<td>Due to inflammable, explosive, corrosive, strong oxidizing, toxic and other properties of dangerous chemicals, the leakage of dangerous chemicals will result in personal injury, equipment damage or fire accident, a large amount of leakage will cause environmental pollution accidents.</td>
<td>II Level</td>
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<td>① If the leakage occurs in chemical dosing system or acid-alkali regeneration system, the person on duty responsible for chemical operation should adjust the equipment operation mode according to the actual situation, stop the faulty equipment and isolate the leakage point. ② If ammonia water leaks, based on leakage situation, should open all doors and windows of chemical public pump room for ventilation, and use the fire fighting water to spray the leakage point. According to the situation on the site, move the leaked liquid ammonia pump bottle outside the door of the public pump room, and spray it with fire fighting water. ③ On-site emergency rescue personnel should stand at upwind side, the evacuation personnel should correctly determine the wind direction, and evacuate towards the upwind side. ④ When the leakage incident occurs, inspection personnel and the finder must promptly report to the shift supervisor the following contents: leakage time and place, name of leakage, leakage point condition, leakage size, and whether some person is trapped. The shift supervisor should report the above content to the HSE Department and Auxilliary Control Department.</td>
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<th>9</th>
<th>Major environmental pollution specific contingency plan</th>
<th>HSE Dept</th>
<th>Ash pipeline leakage, local pipe leakage, landslip and collapse of ash dam at ash storage yard, cause pollution to the surrounding environment at the region, and to the rivers. The suspended particulate matter, carbon dioxide, sulfide and oxynitride contained in the boiler flue gas during the abnormal operation of electrostatic precipitator will cause the short-term and sudden pollution to the atmospheric layer. In case of unusual weather, the dust from the coal yard of the company causes coal dust pollution to the surrounding area near the plant area. If chemical bulk drugs, machine oil and boiler pickling liquid waste are disposed improperly, or abnormal operation of the sewage treatment facilities causes the emission not to meet standards, which will result in environmental pollution.</th>
<th>III Level</th>
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</table>
| ① In case of environmental pollution accident, the person on duty should immediately report the accident to the shift supervisor, environmental protection engineer in the Equipment Dept, and director of the Accident Dept; the shift supervisor should immediately report the accident to Emergency Office, and the accident emergency command group should start the emergency response according to the accident situation. At the same time, according to relevant procedures on accident treatment, the shift supervisor coordinates and commands the machine unit or equipment to stop operation, analyzes accident causes, organizes and leads the emergency rescue team to dispose the accident site, so as to prevent further expansion of the accident. ② Rapidly control the scene, demarcate and establish the emergency isolation area surrounding the accident scene, set warning signs to prevent the rescue-irrelevant personnel from entering the accident site and suffering injury, ensure the smooth traffic for rescue teams’ work, supplies transport and group evacuation, so as to avoid unnecessary injury and damage. ③ Make good group evacuation, reduce the personal injury expansion at the pollution region, make good preparation for emergency evacuation, evacuation areas, evacuation distance, evacuation routes, evacuation transportation tools, security shelter and relocation, and so on. Make good temporary settlement of the groups who have been evacuated to safe places. ④ Do a good job in pollution monitoring, timely track and monitor the contaminated water source, air and soil, determine the types of pollutants at the first time, and issue the monitoring data; when necessary, coordinate with the relevant monitoring
department to conduct timely dynamic monitoring of the environment emergency development momentum and impact, and make a preliminary assessment on monitoring information, and rapidly feed the situation monitoring in various stages and preliminary assessment results to the company, so as to offer basis for the overall emergency response decisions. ② In the process of emergency response, should careful consider the safety of emergency personnel, the issues under consideration include: safety preventive measures, personal protective equipment, site security monitoring, preventing chemicals burns and gas poisoning, ensuring that emergency personnel are free from accident injuries.

| Abnormal low temperature weather specific contingency plan | Abnormal low temperature may result in equipment damage and suspension due to freezing, impose serious threat personal safety of site personnel, affect power generation capacity, result in downtime, affect domestic water supply and heating, and even cause production paralysis of the whole company. | III Level | ① The cold weather may result in freezing of major equipment and systems. When the shutdown is expected to occur or has occurred, the repair is needed, while making emergency preparation, the company should immediately brief such situation to the Emergency Headquarters of Huadian Shanxi Energy Emergency Company. According to the temperature anomalies and accident development status, should immediately convene an emergency meeting to start the company’s abnormal cold weather emergency plan, and make major decisions and deploy of major emergency response issues. The Emergency Office and five emergency response teams should immediately carry out the emergency disposal work in accordance with the division of responsibilities and the requirements of emergency response teams. ② When the abnormal cold weather occurs, the relevant departments of the company should immediately start the relevant emergency response, rush the scene to carry out emergency disposal work and implement emergency measures. |
| Desulphurization system specific contingency plan | May lead to major equipment damage events: booster fan failure can lead to failure of desulfurization operation; full stop of absorption tower slurry circulating pump; fires at absorption tower; absorption tower slurry quality deterioration, may lead to failure of desulfurization operation; failure of desulfurization 10kV power supply; failure of desulfurization 380V power supply; failure of bypass damper startup. | I Level | ① In case of the desulfurization system device damage or failure, according to the severity extent of accident and site situation, possible consequences and the need for emergency work, shall immediately report the relevant information to the company's emergency headquarters and the emergency response office, and notify the relevant department to start the related emergency response. ② The company's emergency headquarters, after receiving the accident report, should immediately convene an emergency meeting to make decisions and deploy emergency response according to the severity of incidents and development trend, and command related emergency rescue teams to rush to the scene to carry out the emergency disposal work according to the division of responsibilities. ③ After the accident (failure) occurs, the relevant departments and units of the company should immediately start emergency response, and rush to the scene to carry out emergency rescue work and implement emergency measures. |
10 Social Impact

10.1 Relationship between enterprises and employees

In order to improve staff’s work enthusiasm, Wuxiang Hexin Thermal Power Generation Co., Ltd has adopted a series of measures to enrich and improve the enterprises' personnel system, work environment, employee benefits, training and other aspects, and has established good, trustworthy relationship between enterprise and employees.

10.1.1 Personnel System

The current personnel composition structure of Wuxiang Hexin Thermal Power Generation Co., Ltd is reasonable; meanwhile, the enterprise has established a relatively perfect system for employees’ participation in decision-making, personnel management and career advancement, and competitive system, laying a solid foundation for the healthy development of enterprises.

(1) Personnel composition structure

As of 2010, Wuxiang Hexin Thermal Power Generation Co., Ltd had 245 formal employees enrolled, see specific personnel structure in Table 10.1-1.

<table>
<thead>
<tr>
<th>Title Structure</th>
<th>Degree Structure</th>
<th>Age Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
<td>Senior</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Number of Persons of</td>
<td>23</td>
<td>62</td>
</tr>
</tbody>
</table>

(2) Employee participation in decision-making and management, job promotion, competitive mechanism

Under the supervision and guidance of trade union, Wuxiang Hexin Thermal Power Generation Co., Ltd has established perfect plant affairs publicizing management, government affairs publicizing management system, plant development planning, management system, and other major events which are related to long-term
development and the vital interests of employees. These major events should be subject to the approval of general meeting of staff representatives.

Staff positions promotion and competition should be based on the "open, fair and just" guiding ideology and the relevant provisions of the standard, and under the comprehensive supervision.

10.1.2 Employee Benefits

Since the company established the plant, it has established normal housing, medical care and vacation system for all workers on the posts.

(1) Provident fund system: based on improving employee housing fund system, established housing subsidies policy for new employees.

(2) Health insurance system: provide all staff with basic medical insurance and supplementary medical insurance, on this basis, the trade union organized "serious illness mutual aid" insurance organized by the Trade Union in Yangquan City, medical examination is conducted on all employees every two years, medical examination is conducted on women workers once a year, periodic medical examination is made on special operations personnel who are engaged in hazardous operations so as to fundamentally prevent the occurrence of occupational diseases.

(3) Leave system: strictly implement the relevant national holiday system, including statutory holidays, paid vacation and leave system.

10.1.3 Staff Training

The education and training work of Wuxiang Hexin Thermal Power Generation Co., Ltd is always based on production safety, is aimed to enhance economic efficiency and protect the environment, cultivate and foster a high-quality employee team. The education and training work focuses on job training and continuing education, and implements the incentive mechanism of "training, assessment, use and treatment" integration. The company strengthens the three-level training network responsibility assessment, and implements the training level-by-level responsibility system with no ignored management. The company fully uses education and training -- basic means for human resources development and management, strengthens the efforts in training and task implementation, innovates the training mode, carries out
the diverse, practical and effective training activities, continuously strengthens the learning-based organization atmosphere, continuously improve the business skill level of “three teams”, and offers strong human resource guarantee for the company to fully achieve safety, environmental protection and economic indicators, and maximize the benefits.

(1) Job training

① Actively carry out various training activities to enhance the overall quality of workers.

② Pay close attention to new employees’ orientation education and pre-post training, ensure new staff take their posts as soon as possible, training backbones for the company.

③ Establish apprenticeship training contracts, carry forward the fine tradition of electric workers passing on knowledge and skills to newcomers.

④ Rely on the "training, contest" activities, vigorously carry out job training, do a good job in training so as to get rich results.

⑤ Improve the education and training on webpage construction, rely on modern management tools to achieve knowledge sharing.

⑥ Strengthen the examination management and make timely assessment of training effectiveness.

⑦ Regularly organize security technical training on special operations personnel, in order to promote production safety.

(2) Environmental protection training

According to environmental training program of Wuxiang Hexin Thermal Power Generation Co., Ltd, the content of environmental protection training provided by the power plant this year includes:

① Organize environmental protection personnel and middle-level or above cadres to learn environmental protection-related laws and regulations.

② Offer practice and theoretical training on desulfurization personnel.

③ Offer job training on environmental protection facilities operators.

10.2. Relationship between Enterprise and Local Residents

Wuxiang Hexin Thermal Power Generation Co., Ltd attaches great importance to the relationship between enterprise with the surrounding residents. Over several years
since establishment of the company, no environmental pollution incidents occurred, nor valid environmental complaints was lodged, the company is in harmony with the surrounding residents. The company has been awarded the title of Environmental Protection Advanced Enterprise by the county, municipal and environmental protection departments for many times.

10.3. Relationship between Enterprise and Society

Sustainable development of enterprise must be under local community’s support and understanding. During the development process, Wuxiang Hexin Thermal Power Generation Co., Ltd does not forget the society, and contribute its own strength to the cause of environmental protection in Wuxiang. The company makes donations for many times to the local poor residents.

10.4 Summary

In order to improve staff’s work enthusiasm, Wuxiang Hexin Thermal Power Generation Co., Ltd has adopted a series of measures to enrich and improve the enterprises' personnel system, work environment, employee benefits, training and other aspects, and has established good, trustworthy relationship between enterprise and employees.

Meanwhile, in order to achieve sustainable development of enterprise, Wuxiang Hexin Thermal Power Generation Co., Ltd pays attention to the relationship between enterprise and surrounding residents, and between enterprise and the entire society, creates itself into a green energy base, and plays an active role in creating an environmental protection model base in Wuxiang.
11 Audit Conclusion

11.1 Conclusion

(1) Project Overview

Wuxiang Hexin Thermal Power Generation Co., Ltd is located in Wuxiang County, Shanxi Province, 130km away from Taiyuan city and 90km away from Changzhi City. The total installed capacity of the power plant is 2×600MW sub-critical air-cooled turbo-generator units. Total evaporation of the boiler is 4,160t/h. The construction of the power plant was started in 2004, and the two generator units were put into operation till February 2007.

(2) Pollution prevention measures

Wuxiang Hexin Thermal Power Generation Co., Ltd attaches great importance to environmental protection work, strictly enforces the environmental protection "three simultaneous" system, and uses the equipment which have high technological level and comply with environmentally-friendly equipment, so as to ensure various environmental indicators to reach standards.

① Exhaust

The power plant’s two boilers are equipped with 4 electrostatic precipitators, with dust removal efficiency of 99.75%; two units adopt limestone - gypsum wet desulfurization technology to make the boiler flue gas desulfurization, with desulfurization efficiency of 95%; boiler soot and SO$_2$ emissions concentration both meets the requirements of Section III of Emission Standard of Air Pollutants for Thermal Power Plants (GB13223-2003).

② Wastewater

The power plant simultaneously constructed industrial wastewater treatment station, coal-bearing wastewater treatment station, and domestic sewage treatment station, makes separate collection, classification and reuse of sewage and wastewater generated by production and domestic life, and makes maximum conservation of water resources, without external discharge of wastewater.

③ Noise

The power plant adopts various noise control measures, such as installing the anti-vibration pad and the silencer on noise-producing equipment, making sound insulation of workshop. After the above noise control is adopted, factory noise
emissions meet Class II standard in Standard of Noise at Boundary of Industrial Enterprises (GB12348-90).

④ Solid Waste
Power plant ash disposal system uses dry ash removal and pneumatic transmission. Dry ash, after being transported to ash tank, is humidified and transported by the private vehicle to the ash yard for storage. Ash tank is equipped with dry ash sorter so as to achieve comprehensive dry ash utilization.

Slag can be directly transported to the ash yard for storage, and can also be sold.

Desulfurization gypsum can be directly transported to the ash yard for storage, and can also be sold.

(3) Environmental management
Since Wuxiang Hexin Thermal Power Generation Co., Ltd started production in 2007, it has formed a relatively complete top-down environmental management system, and developed the Environmental Management Standard, with a high level of environmental management.

(4) Production safety management
The power plant has developed Production Safety Management System, and actively carried out production safety inspection, make rectification, continuously improves the enterprise’s production safety management work, and reduce the occurrence of safety accidents.

(5) Safety management of dangerous chemicals
The power plant has developed Dangerous Chemicals Safety Management System to strengthen and standardize the safety management of hazardous chemicals, to ensure workers lives and property safety, and protect the environment.

(6) Occupational disease prevention
The power plant has developed Occupational Disease Prevention Plan and Implementation Program, actively carries out the occupational disease control and eliminates occupational hazards, improves occupational disease prevention work, and protects the workers’ health protection and their legitimate rights and interests.
(7) Emergency rescue plan

The power plant has developed Production Major Accident Emergency Rescue Plan, in order to effectively control the occurrence and development of emergencies, eliminate the threat of accidents on people and equipment as soon as possible, and reduce to the loss to a minimum.

(8) Social impact

Wuxiang Hexin Thermal Power Generation Co., Ltd has established good trustworthy relationship between enterprise and employees, and created itself into green energy base, and plays an active role in creating environmental protection model base in Wuxiang County.

(9) General conclusion

Based on the above environmental audit analysis of Wuxiang Hexin Thermal Power Generation Co., Ltd, Wuxiang Hexin Thermal Power Generation Co., Ltd has developed detailed pollution prevention measures and various rules and regulations. The environmental management is in place, facilities are complete and improved, and run normally, the discharge of pollutants meets standards, and the total pollutant control target is completed. The company can basically meet the requirements on environmental management.

11.2 Recommendations

(1) In accordance with requirements on environmental audit, the company should gradually straighten out the plant-wide environmental management relationship, and conduct good environmental management. At the same time, the enterprise should regularly carry out environmental audits, and continuously improve corporate environmental management level.

(2) Strictly implement the established environmental management plan and environmental monitoring program, ensure timely understanding and control of pollutant emissions and the impact of pollutants on the surrounding environmental conditions.

(3) Should strengthen the operation and management of environmental protection facilities, ensure the normal operation and processing efficiency of environmental protection facilities, and ensure the pollutant discharge to meet
standards.

(4) Strengthen the security and environmental protection education on employees, implement labor protection measures, improve workers’ safety and environmental protection awareness, and ensure employee safety and health.

(5) Adopt mature and effective risk prevention measures, establish emergency plans, strictly monitor the warning measures, so as to prevent or reduce accidents, personal injury and environmental contamination.

(6) Based on the industry characteristics and possible environmental impact, strengthen the social exchanges in the region, and publicize the corporate overview, energy-saving measures, and pollutant emissions on a regular basis.