



Environmental Monitoring Report

Environmental Monitoring Report
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Prepared by Liaoning Provincial Development and Reform Commission Foreign Capital
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Asian Development Bank

**PEOPLE'S REPUBLIC OF CHINA
LIAONING ENVIRONMENTAL IMPROVEMENT PROJECT
ADB LOAN 2112-PRC**

Semiannual Environmental Monitoring Report

For the Period from 1 October 2007 to 31 March 2008

**Prepared for
Asian Development Bank**

**Prepared by
Liaoning Provincial Development and Reform Commission
Foreign Capital Utilization Project Office**

and



H & J, Inc., USA

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ABBREVIATIONS

ADB	–	Asian Development Bank
BEPB	–	Benxi Environmental Protection Bureau
BEMC	–	Benxi Environmental Monitoring Center
BGHC	–	Benxi General Heating Company
CEM	–	Continuous Environmental Monitoring
CFB	–	Circulating Fluidized Bed
CHP	–	Combined Heat and Power Generation
CNY	–	Chinese Yuan
EIA	–	Environmental Impact Assessment
EMO	–	Environmental Management Office
EMP	–	Environmental Management Plan
EPB	–	Environmental Protection Bureau
ESP	–	Electrostatic Precipitator
GLP	–	Government of Liaoning Province
LDRC	–	Liaoning Development and Reform Commission
LEPB	–	Liaoyang Environmental Protection Bureau
LNEIP	–	Liaoning Environmental Improvement Project
LREHC	–	Liaoyang Real Estate Heating Company
PIA	–	Project Implementing Agency
SIEE	–	Summary Initial Environmental Examination
YEPB	–	Yingkou Environmental Protection Bureau

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I. INTRODUCTION

1. This semiannual environmental report describes the implementation of the environmental monitoring and implemented mitigation measures recommended in the environmental impact assessment (EIA) reports and the summary analyses of the environmental monitoring data collected from 1 October 2007 to 31 March 2008 for the Liaoning Environmental Improvement Project (“the Project”).

2. Based on the Project Agreement, the Government of Liaoning Province (GLP) and each project implementation agency (PIA) shall ensure that (i) the Project be constructed and operated in accordance with national and local environmental procedures and guidelines, ADB’s Environmental Policy (2002), and the EIAs; (ii) any adverse environmental impacts arising from the construction and operation of the Project facilities be minimized by implementing the mitigation measures, environmental monitoring programs, and other recommendations presented in the EIAs; and (iii) the implementation of the environmental management plan and any violation of safety or environmental standards, if any, be regularly reported to ADB.

3. H&J’s environmental specialists visited the Project cities during and after the reporting period. During the visits meetings were held with the PIAs and local EPBs from Benxi, Liaoyang and Yingkou in regard to their responsibilities for environmental monitoring. Particular attention was focused on the monitoring and reporting compliance. The PIAs involved in the district heating projects have all signed agreements with their local environmental monitoring centers to conduct monitoring as required by the EIA. Individuals from environmental monitoring offices continued to be responsible for carrying out the required monitoring.

4. The scope of the Project has been adjusted to include a total of seven subprojects including four ongoing subprojects, one revised subproject and two new subprojects. The four ongoing subprojects are: (a) Benxi Central Heating Subproject; (b) Liaoyang Central Heating Subproject; (c) Yingkou Central Heating Subproject; and (d) Benxi Gas Distribution Improvement Subproject. The Benxi and Liaoyang Central Heating Subproject has been completed; most of the Yingkou Central Heating Subproject has been completed and the remaining part is expected to be completed by the end of 2008. Two-thirds of Benxi Gas Distribution Improvement Subproject has been completed and the remaining part is also expected to be completed by the end of 2008.

5. The Fuxin CBM/CMM Development Subproject is under the process of land acquisition, while Benxi Huaxing Central Heating Subproject and Fuxin Heating Subproject are at the procurement stage.

6. This report covers the following areas: (i) documentation review and compliance with environmental regulations, (ii) environmental institutional structure and responsibility, (iii) mitigation measures undertaken to minimize adverse environmental impacts arising from the construction or operation of the Project facilities, (iv) environmental monitoring and status of ambient environmental quality, and (v) conclusions and recommendations.

A. Basis of Semiannual Environmental Monitoring Report

7. This semiannual environmental monitoring report has been prepared based on the following documents:

- ♦ Summary Initial Environmental Examination (SIEE);
- ♦ Environmental Impact Assessments (EIAs);

- ♦ Environmental Management Plans (EMPs);
- ♦ Project Agreement;
- ♦ Monthly/Quarterly Environmental Monitoring Reports;
- ♦ Quarterly Progress Reports; and
- ♦ Relevant Environmental Codes.

B. Environmental Procedure Review

8. Each of the contractors, construction supervision companies, and the PIA's designated staff from the site management team are responsible for environmental monitoring and supervision. The responsibilities of these staffs include day to day site environmental monitoring of their own contracts, implementation of the environmental action plan's mitigation measures, and reporting the site's environmental performance regarding the contract sections, which is mainly self inspection and self monitoring.

9. During the construction stage, the construction supervision companies are responsible for the preparation and submission of monthly environmental supervision reports; meanwhile, the environmental monitoring agencies are responsible for the monitoring of environmental parameters and development of quarterly environmental progress reports. During the operational stage, the operators from the PIAs are responsible for the preparation and submission of monthly environmental supervision reports; meanwhile, the environmental monitoring agencies, with the assistance of the PIAs, are responsible for the monitoring of parameters and development of quarterly environmental progress reports. The PMO has designated Mr. Chen Bin, to serve as an environmental officer for this Project because of his environmental engineering background. The PMO, with the assistance of the project implementing consultants, is responsible for compiling semiannual environmental monitoring reports.

10. Specific responsibilities of the PIAs, contractors, local environmental monitoring centers, and construction supervision companies are defined as follows:

PIA:

- Develop the environmental section of the contract;
- Provide training to contractors and all other related environmental personnel;
- Site review;
- Resolve environmental complaints;
- Develop and implement pollution prevention measures;
- Implement environmental monitoring plans;
- Provide monthly environmental monitoring reports with monitoring data;
- Implement mitigation measures and health and safety; and
- Arrange for environmental meetings as necessary.

Local Environmental Monitoring Center:

- Conduct environmental monitoring and oversight; and
- Prepare environmental monitoring reports based on data collected.

Supervision Companies (during construction period):

- Environmental management;
- Receive complaint calls; and
- Report environmental issues.

Contractors (during construction period):

- Implementation of environmental mitigation measures;
- Providing basic sanitation facilities;

- Domestic sewage treatment;
- Solid waste management;
- Noise and dust control;
- Personal protective equipment for workers; and
- Measures to ensure construction equipment meet relevant national or local emissions and noise standards.

11. As of the end of March 2008, 414 small coal-fired heat boilers in the project cities have been decommissioned including 174 boilers in Liaoyang, 63 boilers in Benxi and 177 boilers in Yingkou.

C. Legal Requirements

12. All project facilities must comply with all applicable PRC environmental laws and regulations during the project implementation. The following is a list of some potentially applicable environmental laws and regulations:

- ◆ Emission Standard of Air Pollutants for Boilers, GB13271-2001
- ◆ Air Pollutant Integrated Emission Standard, GB16297-1996
- ◆ Environmental Quality Standards for Surface Water, GB 3838-2002
- ◆ Quality Standard for Ground Water, GB/T 14848-93
- ◆ Noise Limits for Construction Site, GB 12523-90
- ◆ Integrated Wastewater Discharge Standard, GB 8978-1996
- ◆ Standard of Noise at Boundary of Industrial Enterprises, GB 12348-90
- ◆ Emission Standard of Air Pollutants for Thermal Power Plants, GB 13223-2003
- ◆ Integrated Emission Standard of Air Pollutants, GB16297-1996
- ◆ Ambient Air Quality Standards, GB 3095-1996
- ◆ Environmental Monitoring Specification for Power Plant, DL/T414-2004
- ◆ Standard of Environmental Noise in Urban Area, GB 3096-93
- ◆ Environmental Quality Standard for Soils, GB 15618-1995
- ◆ Liaoning Wastewater and Waste Gas Discharge Standard, DB21-60-89.
- ◆ Water Quality Standard for wastewater to be injected into city sewage system, CJ 1082-1999 or CJ 0082-1999
- ◆ Standard for Labeling Dangerous Goods, GB 15258-94

II. BENXI CENTRAL HEATING SUBPROJECT

A. Background

13. The project implementing agency for this subproject is the Benxi General Heating Company, which was privatized from a state owned company in 2007. The subproject aims at improving the local air quality by replacing numerous small boilers with a larger more efficient central heating supply system. The subproject consists of: constructing 2 x 58 MW circulated fluid bed (CFB) hot water boilers; support facilities (water, power and coal supply systems), 17 km of heat supply pipeline and 18 heat exchange stations. The subproject also consists of decommissioning 63 small and inefficient coal-fired boilers.

B. Current Status

14. The construction of Benxi Central Heating Subproject was completed in 2006. The boilers reached full capacity during 2006-2007 heating season. Benxi Boiler Inspection & Acceptance Institution, under Benxi Technical Monitoring and Inspecting Bureau, inspected the facility and issued permits for the regular operation of the two boilers and associated equipment. In addition, the PIA has developed an operation and maintenance program including manuals for its boilers and auxiliaries in order to extend the useful life of the boiler facility and reduce potential accidents.

C. Environmental Management Office

15. The Benxi General Heating Company has appointed Ms. Xia Jing and Mr. Jiang Hai to be responsible for the environmental management of this project. The responsibilities of the PIA and the Benxi Environmental Monitoring Center were discussed in Section I.B of this report. The individuals and their titles in the Environmental Management Office (EMO) are summarized in Table 2-1.

Table 2-1 Benxi General Heating Company EMO Personnel

Name	Organization	Position	Titles in EMO
Xia Jing	BGHC	Division Chief	Director of EMO
Li Yu Shi	BEPB	Deputy Director	Deputy Director of EMO
Gao Guisheng	BEMC	Director	Environmental Monitoring Person
Jiang Hai	BGHC	Project Manager	Managing Person
Wu Nan	BGHC	Environmental Person	Managing Person
Chen Bin	PMO	Environmental Officer	Coordinator on Environmental issues

D. Operations

1. Coal Consumption

16. The coal consumption and lime injection amount for the two sets of ADB-financed boilers during 2007-2008 heating season have been estimated and they are shown in Table 2-2 below:

Table 2-2 Benxi Coal Consumption

Year	Coal (ton)	Lime (ton)
2007-08 heating season	100,000	10,000

2. Coal Quality

17. No information has been provided by the PIA to the Consultant regarding the coal quality used in the 2007-08 heating season.

3. Solid Waste Disposal

18. The ash and slag amounts produced during 2004-2007 heating seasons are provided in Table 2-3 below. However, the PIA has not provided the ash and slag information for 2007-08 heating season.

Table 2-3 Benxi Ash and Slag Production

Year	Ash (ton/year)	Slag (ton/year)
2004-05	7,439	53,789
2005-06	7,371	53,298
2006-07	8,838	63,902
2007-08	Not available	Not available

19. Ash and slag were sold to a local company, Gong Yuan Cement Company, for CYN 15 per truck load to be recycled into construction materials. Small amounts of domestic solid waste were disposed of at the Benxi Sanitary Landfill.

E. Small Boiler Decommissioning

20. The PIA has decommissioned 63 small obsolete boilers as the end of March 2008.

F. Environmental Monitoring Data and Data Analysis

21. The PIA signed a contract with Benxi Environmental Protection Bureau in the first quarter of 2008 to provide environmental monitoring and collect environmental data.

1. Ambient Air Quality of Benxi Heating Plant

Five monitoring locations were set up for monitoring concentrations of SO₂, NO₂, TSP and PM₁₀.

22. Monitoring lasted five days from January 21-25, 2008 to acquire daily average values of TSP and PM₁₀ and hourly average values of NO₂ and SO₂. Hourly average concentrations are monitored four times every day. Monitoring times are 7:00, 10:00, 14:00, and 19:00.

23. The air quality monitoring results, summarized in Appendix A, showed that daily values for TSP varied from 0.127 mg/m³ to 0.343 mg/m³, and 12% of the values exceed compliance levels of the Ambient Air Quality Standard (GB3095-1996) of 0.30 mg/m³; daily values for PM₁₀ varied from 0.076 mg/m³ to 0.206 mg/m³, and nearly 40% of the values are not in compliance with the Standard of 0.15 mg/m³; all the hourly values for SO₂ are in compliance with the Standard of 0.5 mg/m³; and all the hourly values for NO₂ are in compliance with the Standard of 0.24 mg/m³.

2. Emissions from Boilers

24. The monitoring locations were set up in two outlets of the ESPs for the boilers. The concentrations of dust, SO₂ and the blackness of smoke were monitored.

25. The applicable standard used for assessing compliance is the Emission Standard of Air Pollutants for Boilers (GB13271-2001), Time Zone II. The monitoring results, summarized in Appendix A, showed that amounts for SO₂ concentration at the outlets from the ESPs of the boilers were 782 and 836 mg/m³, which is in compliance with the standard of 900 mg/m³. The amounts for particulate matter concentration were 108.4 and 96.7 mg/m³, which is in compliance with the standard of 200 mg/m³.

3. Fugitive Dust Monitoring for Coal Storage and Ash Storage

26. The predominant wind direction in Benxi City area is easterly. Thus one monitoring location was set up upwind of the plant site while two monitoring stations were set up downwind area of the plant area. The concentrations of TSP were monitored twice a day from 22-23 January 2008, once in the morning and once in the afternoon.

27. The applicable standard used for evaluating monitoring data compliance is the Air Pollutant Integrated Emission Standard (GB16297-1996) for Grade II boiler.

28. The results, also summarized in Appendix A, showed that all the monitoring values for TSP are in compliance with the national standard of 1.0 mg/m³.

4. Wastewater Monitoring

29. Wastewater from the facility included (1) discharged water from boilers, (2) wastewater from softening water system and cooling system, and (3) domestic wastewater from the facility. Only the domestic waste water was discharged into the municipal sewers and finally into Taizi River. The other two types of wastewater are recycled on-site and no industrial wastewater was discharged to the local WWTP.

30. One monitoring location for surface water was set up in an upstream of the plant, and the other two were set up in the downstream of the plant. Monitoring period was from 21 – 23 January 2008. Parameters monitored include: pH, SS, NH₃, COD, fluoride, oil, and arsenic.

31. The applicable standard used for evaluating compliance is the Environmental Quality Standards for Surface Water GB 3838-2002, Water Body Category IV.

32. The monitoring results (see Appendix A) showed that values for pH, SS, NH₃, COD, Fluoride, Oil, and Arsenic are in compliance with the Standard of 6-9, 150 mg/l, 1.0 mg/l, 30 mg/l, 1.5 mg/l, 0.5 mg/l and 0.1 mg/l, respectively.

5. Noise Monitoring

33. Four monitoring locations for noise at the east, south, west and north sides of the heating plant were set up during 22-23 January 2008. Noise levels were measured once during day time and once at night.

34. The applicable national standard is the Standard of Noise at Boundary of Industrial Enterprises (GB 12348-90), Category III.

35. The results of noise levels showed that all the values for noise for day and night are in compliance with the standard of 65 dB(A) during day time and 55 dB(A) at night (see Appendix A for details).

6. Mitigation Measures Implemented

36. Air Pollution - The coal conveyor system consists of coal hoppers, belt conveyors, pulverizer rooms and coal storage cells. In order to reduce dust emissions, the areas surrounding coal unloading mouths had been tightly sealed.

37. In the coal transfer stations, emissions would escape around unsealed places of coal troughs during coal unloading. In order to reduce coal dust, the distances for coal unloading were reduced and all gaps were sealed. In addition, bag dust removers were applied in the pulverizer rooms.

38. Sprayed water or cloth nets were applied to the dry coal shed to cover and reduce fugitive dust generation.

39. Noise - The main noise sources were from pulverizers, water pumps, air blowers and ID fans and boilers. Low-noise requirements were met for newly procured equipment. Sound insulation, silencing, and vibrating-reducing measures were adopted for equipment with high-noise levels to efficiently control noise.

40. In order to reduce emissions and meet relevant emission standards, 4 sets of ESPs were installed with a dust removal efficiency of 99.7%. In addition, limestone was combined with coal combustion to reduce SO₂ emissions with an efficiency of 80%.

41. An environmental permit for the operation of the boiler facilities needs to be obtained. No other violation of safety or environmental standards was reported during the period.

7. Ambient Air Quality Data for the City of Benxi

42. There were five environmental monitoring stations in Benxi City from 2001 to 2005, which were Xihu, Caitun, Fadian, Dongming and Dayu stations. However, in 2006 the environmental monitoring station of Fadian was discontinued, and the environmental monitoring station at Zhiyi Hospital was established. The boiler facility is located in the area of Caitun.

43. Sample data, maximum and average quarterly/yearly ambient air monitoring data and exceeding standards for SO₂, NO₂, CO, TSP, and PM₁₀ for 2001-2005 are presented in Appendix A. The ambient air monitoring data regarding SO₂, NO₂, TSP, CO, and PM₁₀ for different monitoring stations for 2001-2006 are also presented in Appendix A. Furthermore, the ambient air monitoring data concerning PM₁₀, SO₂ and NO₂ for 2007 are presented in Appendix A.

G. Conclusions

1. Compliance

44. More parameters in this period are in compliance than in last period. However, as analyzed above, there are still some issues with compliance for some standards. The PIA should investigate the issues and identify mitigation measures bring these parameters into compliance.

45. Based on discussions with a representative of the BEMC, no on-line monitoring equipment at the stack was installed and thus no on-line monitoring was conducted.

2. Issues

46. As of March 2008, the exposed slope at the plant has not been stabilized to prevent further erosion.

3. Future Action Items

47. Operators and/or Individuals from boiler workshop, chemical water workshop, and production workshop should become members of the Benxi Environmental Monitoring Office so coordinated actions are taken to reduce negative environmental impacts from the plant.

48. Immediate action must be taken to stabilize and seed the exposed excavation surface to prevent further erosion and loss of topsoil.

49. A detailed electronic city map with all the ambient air quality monitoring stations identified as well as the location of the heating facility should be provided along with the environmental monitoring report.

III. LIAOYANG CENTRAL HEATING SUBPROJECT

A. Background

50. The PIA for the Liaoyang Heating Subproject is the Liaoyang Real Estate Heating Company (LREHC). The Liaoyang Heating Subproject consists of the construction of two boiler houses, in Doushuangshu and Beicaoku, to house 4 x 208 GJ/hour and 4 x 208 GJ/hour high-efficiency boilers, respectively. The subproject also includes the decommissioning of 174 small or obsolete boilers which are currently supplying heat to 5.82 million m², 6.8 km of pipeline and 55 heat exchanger stations.

B. Current Status

51. All civil works for the subproject, including all the eight chain-grate stoker hot water boilers, their auxiliaries, pipelines and heat exchange stations, was completed in October 2007. Boilers at both boiler plants provided heat to local residents in Liaoyang during the 2007-08 heating season.

C. Environmental Management Office

52. The Liaoyang Real Estate Heat Supply Company has appointed Mr. Zhao Guangwei and Mr. Luo Jiming to be responsible for the environmental management of this project. The responsibilities for the PIA, Liaoyang Environmental Protection Bureau, Contractor and Loan Supervision Companies are discussed in Section I.B. The individuals and their titles in the Environmental Management Office are summarized in Table 3-1. Operators and individuals from boiler workshop, chemical water workshop, and production workshop have become members of the Liaoyang Environmental Monitoring Office.

Table 3-1 EMO Personnel of LREHC

Name	Organization	Position	Titles in EMO
Zhao Guangwei	LREHC	Deputy General Manager	Director of EMO
Luo Jiming	LEPB	Deputy Director	Deputy Director of EMO
Gaomingjie	LREHC	Operator for ww tank	Worker
Xu Guangle	LREHC	Operator for slag removal machine	Worker
Zhou Baohong	LREHC	Operator for dust removal systems	Worker
Chen Hongbin	LREHC	Operator for circulation pumps	Worker
Shi Jie	LREHC	Section Chief	Environmental protection person
Hong Xia	LEPB	Officer	Environmental protection person
Chen Bin	PMO	Environmental Officer	Coordinator on environmental issues

D. Operations

1. Coal Consumption

53. The coal consumption for the ADB-financed boilers during 2006-2008 heating season is shown in Table 3-2. No lime was used by these boilers.

Table 3-2 Coal Consumption for Liaoyang Heating Supply Subproject

Year	Coal (ton)	Lime (ton)
2006-07	238,548	N/A
2007-08	272,000	N/A

2. Coal Quality

54. The coal qualities for both the Beicaoku Heating Center and Doushuangshu Heating Center are given in Table 3-3 below.

Table 3-3 Coal Quality

Location of Coal Sample	Ash (%)	Sulphur (%)
Beicaoku Heating Center	44.11	1.36
Doushuangshu Heating Center	47.51	1.78
Design Value	20	0.8

55. It can be seen from Table 3-3 that both the sulphur and ash contents of the coal used for the eight boilers are higher than the design values. It is recommended that the PIA purchase coal meeting the relevant design values to ensure optimal operational conditions.

3. Solid Waste Disposal

56. The total amount of solid waste generated from the plant was 57,150 tons in 2007-2008 heating season, which was in compliance with a total amount of 72,000 ton/year specified in the approved EIA for solid waste. Ash and slag generated from the boilers are sold to a local brick company to be used as raw construction materials. The ash and slag amounts produced during 2006-2008 heating seasons are provided in Table 3-4 below.

Table 3-4 Ash and Slag Production for Liaoyang Real Estate Heat Supply Co.

Year	Ash (ton/year)	Slag (ton/year)
2006-07	8,838	63,902
2007-08	6,858	50,292

E. Environmental Acceptance

57. On 18 March 2008, per a request from Liaoning Environmental Protection Bureau, Liaoning Environmental Monitoring Station held a site investigation regarding environmental protection measures, emissions and wastewater discharges of the subproject. During 25-28 March 2008, an environmental acceptance and monitoring on site was made according to "Environmental Protection Acceptance and Administration Measures for Construction Project Completion" and "Notification of Issues on Monitoring and Administration of Environmental

Protection Facility Completion Acceptance and Administration Measures for Construction Project”.

58. The total cost of the subproject is 307.78 million RMB. 3.7% of the total project cost, 11.37 million RMB, was for environmental protection such as dust removal systems, noise control and landscaping.

59. Wastes and noise produced from the operation of the boiler plant are shown in Figure 3-1 below.

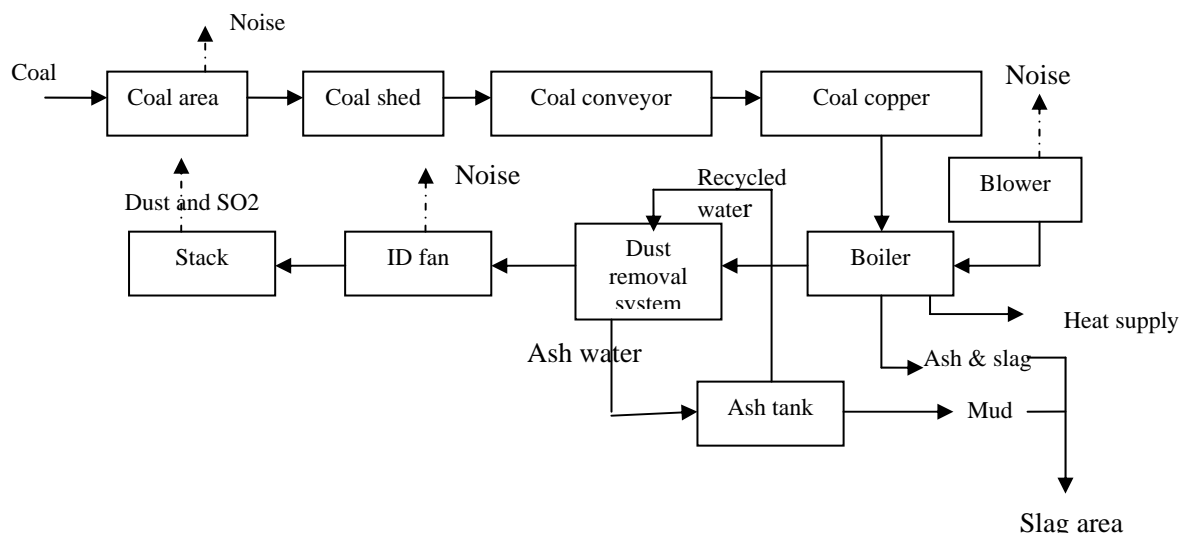


Figure 3-1 Wastes and Noise from the Boiler Plant

60. At present the PIA has decommissioned 174 small coal-fired boilers. As a result, the ambient air quality in Liaoyang urban area has been significantly improved.

F. Environmental Monitoring

61. Environmental monitoring for the purpose of environmental compliance was conducted regarding emissions, noise and coal storage during 25-28 March 2008. The environmental manager of the PIA worked closely with the LEPB, Liaoning Environmental Monitoring Station and the Consultant to ensure that environmental monitoring was conducted as prescribed under the Chinese relevant regulations and the covenants of this loan in accordance with ADB's guidelines. The results of the environmental monitoring are summarized in this section.

1. Fugitive Dust Emissions

62. The PIA uses a very fine high-quality mesh net to temporarily cover the coal stock piles to reduce fugitive dust emissions. The fugitive emissions were monitored for both the Beicaoku and Doushuangshu Heating Plants. Four monitoring locations with a distance of over 20 meters upstream and downstream from each plant were set up. Monitoring lasted from 25-26 March 2008 and average values of fugitive emissions were calculated.

63. The monitoring results are presented in Appendix B. The monitoring data showed that all values are in compliance with the standards for fugitive dust emissions (1.00 mg/m^3) in accordance with the applicable standards of the Air Pollutant Integrated Emission Standard (GB16297-1996).

2. Emissions from Boilers

64. The monitoring locations were set up in both the inlet and outlet of the six wet-type dust removal systems for the boilers in Beicaiku and Doushuangshu Heating Plants. The dust concentrations, smoke, SO₂, and amount of dust and smoke were monitored.

65. The applicable standard used for monitoring methods and evaluation is the Emission Standard of Air Pollutants for Boilers (GB13271-2001), Time Zone II, Region II. Fifty percent of the maximum emissions specified in the Standard are applied.

66. The results for 3 sets of wet-type dust removal systems for Beicaiku Heating Plant, summarized in Appendix B, showed that the dust concentrations at the outlets of the wet-type dust removal systems were from 63 to 81 mg/m³, representing dust removal efficiencies of 92.2-92.8%. The SO₂ concentrations were from 337 to 387 mg/m³, representing desulfurization efficiencies of 57.1-62.6%. The height of stack connected to the wet-type dust removal systems is 100 meters.

67. The results for 3 sets of wet-type dust removal systems for Doushuangshu Heating Plant, also summarized in Appendix B, showed that the dust concentrations at the outlets of the wet-type dust removal systems were from 60 to 86 mg/m³, representing dust removal efficiencies of 92.3-93.5%. The SO₂ concentrations were from 407 to 345 mg/m³, representing desulfurization efficiencies of 59.6-62.5%. The height of stack connected to the wet-type dust removal systems is 80 meters.

68. Compared with the Emission Standard of Air Pollutants for Boilers (GB13271-2001), the concentrations of dust emissions from both boiler plants are in compliance with the standard of 100 mg/ m³ in Region II, Time Zone II. Similarly the SO₂ emissions from the boiler plants are also in compliance with the standard of 450 mg/ m³.

3. Wastewater Monitoring

69. Water from deep wells are used as water resources for both the Beicaiku and Doushuangshu Heating Plants. The water usage rate is 1072.7 m³/h, including a raw water amount of 72.7 m³/h and a recycled water amount of 1000 m³/h. The recycled water utilization rate is 93.2%. Wastewater comes from two sources, one from boilers and softening water tanks and the other from domestic wastewater. The former is used for slag brushing first and then is recycled, and the latter is discharged into municipal sewers after being treated by septic tanks.

4. Noise Monitoring

70. Noise was mainly caused by mechanical and mobile sources. The mechanical noise came from ID fans, blowers and pumps, and the moving noise came from vehicles to load and unload coal, ash and slag. ID fans, blowers and pumps are located inside buildings.

71. Four locations for noise monitoring for the Beicaiku Heating Plant and four locations for the Doushuangshu Heating Plant were set up. As required in the sampling requirements, monitoring was conducted once during the day and once at night.

72. The applicable standard used for evaluating compliance is the Standard of Noise at Boundary of Industrial Enterprises GB 12348-90, Category II.

73. The results showed that the noise was from 46.9-57.1 dB(A) during daytime and 41.7-46.9 dB(A) at night, in compliance with the standard of 60 dB(A) during day time and 50 dB(A) at night (see Appendix B for details).

5. Mitigation Measures Implemented

74. The Project's environmental protection facilities were designed, installed and operated in accordance with "Environmental Protection Law of PRC" and "Environmental Protection Administration for Constructed Project". The people responsible for environmental protection are from the production and technical departments with knowledge of environmental protection regulations. There is an operation procedure for dust removal systems in both heating plants. No environmental and safety violations were report to the PMO during the reporting period.

6. Ambient Air Quality Data for the City of Liaoyang

75. There were four environmental monitoring stations in Liaoyang City area from 2001 to 2004, which were located at Jiangong School, Liaohua, Shuguang Traffic Intersection and Yuanlin. However, in 2005 two of the above-mentioned environmental monitoring stations were removed and three new environmental monitoring stations were set up. Therefore, comparison between current ambient air quality and the baseline data for the City of Liaoyang on a station by station basis would not be practical.

76. The ambient air monitoring data regarding SO₂, NO₂, TSP, CO, and PM₁₀ for different monitoring stations for January, April, July and October 2001-2006 are presented in Appendix B. No relevant information for 2007 was provided during the reporting period.

77. A map of locations of monitoring stations and a map of locations of decommissioned small boilers are included in the appendix as well.

G. Conclusions and Recommendations

1. Compliance

78. Environmental acceptance testing for Liaoyang Central Heating Subproject has been completed. Most environmental protection measures specified in the approved EIA have been taken except that the sheds for coal and ash storage. According to the results submitted and discussions with representatives of the LEPB, there are no outstanding violations or non-compliance issues.

2. Issues

79. No information was provided regarding dust monitoring for coal storage and ash storage. Sheds for coal and ash storages have not been constructed

3. Future Action Items

80. The PMO has been informed by the PIA that plans are currently being formulated to construct an enclosed coal storage building to be constructed in 2010. It is recommended that the PIA evaluate the possibility of constructing the coal storage sheds sooner.

81. Improving the management of ash and slag in the plants so that ash and slag in the plants can be timely transported to a brick plant to avoid fugitive dust pollution. Vehicles used to transport coal and slag should drive along designated routes to avoid disturbing local residents.

82. Because fugitive dust pollution is an issue with this subproject, it is recommended that daily maintenance on dust removal systems be strengthened to ensure compliance of dust emissions and reducing pollution to surrounding environment.

IV. YINGKOU CENTRAL HEATING SUBPROJECT

A. Background

83. The subproject consists of construction of one combined heat and power (CHP) generation plant and auxiliaries, two hot water boilers (to meet peak load demand on heating), 12 heat exchange stations and 40 km of heat supply pipelines. The thermal power plant will meet the requirement of base heat load, and the peak load boilers will meet the heating requirement of during peak load periods. This central heating subproject in Yingkou will replace 175 small boilers and will supply heat to 2.10 million m² of residential area once the subproject is completed and fully operational.

B. Current Status

84. The Yingkou Central Heating Subproject consists of: (1) three 58 MW circulated fluidized-bed (CFB) boilers, of which 2 are financed by local funds and one by the ADB fund; (2) two 12 MW steam turbine power generators, of which one is financed by local funds and the other by the ADB fund; (3) two 29 MW peak shaving boilers; (4) 12 heat exchange stations; and (5) 40 km heat distribution pipelines.

85. The procurement of the three ICB equipment contracts under Yingkou CHP Subproject was completed in 2007, and all the installation work has been completed except for the installation of boilers and their auxiliaries in the peak boiler house. The construction and installation of boilers for the peak shaving boiler house is scheduled to resume in the second half of 2008.

86. The monitoring plan has been implemented in accordance to the EIA and requirements for daily environmental management released by the Yingkou Environmental Protection Bureau.

C. Environmental Management Office

87. The Yingkou Heating Company has appointed Mr. Wu Yongchang and Mr. Luan Chenggang to be responsible for the environmental management of this project. The responsibilities for the PIA, the Yingkou Environmental Monitoring Center, contractor and local supervision companies are discussed in Section I.B. The individuals and their titles in the Environmental Management Office are summarized in Table 4-1.

Table 4-1 Environmental Management Office Personnel for Yingkou Heating Company

Name	Work Unit	Position	Titles in EMO
Shi Fenglai	Yingkou Heating Company	Chief Engineer	Director of EMO
Liu Han	Yingkou Environmental Monitoring Center	Deputy Director	Deputy Director of EMO
Yang Xishen	Yingkou Heating Company	Section Chief	Manager
Que Shijin	Anshan Sida Supervision Company	Chief Supervision Engineer	Manager
Qian Jufu	Jiangsu Huaneng Construction and Engineering (Group)Co. Ltd (Contractor)	Project Manager	Manager
Cao Hong	Yingkou Binhai Thermal Power Co. Ltd	Section Chief,	Manager

Name	Work Unit	Position	Titles in EMO
		Production Section	
Wu Yongchang	Yingkou Binhai Thermal Power Co. Ltd	Director, Boiler Workshop	Environmental Sepecialist
Luan Chenggang	Yingkou Binhai Thermal Power Co. Ltd	Director, Chemical Water Workshop	Environmental Sepecialist
Chen Bin	PMO	Environmental Officer	Environmental Coordinator

D. Operations

1. Coal Consumption

88. The coal consumption and lime injection amounts during the 2006-2007 heating season are provided in Table 4-2, but similar information for 2007-2008 heating season was not provided by the PIA.

Table 4-2 Coal Consumption for Yingkou Heating Supply Subproject

Year	Coal (ton/year)	Lime (ton/year)
2006-07	61,000	6000
2007-08	Not available	Not available

2. Solid Waste Disposal

89. The ash and slag amounts produced during the 2006-2007 heating seasons are provided in Table 4-3. However, no similar information was provided for 2007-2008 heating season. Ash and slag are sold to the Yingko Yunhai Development and Construction Ltd., Co. for CYN 5 per m³.

Table 4-3 Ash and Slag Production for Yingko Heating Company

Year	Ash (ton/year)	Slag (ton/year)
2006-07	9.6	12.2
2007-08	Not available	Not available

3. Wastewater Discharge

90. A certain amount of wastewater was produced during normal operations of the facility and the details are discussed in Section F.4 below.

E. Small Boiler Decommissioning

91. As of the end of March 2008, 177 small boilers have been decommissioned in the subproject service area.

F. Environmental Monitoring

92. The PIA signed a contract with Yingkou Environmental Monitoring Center during the 1st quarter of 2008 to provide environmental monitoring and collect environmental data according to the requirements in the EIA approval and guidance provided by the consultant. The environmental manager of PIA worked closely with the center, the PMO and the consultant to ensure that environmental monitoring was conducted as prescribed under the covenants of this loan.

1. Ambient Air Quality Monitoring around the Plant

93. According to the EIA, eight monitoring locations were set up to monitor SO₂, NO₂, TSP and PM₁₀.

94. Monitoring lasted five days, from 22 March to 26 March 2008, to acquire daily average values of TSP, PM₁₀, SO₂, NO₂ and hourly average values of NO₂ and SO₂. Hourly average concentrations were monitored four times every day at 7:00, 10:00, 14:00 and 19:00. Each sampling time is approximately 45 minutes. It took at least 18 hours to sample SO₂ and NO₂ every day and it took 12 hours or more to sample TSP and PM₁₀ every day. At the same time it is necessary to record wind directions and wind speeds, air temperatures and other conditions. Appendix C shows the sampling time requirements. Monitoring and analysis methods and their basis are also shown in Appendix C.

95. The results, summarized in Appendix C, showed that daily values for TSP varied from 0.075 mg/m³ to 0.389 mg/m³, and 5% of the values exceed the Ambient Air Quality Standard (GB3095-1996) of 0.30 mg/m³. The daily values for PM₁₀ varied from 0.034 mg/m³ to 0.183 mg/m³, and 2.9% of the values exceed the standard of 0.15 mg/m³. All daily and hourly values for SO₂ are in compliance with the standard of 0.15 and 0.5 mg/m³; and all daily and hourly values for NO₂ are in compliance with the standard of 0.12 and 0.24 mg/m³.

2. Emissions from Boilers

96. The monitoring locations were set up in each inlet and outlet of the ESPs. The concentrations of dust, SO₂, and NO_x and blackness of smoke were monitored. The monitoring continued three times each day for three days from 24-26 March 2008.

97. The applicable standard used for sampling and testing is "Environmental Monitoring Specification for Power Plant" DL/T414-2004. The applicable standards for monitoring methods and evaluating compliance are the Emission Standard of Air Pollutants for Thermal Power Plants (GB 13223-2003), Time Zone III.

98. The results, summarized in Appendix C, show that SO₂, NO₂ and dust concentrations at the outlets from the ESPs of the boilers are in compliance with the standard of 400 mg/m³, 450 mg/m³ and 50 mg/m³.

3. Dust Monitoring for Coal Storage and Ash Storage

99. A monitoring location was set up in the outlet of the dust removal system used for coal conveyor systems and dust concentrations were monitored. During 24-26 March 2008, the monitoring continued three times each day for three days.

100. The applicable standard used for evaluating compliance is the Air Pollutant Integrated Emission Standard (GB16297-1996) Grade II. The results, summarized in Appendix C, showed that all monitoring data for TSP are in compliance with the standard of 120 mg/m³.

4. Wastewater Monitoring

101. A monitoring station was set up in the overall wastewater discharge outlet of the plant. The concentrations for pH, SS COD and NH_3 were monitored. Monitoring was conducted three times each day for three days from 24-26 March 2008.

102. The applicable standard used for sampling and testing is the Ground Water and Wastewater Monitoring Specification HJ/T91-2002. The applicable standard used for monitoring and evaluating compliance is the Liaoning Provincial Wastewater Discharge and Air Emission Standard DB21-60-89, Grade II.

103. The results, summarized in Appendix C, showed that all values for pH, SS, COD and NH_3 are in compliance with the standards of 6-9, 100 mg/l, 100 mg/l and 15 mg/l, respectively.

5. Noise Monitoring

104. Seven monitoring locations were set up around the plant and within surrounding residential quarters. The specific noise monitoring locations are given in Appendix C. Noise monitoring was conducted at 10:00 AM and 10:00 PM for two days from 23-24 March 2008.

105. The applicable standard used for sampling and testing is "Measurement Method on Noise at Boundary of Industrial Enterprises" and "Environmental Noise Measurement Method in Urban Areas". The applicable standard for assessing compliance for location Nos.1 - 5 is Standard of Noise at Boundary of Industrial Enterprises GB 12348-90, Grade II, and Standard of Environmental Noise in Urban Area GB 3096-93 for locations Nos. 6-7.

106. The results, summarized in Appendix C, showed that average values for noise levels are in compliance with the standard of 60 dB(A) during day time and 50 dB(A) at night.

6. Ambient Air Quality Data for the City of Yingkou

107. There were four environmental monitoring stations in Yingkou City from 2001 to 2004, which were Yingkou University station, Liming Primary School station, West Dianhuohua station, and West Paotai station. However, in 2005 three environmental monitoring stations were discontinued and three new environmental monitoring stations were set up in different part of the city. Therefore, comparison between current ambient air quality and the historical data of the city of Yingkou would be difficult to compare.

108. The ambient air monitoring data regarding SO_2 , NO_2 , TSP, CO, and PM_{10} from different monitoring stations for January, April, July and October during 2001-2006 are presented in Appendix C for reference. No relevant information for 2007 was provided during the reporting period. The locations of the Yingkou Central Environmental Monitoring Station and locations of all environmental monitoring stations in Yingkou City are also included in Appendix C.

G. Mitigation Measures

1. Air

109. There were monitoring ports at the inlet and outlet of the flue gas of the boiler facilities. The monitoring frequency is once a month. The amount of emissions of dust, SO_2 and NO_x were monitored. The bag-type dust collectors were checked regularly to prevent bag damages to ensure the efficiency of dust collection.

110. In order to ensure the result of desulphurization and meet the emission requirements for SO_2 , the amount of limestone injected was strictly monitored.

2. Noise

111. Equipment maintenance was strengthened to ensure optimal performance of major equipment. Meanwhile, doors and windows of workshops were closed to reduce noise impacts from power equipment such as motors on surrounding areas and residents.

3. Ground Water

112. Wastewater needs to be tested and confirmed in compliance prior to discharge into the municipal sewers. Thus the potential pollution on ground water was reduced.

4. Solid Waste

113. Ash and slag from boiler facilities were handled using covered vehicles to closed ash and slag sheds. Slags were handled using vehicles with covers, and ash was handled using hermetically tank-type vehicles. Thus fugitive dust pollution was reduced.

5. Others

114. Production and dispatching meetings were held regularly. Environmental management was integrated into production management. Responsibilities for environmental management at deferent levels were identified. Environmental management staff on waste water discharging and emission control worked carefully and appropriate actions were taken where environmental problems arose. Routine environmental management work was well done.

6. Training and Public Participation

115. The PIA provides training to its staff with different responsibilities. The training for the staff included technical skills, production safety and environmental management. Operational procedures were strictly carried out to ensure safe, stable and economical operations and environmental compliance.

116. Visiting the surrounding residents was conducted to discuss their heating conditions and the environmental impacts with them. A complaint phone number was established to resolve any complaints or issues from local residents.

H. Conclusions and Recommendations

1. Compliance

117. The Yingkou Heating Company entered into a contractual agreement with the Yingkou Environmental Monitoring Center and has implemented the environmental monitoring plan for the 2007-2008 heating season. According to the results submitted and in conversations with representatives of the YEPB, there are no outstanding violations or non-compliance issues at the facility.

118. With the exception of exceeding the daily averages for PM₁₀ and TSP on 25 March 2008, possibly attributed to weather conditions, the City of Yingkou achieved compliance with the Ambient Air Quality Standard GB3095-1996, Class II according to the data submitted to the PMO.

2. Issues

119. No data was submitted for ambient air quality monitoring at locations and sensitive receptors adjacent to the plant as required by the EIA.

3. Future Action Items

120. Expand the existing environmental monitoring program to include ambient air quality monitoring at sensitive receptors adjacent as required by the EIA.

V. BENXI GAS DISTRIBUTION IMPROVEMENT SUBPROJECT

121. The PMO and the consultant have repeatedly request environmental monitoring data and information from the PIA. However, no information was provided during the reporting period.

VI. CONCLUSIONS

122. The PIAs for the central heating subprojects have signed contracts with local environmental agencies for related environmental monitoring and environmental management offices have also been established. Relevant environmental monitoring was conducted during the 2007-2008 heating season all PIAs except Benxi Gas Distribution PIA. Monitoring data have been submitted to the PMO. However, environmental monitoring work and monitoring data vary from different cities. The PMO will continue to require them to conduct monitoring at the same level during next operation period with technical guidance from the consultant. Better environmental monitoring reports from the PIAs and local environmental agencies are expected. In addition, more individuals from operation workshops concerned should become members of environmental management offices for Liaoyang Central Heating Project and Benxi Central Heating Project.

123. There still exist some major gaps and issues in the process of establishing baseline data for each of the project cities. Requests were made to all EPBs, but response was slow, and data is sparse in some areas. Also some cities have recently installed Continuous Environmental Monitoring (CEMs) devices that will create some difficulty in comparing the historical data, which was sampled only a few times per month or per year, to the future data which will be continuously monitored. In addition, the reporting of the data varies from hourly, daily, monthly, quarterly to annually.

124. Cities like Liaoyang have been proactive in not only cooperating with this project, but also in targeting heavily polluting sources to further improve ambient air quality. Combined with the implementation of this project, these actions should provide ample results towards the goal of pollution prevention and reduction.

APPENDIX A

MONITORING DATA FOR BENXI CENTRAL HEATING PLANT

Table A-1 Monitoring Data for TSP and PM₁₀ at Different LocationsUnit: mg/m³

		Heijin Grain Shop	Caisheng Residential Quarters	Dongfen Square	Beidi Square	Meitie Shop
January 21	TSP	0.270	0.268	0.238	0.180	0.282
	PM ₁₀	0.189	0.161	0.143	0.108	0.169
January 22	TSP	0.204	0.130	0.230	0.132	0.287
	PM ₁₀	0.143	0.078	0.138	0.089	0.172
January 23	TSP	0.343	0.288	0.216	0.152	0.322
	PM ₁₀	0.206	0.173	0.103	0.091	0.193
January 24	TSP	0.168	0.200	0.245	0.128	0.277
	PM ₁₀	0.101	0.120	0.147	0.085	0.166
January 25	TSP	0.250	0.163	0.177	0.127	0.312
	PM ₁₀	0.152	0.098	0.106	0.076	0.187

Table A-2 Fugitive EmissionUnit: mg/m³

Location	Monitoring Time	Upstream Direction	Downstream Direction	
		1#	2#	3#
Coal Shed	January 22	Morning	0.198	0.256
		Afternoon	0.201	0.271
	January 23	Morning	0.198	0.301
		Afternoon	0.202	0.268
Slag Place	January 22	Morning	0.266	0.294
		Afternoon	0.243	0.273
	January 23	Morning	0.198	0.221
		Afternoon	0.202	0.273

Table A-3 Monitoring Data for SO₂Unit: mg/m³

Location	January 21					January 22					January 23					January 24					January 25				
	7 O'clock	10 o'clock	14 o'clock	19 o'clock	Daily averag e	7 o'clock	10 o'clock	14 o'clock	19 o'clock	Daily avera ge	7 o'clock	10 o'clock	14 o'clock	19 o'clock	Daily avera ge	7 o'clock	10 o'clock	14 o'clock	19 O'clock	Daily avera ge	7 o'clock	10 o'clock	14 o'clock	19 o'clock	Daily avera ge
Heijin Grain Shop	0.036	0.043	0.049	0.038	0.045	0.038	0.046	0.063	0.047	0.051	0.044	0.038	0.062	0.037	0.048	0.071	0.056	0.057	0.051	0.053	0.052	0.046	0.061	0.078	0.055
Caisheng Residential Quarters	0.059	0.046	0.068	0.072	0.057	0.078	0.064	0.046	0.053	0.056	0.057	0.053	0.087	0.076	0.060	0.097	0.052	0.067	0.091	0.065	0.066	0.056	0.083	0.076	0.066
Dongfen Square	0.087	0.092	0.077	0.091	0.074	0.067	0.069	0.102	0.077	0.072	0.056	0.069	0.072	0.085	0.070	0.063	0.077	0.086	0.091	0.069	0.066	0.085	0.067	0.084	0.072
Beidi Square	0.065	0.053	0.072	0.061	0.060	0.046	0.067	0.061	0.072	0.061	0.067	0.059	0.048	0.064	0.058	0.069	0.054	0.049	0.078	0.059	0.063	0.052	0.048	0.069	0.061
Meitie Shop	0.047	0.056	0.061	0.043	0.054	0.039	0.061	0.056	0.047	0.052	0.063	0.045	0.041	0.062	0.056	0.067	0.049	0.039	0.061	0.053	0.061	0.043	0.044	0.067	0.054

Table A-4 Monitoring Data for NO₂

Unit: mg/m³

Location	January 21					January 22					January 23					January 24					January 25				
	7 O'clock	10 o'clock	14 o'clock	19 o'clock	Daily average	7 o'clock	10 o'clock	14 o'clock	19 o'clock	Daily average	7 o'clock	10 o'clock	14 o'clock	19 o'clock	Daily average	7 o'clock	10 o'clock	14 o'clock	19 O'clock	Daily average	7 o'clock	10 o'clock	14 o'clock	19 o'clock	Daily average
Heijin Grain Shop	0.031	0.037	0.021	0.037	0.033	0.036	0.041	0.0333	0.041	0.040	0.033	0.036	0.031	0.041	0.038	0.036	0.051	0.047	0.041	0.042	0.061	0.049	0.043	0.038	0.039
Caisheng Residential QUarters	0.044	0.039	0.033	0.051	0.044	0.043	0.047	0.052	0.061	0.053	0.041	0.051	0.038	0.058	0.050	0.044	0.038	0.057	0.062	0.051	0.044	0.039	0.041	0.057	0.043
Dongfen Square	0.056	0.051	0.042	0.068	0.052	0.062	0.051	0.049	0.046	0.054	0.054	0.046	0.039	0.067	0.050	0.062	0.044	0.045	0.062	0.051	0.067	0.049	0.042	0.066	0.053
Beidi Square	0.057	0.049	0.041	0.068	0.061	0.056	0.049	0.066	0.071	0.055	0.061	0.059	0.046	0.071	0.056	0.049	0.051	0.068	0.071	0.058	0.064	0.051	0.049	0.068	0.057

Table A-5 Groundwater Monitoring Data

mg/L

Section	Sample Date	Pollutant Concentration Unit: mg/L						
		PH	SS	NH3	COD	Fluoride	Oil	Arsenic
Upper Position of Outlet (100 m)	January 21	7.65	28.2	0.92	21.6	0.20	0.16	<0.005
	January 22	7.60	27.5	0.89	20.8	0.18	0.18	<0.005
	January 23	7.62	26.4	0.84	19.6	0.22	0.12	<0.005
Lower Position of Outlet (100 m)	January 21	7.63	26.5	0.76	21.3	0.24	0.14	<0.005
	January 22	7.69	27.6	0.78	20.7	0.18	0.16	<0.005
	January 23	7.67	26.9	0.88	21.8	0.20	0.15	<0.005
Lower Position of Outlet (1000 m)	January 21	7.66	27.6	0.89	19.4	0.22	0.18	<0.005
	January 22	7.70	26.4	0.93	20.3	0.18	0.14	<0.005
	January 23	6.69	28.0	0.86	19.9	0.20	0.16	<0.005

Table A-6 Noise Monitoring Data Near Benxi Central Heating Facility

unit: dB(A)

Location	Time	Parameters			
		Leq	L ₁₀	L ₅₀	L ₉₀
East	Day time on January 22	50.4	52.6	50.2	49.2
	Night on January 22	47.3	47.6	43.8	42.9
	Day time on January 23	51.0	51.3	48.3	46.5
	Night on January 23	47.5	48.3	46.6	46.2
West	Day time on January 22	52.2	53.3	47.8	42.1
	Night on January 22	47.2	48.2	46.7	45.9
	Day time on January 23	51.4	52.5	47.6	45.8
	Night on January 23	47.3	49.3	45.4	45.0
South	Day time on January 22	47.0	47.8	45.2	44.1
	Night on January 22	46.2	47.9	45.7	45.2
	Day time on January 23	49.1	49.8	48.2	47.7
	Night on January 23	45.5	48.3	46.2	44.6
North	Day time on January 22	52.0	53.4	48.5	45.8
	Night on January 22	45.6	46.5	45.2	45.0
	Day time on January 23	50.3	54.3	47.6	45.4
	Night on January 23	46.9	48.6	47.1	46.2

Table A-7 Monitoring Data at Outlet of ESPsUnit: mg/m³

	Monitoring Index		
	Smoke	SO ₂	Black Level of Smoke
Outlet of No. 1 ESP	108.4	782.0	0.5
Outlet of No. 2 ESP	96.7	836.0	0.5

Table A-8 SO₂ for Benxi City During 2001-2006mg/m³

Location	Xihu	Caitun	Fadian	Dongming	Dayu	Zhiyi Hospital	Weining	Urban Area
2001	0.070	0.085	0.090	0.084	0.042			0.071
2002	0.089	0.081	0.074	0.078	0.029			0.068
2003	0.077	0.088	0.079	0.057	0.024			0.060
2004	0.079	0.084	0.072	0.055	0.030			0.060
2005	0.082			0.066	0.030			0.059
2006	0.063			0.046	0.037	0.030		0.044

Table A-9 NO₂ for Benxi City During 2001-2006mg/m³

Location	Xihu	Caitun	Fadian	Dongming	Dayu	Zhiyi Hospital	Weining	Urban Area
2001	0.033	0.038	0.038	0.044	0.020			0.033
2002	0.033	0.045	0.040	0.046	0.021			0.036
2003	0.043	0.046	0.044	0.043	0.025			0.039
2004	0.034	0.041	0.040	0.038	0.017			0.032
2005	0.045			0.039	0.022			0.036
2006	0.027			0.025	0.030	0.031		0.028

Table A-10 TSP for Benxi City During 2001-2006mg/m³

Location	Xihu	Caitun	Fadian	Dongming	Dayu	Zhiyi Hospital	Weining	Urban Area
2001	0.439	0.509	0.437	0.290	0.196			0.346
2002	0.334	0.393	0.359	0.262	0.143			0.288
2003	0.381	0.340	0.384	0.234	0.149			0.282
2004	0.345	0.334	0.375	0.251	0.170			0.280
2005	0.190			0.108	0.060			0.119
2006	0.161			0.102	0.08	0.100		0.111

Table A-11 CO for Benxi City During 2001-2006

								mg/m ³
Location	Xihu	Caitun	Fadian	Dongming	Dayu	Zhiyi Hospital	Weining	Urban Area
2001	3.86	2.74	2.39	1.84	0.77			2.26
2002	3.03	2.32	1.75	1.77	0.98			1.95
2003	2.17	2.08	1.78	1.35	0.71			1.54
2004	2.23	1.87	2.13	1.40	1.40			1.76
2005	1.38	1.72	1.44	1.24	1.01			1.29
2006	2.07			1.31	1.36			1.58

Table A-12 PM10 for Benxi City During 2001-2006

								mg/m ³
Location	Xihu	Caitun	Fadian	Dongming	Dayu	Zhiyi Hospital	Weining	Urban Area
2001	30.2	44.8	43.4	29.0	10.5			28.5
2002	29.9	44.4	40.3	26.3	10.6			27.3
2003	28.9	44.0	35.9	25.2	9.9			26.0
2004	29.0	44.0	36.3	22.1	8.8			25.0
2005	26.2	41.3	33.8	19.4	8.5			22.9
2006	26.0	44.0		20.5	10.0	16.4	15.4	22.0

APPENDIX B

MONITORING DATA FOR LIAOYANG HEATING PLANT

Table B-1 Monitoring Data for Dust Removal Systems (DRSs) for Doushuangshu

Name	Location of Monitoring	Time	Frequency	Dust Flow M³/h	Dust Concentration mg/m³	Dust Volume kg/h	SO₂ Concentration mg/m³	SO₂ Emission Volume kg/h	Ringelmann number/Grade
No.3 DRS	Inlet	March26	1	98810	1043	103	1016	100	——
			2	99510	1031	103	1043	104	——
			3	99517	1079	107	1032	103	——
		March 27	1	98580	1027	101	1029	101	——
			2	98612	1040	103	1018	100	——
			3	99049	1061	105	1063	105	——
	outlet	March26	1	106125	68	7	375	40	<1
			2	107546	79	8	391	42	<1
			3	107845	81	9	371	40	<1
		March 27	1	107153	72	8	383	41	<1
			2	106958	62	7	380	41	<1
			3	106754	86	9	368	39	<1
	Standards		——	——	100	——	450	——	<1
	Compliance		——	——	yes	——	yes	——	Yes
	Efficiency		Dust removal Efficiency is 92.3%, and desulphurization efficiency is 60.8%.						
No.4 DRS	Inlet	March26	1	97561	1038	101	1125	110	——
			2	98548	1079	106	1104	109	——
			3	98856	1087	107	1115	110	——
		March 27	1	99619	1093	109	1123	112	——
			2	99486	1114	111	1095	109	——
			3	99253	1081	107	1131	112	——

Outlet	March26	1	104810	72	7	392	41	<1	
		2	105510	76	8	382	40	<1	
		3	107517	68	7	406	44	<1	
	March 27	1	105711	84	9	407	43	<1	
		2	107628	72	8	373	40	<1	
		3	108747	63	7	401	44	<1	
	Standards		—	—	100	—	450	—	<1
	Compliance		—	—	yes	—	yes	—	yes
	Efficiency		Dust removal Efficiency is 92.5%, and desulphurization efficiency is 61.8%.						

Table B-1 Monitoring Data for Dust Removal Systems (DRSs) for Doushuangshu (Con.)

Name	Location of Monitoring	Time	Frequency	Dust Flow M ³ /h	Dust Concentration mg/m ³	Dust Volume kg/h	SO ₂ Concentration mg/m ³	SO ₂ Emission Volume kg/h	Ringelmann number/Grade
No.5 DRS	Inlet 1	March26	1	45597	1091	50	1051	48	—
			2	45107	1048	47	1021	46	—
			3	47731	1054	50	1014	48	—
		March 27	1	43402	1096	48	1065	46	—
			2	44059	1074	47	1037	46	—
			3	44632	1094	49	1025	46	—
	Inlet 2	March26	1	55754	1080	60	1022	57	—
			2	56553	1046	59	1063	60	—
			3	55797	1058	59	1014	57	—
		March 27	1	56737	1065	60	1053	60	—

Outlet		2	53779	1152	62	1028	55	—
		3	51309	1098	56	1011	52	—
		1	110297	78	8	371	41	<1
	March26	2	112216	71	8	345	39	<1
		3	110046	67	7	351	38	<1
		1	104002	75	8	357	37	<1
	March 27	2	106779	81	9	384	41	<1
		3	107424	71	8	356	38	<1
	Standards	—	—	100	—	450	—	<1
	Compliance	—	—	yes	—	yes	—	yes
Efficiency		Dust removal Efficiency is 92.6%, and desulphurization efficiency is 62.5%.						

Table B-2 Monitoring Data for Dust Removal Systems (DRSs) for Beicaoku

Name	Location of Monitoring	Time	Frequency	Dust Flow M ³ /h	Dust Concentration mg/m ³	Dust Volume kg/h	SO ₂ Concentration mg/m ³	SO ₂ Emission Volume kg/h	Ringelmann number/Grade
No.7 DRS	Inlet 1	March26	1	40669	1097	45	1028	42	—
			2	40169	1120	45	1011	41	—
			3	40935	1108	45	1036	42	—
		March 27	1	40457	1040	42	1019	41	—
			2	41040	1100	4.5	1032	42	—
			3	40774	1017	41	1021	42	—
	Inlet 2	March26	1	58664	1030	60	1032	61	—
			2	59101	1004	59	1017	60	—

No.8 DRS		March 27	3	59217	1041	62	1019	60	——	
			1	58646	1043	61	1035	61	——	
			2	58651	1023	60	1051	62	——	
			3	59326	1101	65	1027	61	——	
	Outlet	March26	1	105618	74	8	375	40	<1	
			2	107513	68	7	348	37	<1	
			3	110864	81	9	356	39	<1	
		March 27	1	106986	79	8	355	38	<1	
			2	110589	63	7	371	41	<1	
			3	105835	71	7	337	36	<1	
		Dust removal status			Dust removal Efficiency is 92.4%, and desulphurization efficiency is 62.6%.					
		Inlet 1	March26	1	50931	1075	55	1075	55	——
	2			50766	1028	52	1023	52	——	
	3			51096	1063	54	1038	53	——	
	March 27		1	50597	1024	52	1004	51	——	
			2	50759	1039	53	1044	53	——	
			3	50078	1094	55	1015	51	——	
Inlet 2	March26	1	59073	1006	59	987	58	——		
		2	58211	1080	63	1011	59	——		
		3	58508	1047	61	1004	59	——		
	March 27	1	58031	1080	63	1021	59	——		
		2	58432	1031	60	1040	61	——		
		3	59496	1062	63	1019	61	——		
Outlet	March26	1	117618	75	9	367	43	<1		
		2	118584	66	8	376	44	<1		

		3	118286	78	9	359	42	<1
		1	118143	74	9	375	44	<1
	March 27	2	116972	78	9	362	42	<1
		3	118432	66	8	386	46	<1
	Standards	Dust removal Efficiency is 92.2%, and desulphurization efficiency is 61.5%.						
	Compliance	—	—	100	—	450	—	<1
	Efficiency	—	—	yes	—	yes	—	yes

Table B-2 Monitoring Data for Dust Removal Systems (DRSs) for Beicaoku (Con.)

Name	Location of Monitoring	Time	Frequency	Dust Flow M ³ /h	Dust Concentration mg/m ³	Dust Volume kg/h	SO ₂ Concentration mg/m ³	SO ₂ Emission Volume kg/h	Ringelmann number/Grade
No.9 DRS	Inlet 1	March26	1	42563	1123	48	1125	48	—
			2	43528	1120	49	1008	44	—
			3	42298	1098	46	1084	46	—
		March 27	1	42522	1077	46	1027	44	—
			2	43015	1082	47	1058	46	—
			3	43186	1102	48	1026	44	—
	Inlet 2	March26	1	58332	1184	69	1078	63	—
			2	58875	1099	65	1031	61	—
			3	58427	1052	61	1005	59	—
		March 27	1	58556	1110	65	1007	59	—
			2	57998	1066	62	1025	59	—
			3	58835	1075	63	1031	61	—

Outlet	March26	1	119985	73	9	376	45	<1
		2	118016	68	8	378	45	<1
		3	119022	70	8	364	43	<1
	March 27	1	119111	77	9	386	46	<1
		2	118245	72	8	383	45	<1
		3	118776	63	7	387	46	<1
	Standards	——	——	100	——	450	——	<1
	Compliance	——	——	yes	——	yes	——	yes
	Efficiency	Dust removal Efficiency is 92.8%, and desulphurization efficiency is 57.1%.						

Table B-3 Monitoring Data for Fugitive Emissions from Doushuangshu Heating Plant

Unit: mg/m³

Sampling Date	Sampling Frequency	Sampling Number and Location				Standard	Compliance
		No. 1 in the north of the Plant (upstream direction)	No. 2 in the east of the Plant (downstream direction)	No. 3 in the south of the Plant (downstream direction)	No. 4 in the west of the Plant (downstream direction)		
March 25	2	0.152	0.254	0.209	0.261	1.0	达标
		0.136	0.235	0.278	0.236		
March 26	2	0.154	0.376	0.289	0.250		达标
		0.123	0.251	0.268	0.271		

Table B-4 Monitoring Data for Fugitive Emissions from Beicaoku Heating PlantUnit: mg/m³

Sampling Date	Sampling Frequency	Sampling Number and Location				Standard	Compliance
		No. 1 in the north of the Plant (upstream direction)	No. 2 in the east of the Plant (downstream direction)	No. 3 in the south of the Plant (downstream direction)	No. 4 in the west of the Plant (downstream direction)		
March 25	2	0.169	0.223	0.204	0.298	1.0	达标
		0.146	0.222	0.237	0.198		
March 26	2	0.110	0.291	0.182	0.295		达标
		0.136	0.245	0.245	0.272		

Table B-5 Monitoring Data for Noise Levels

Unit: dB(A)

Location No.	Time	Location	Monitoring Data (Leq)							
			Daytime				Night			
			L ₁₀	L ₅₀	L ₉₀	Leq	L ₁₀	L ₅₀	L ₉₀	Leq
1	March 25	East of DSS	49.5	47.0	44.1	46.9	45.2	43.7	41.1	43.5
2		North of DSS	51.8	47.6	45.3	47.4	45.6	43.1	40.3	42.9
3		West of DSS	57.3	53.4	52.3	54.7	51.0	43.2	42.5	43.9
4		South of DSS	59.8	51.1	48.2	51.1	47.9	44.1	39.9	44.5
5		East of BCK	51.8	50.0	47.9	50.3	43.5	38.9	37.6	41.8
6		North of BCK	54.7	49.2	48.0	52.9	46.4	38.9	38.2	43.8
7		West of BCK	54.4	53.1	50.5	52.6	45.5	42.8	41.8	43.9
8		South of BCK	56.4	53.4	50.5	54.1	47.1	46.0	42.1	45.8
1	March 26	East of DSS	50.2	47.0	46.1	47.0	43.6	42.2	41.4	42.7

2	North of DSS	48.6	48.2	45.6	48.1	43.5	40.3	39.8	42.3
3	West of DSS	62.5	55.5	49.7	57.1	46.7	43.8	42.0	44.9
4	South of DSS	51.3	48.0	46.7	49.2	47.7	44.9	38.2	43.6
5	East of BCK	51.2	50.1	47.8	49.6	46.9	39.1	38.2	41.7
6	North of BCK	54.2	53.9	50.5	53.1	43.8	42.8	41.8	42.7
7	West of BCK	53.3	52.4	51.3	52.3	46.8	44.6	43.9	44.8
8	South of BCK	59.5	51.7	50.3	54.8	48.5	47.6	43.0	46.9
Standard		60				50			
Compliance		In Compliance				In Compliance			

Table B-6 Total Emissions

Name	Flue gas flow Nm ³ /h	Flue dust		SO ₂	
		Hourly Emission kg/h	Yearly Emission t/a	Hourly Emission kg/h	Yearly Emission t/a
Boiler 1	109371	8	19.7	42	103.5
Boiler 2	99681	7	17.2	38	93.6
Boiler 3	107064	8	19.7	41	101.0
Boiler 4	106654	8	19.7	42	103.5
Boiler 5	108461	8	19.7	39	96.1
Boiler 7	107901	8	19.7	39	96.1
Boiler 8	118006	9	22.2	44	108.4
Boiler 9	118859	8	19.7	45	110.9
Total	875997	64	157.7	330	813.1
Total amount approved in EIA		—	667.6	—	1003.3
Actual amount control status		—	In Compliance	—	In Compliance

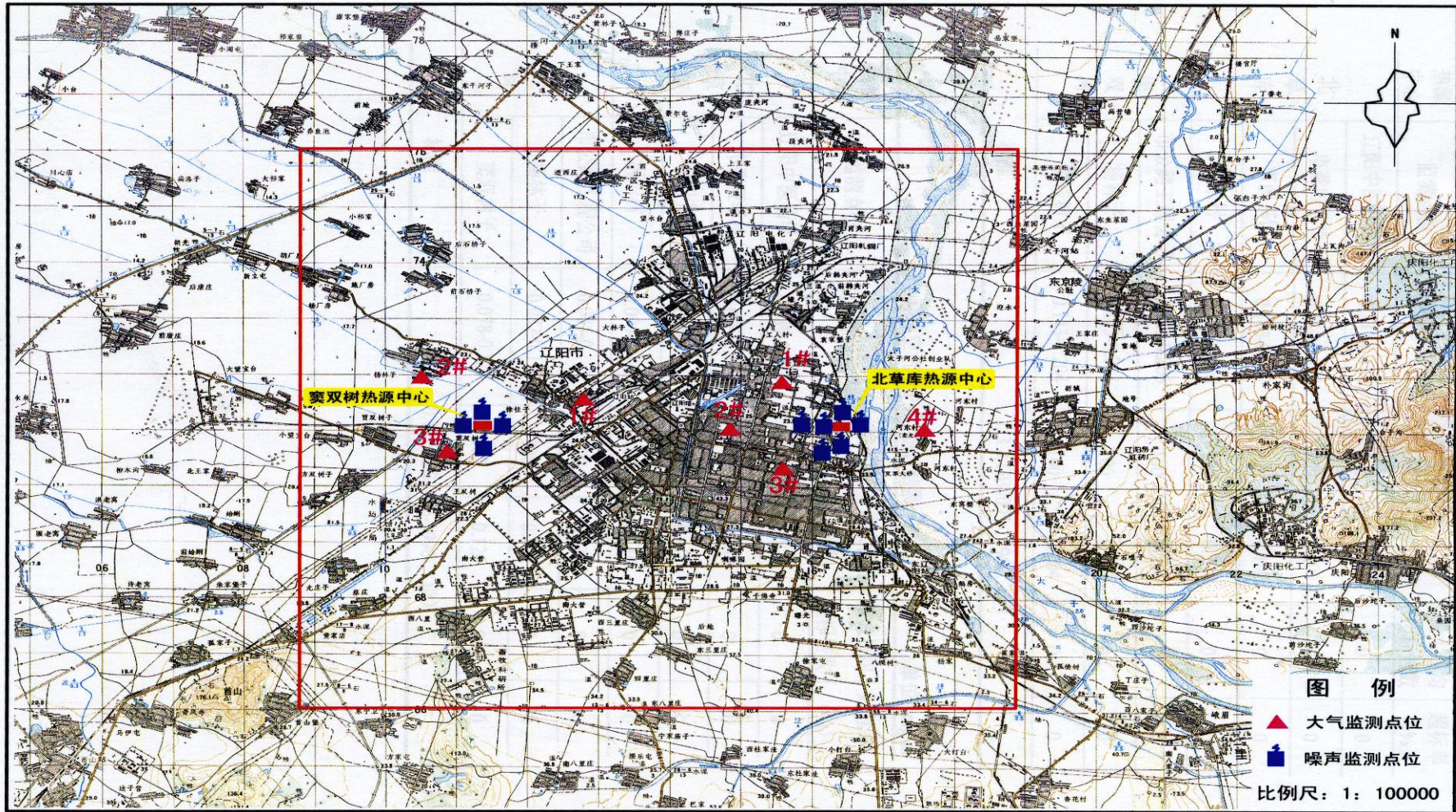


图2-2 项目监测点位图

Figure B-1 – Map of Monitoring Locations



图4-7 替代源位置图

Figure B-2 - Map of Locations of Decommissioned Small Boilers

Table B-7 SO₂ Monitoring Data for Liaoyang CityMonthly/Quarterly Average Values (mg/m³)

Location/ Year	Jan	Feb	Mar	Avg for Q1	Apr	May	Jun	Avg for Q2	Jul	Aug	Sep	Avg for Q3	Oct	Nov	Dec	Avg for Q4	Monitoring Days	Yearly Avg
Jiangong School Monitoring Station																		
2001	0.138				0.003				0.002				0.004				48	0.037
2002	0.142				0.004				0.005				0.003					0.038
2003	0.132				0.03				0.004				0.013					0.045
2004	0.098				0.006				0.007				0.005					0.029
2005																		
Liaohua Monitoring Station																		
2001	0.036				0.007				0.002				0.006				48	0.013
2002	0.024				0.001				0.006				0.004					0.011
2003	0.071				0.012				0.009				0.004					0.024
2004	0.056				0.01				0.006				0.008					0.02
2005	0.072	0.07	0.041	0.061	0.024	0.022	0.008	0.018	0.019	0.035	0.03	0.028	0.023	0.058	0.143	0.075		0.045
Shuguang Traffic Intersection Monitoring Station																		
2001	0.138				0.015				0.002				0.005				48	0.04
2002	0.083				0.004				0.004				0.005					0.024
2003	0.151				0.019				0.006				0.012					0.047
2004	0.183				0.013				0.011				0.01					0.054
2005																		
201 Xuezhan Monitoring Station																		
2001																		
2002																		
2003																		
2004																		
2005	0.176	0.145	0.097	0.0139	0.044	0.023	0.011	0.026	0.03	0.038	0.05	0.039	0.04	0.137	0.279	0.152		0.089
Yuanli Xiaoqu Monitoring Station																		
2001	0.053				0.018				0.002				0.004				48	0.019
2002	0.132				0.003				0.005				0.005					0.036

Location/Year	Jan	Feb	Mar	Avg for Q1	Apr	May	Jun	Avg for Q2	Jul	Aug	Sep	Avg for Q3	Oct	Nov	Dec	Avg for Q4	Monitoring Days	Yearly Avg
2004																		
2005	0.066	0.06	0.042	0.056	0.035	0.029	0.027	0.03	0.033	0.034	0.049	0.038	0.039	0.05	0.049	0.046		0.042
Yuanli Xiaoqu Monitoring Station																		
2001	0.03				0.02				0.018				0.046				48	0.028
2002	0.059				0.021				0.025				0.028					0.033
2003																		
2004	0.065				0.036				0.017				0.019					0.034
2005	0.059	0.053	0.04	0.051	0.034	0.031	0.02	0.028	0.016	0.016	0.036	0.022	0.032	0.033	0.039	0.035		0.034
Steel Pipe Plant Monitoring Station																		
2001																		
2002																		
2003																		
2004																		
2005																		
Automatic Monitoring Station																		
2001																		
2002																		
2003																		
2004																		
2005		0.033	0.035			0.035	0.032			0.031	0.032			0.04	0.073			0.039

[illegible]

Table B-10 TSP Monitoring Data for Liaoyang City

Monthly/Quarterly Average Values (mg/m ³)																		
Location/ Year	Jan	Feb	Mar	Avg for Q1	Apr	May	Jun	Avg for Q2	Jul	Aug	Sep	Avg for Q3	Oct	Nov	Dec	Avg for Q4	Monitoring Days	Yearly Avg
Jiangong School Monitoring Station																		
2001	0.335			0.335	0.316			0.316	0.142			0.142	0.229			0.229	48	0.256
2002	0.267				0.263				0.142				0.108					0.195
2003	0.211				0.288				0.126				0.158					0.198
2004	0.244				0.258				0.11				0.115					0.189
2005																		
Liaohua Monitoring Station																		
2001	0.238			0.238	0.328			0.328	0.127			0.127	0.21			0.21	48	0.226
2002	0.211				0.323				0.159				0.11					0.201
2003	0.203				0.257				0.122				0.124					0.177
2004	0.296				0.28				0.126				0.104					0.201
2005																		
Shuguang Traffic Intersection Monitoring Station																		
2001	0.319			0.319	0.423			0.423	0.37			0.37	0.354			0.354	48	0.366
2002	0.287				0.271				0.168				0.162					0.222
2003	0.246				0.34				0.227				0.258					0.268
2004	0.182				0.327				0.235				0.133					0.219
2005																		
201 Xuezhan Monitoring Station																		
2001				0				0				0				0		
2002																		
2003																		
2004																		
2005																		
Yuanli Xiaoqu Monitoring Station																		
2001	0.272			0.272	0.334			0.334	0.143			0.143	0.236			0.236	48	0.246
2002	0.218				0.191				0.141				0.103					0.163

[illegible]

APPENDIX C

MONITORING DATA FOR YINGKOU HEATING PLANT

Table C-1 Monitoring Station Locations for Existing Ambient Air

No	Location	Relative Location to Plant	Distance between Plant and Monitoring Location (km)	Note
1#	Broadcast/TV Station Launcher	SW	0.6	Mixed area
2#	Yingkou Environment and Sanitary Management Department	NE	0.8	Urban Center Area
3#	Yingkou Municipal No. 3 Pump Station	NNE	1.4	Urban Center Area
4#	Cultural Palace of Xisu District	N	2.2	Urban Center Area
5#	Lengyan Temple	NE	2.1	Urban Center Area
6#	Yingkou Rural and Township Enterprise Management Bureau	NE	2.8	Urban Center Area
7#	Yingkou Municipal Government	NE	3.2	Urban Center Area
8#	Transferring Coal Storage Area	S	1.2	Mixed area

Table C-2 Sampling Time Requirement

Index	Sampling Type	Sampling Period
NO ₂ 、SO ₂	Daily Density	18 hours
TSP、PM ₁₀	Daily Density	12 hours
NO ₂ 、SO ₂	Hourly Density	45 minutes

Table C-3 Ambient Air Monitoring and Analysis Method - Manually Measuring Code for Ambient Air Quality and Environmental Monitoring Code for Power Plant-DL/T414-2004

Index	Analysis Method	Detection Limit
PM ₁₀	Gravimetric Method	0.001mg/m ³
TSP	Gravimetric Method	0.001mg/m ³
NO ₂	Ethylenediamine Dihydrochloride Spectrophotometric Method	0.002 mg/m ³ (Daily average) 0.005 mg/m ³ (Hourly average)
SO ₂	Methylene Oxide Buffer Solution Absorb--hydrochloride Deputy Rose Aniline	0.003mg/m ³ (Daily average) 0.020 mg/m ³ (Hourly average)

Table C-4 **Ambient Air Quality Standard GB3095-1996**) , Class II.

Standard	Index	Pollutant Limit (mg/m ³)	
		Hourly Average	Daily Average
GB3095-1996	SO ₂	0.50	0.15
	TSP	-	0.30
	NO ₂	0.24	0.12
	PM ₁₀	-	0.15

Table C-5 Weather Information

Time	Wind Direction	Wind Speed	T	Humidity	Air Pressure
	°	m/s	°C	%	hPa
2008-03-22 07:00:00	120	3.1	-0.3	59	1008.3
2008-03-22 10:00:00	133	3.0	3.5	48	1007.5
2008-03-22 14:00:00	165	2.4	5.9	32	1004.1
2008-03-22 19:00:00	179	1.3	3.2	42	1003.1
Daily Average	141	2.0	3.8	44	1004.2
2008-03-23 07:00:00	124	0.9	1.9	54	998.9
2008-03-23 10:00:00	153	1.8	8.9	40	997.5
2008-03-23 14:00:00	203	2.9	9.2	39	991.1
2008-03-23 19:00:00	180	0.8	3.8	56	987.8
Daily Average	146	1.9	4.2	41	998.6
2008-03-24 07:00:00	98	1.0	2.6	68	988.4
2008-03-24 10:00:00	126	1.3	4.0	70	990.5
2008-03-24 14:00:00	146	1.5	4.8	69	991.2
2008-03-24 19:00:00	130	1.8	3.9	71	992.6
Daily Average	162	1.6	4.5	59	989.8
2008-03-25 07:00:00	160	1.7	2.1	81	990.8
2008-03-25 10:00:00	229	1.8	6.2	70	990.5
2008-03-25 14:00:00	235	3.4	8.5	55	983.1
2008-03-25 19:00:00	125	2.2	4.4	72	982.2
Daily Average	156	1.5	4.3	73	990.3
2008-03-26 07:00:00	113	3.0	6.1	66	978.4
2008-03-26 10:00:00	121	3.6	9.7	57	977.2
2008-03-26 14:00:00	132	3.5	9.9	62	968.4
2008-03-26 19:00:00	148	2.4	8.1	70	963.5
Daily Average	149	2.3	7.5	65	981.2

Table C-6 Daily Average for SO₂Unit: mg/m³

Date Location	22 March	23 March	24 March	25 March	26 March
Broadcast/TV Station Launcher	0.020	0.037	0.026	0.035	0.041
Yingkou Environment and Sanitary Management Department	0.025	0.038	0.034	0.033	0.027
Yingkou Municipal No. 3 Pump Station	0.038	0.036	0.045	0.037	0.032
Cultural Palace of Xisu District	0.038	0.042	0.035	0.041	0.022
Lengyan Temple	0.036	0.031	0.024	0.044	0.033
Yingkou Rural and Township Enterprise Management Bureau	0.022	0.038	0.042	0.033	0.026
Yingkou Municipal Government	0.022	0.031	0.038	0.030	0.021

Table C-7 Daily Average for NO₂Unit: mg/m³

Date Location	22 March	23 March	24 March	25 March	26 March
Broadcast/TV Station Launcher	0.028	0.025	0.035	0.034	0.032
Yingkou Environment and Sanitary Management Department	0.039	0.024	0.026	0.041	0.020
Yingkou Municipal No. 3 Pump Station	0.033	0.025	0.022	0.018	0.014
Cultural Palace of Xisu District	0.016	0.023	0.014	0.030	0.039
Lengyan Temple	0.021	0.024	0.015	0.032	0.040
Yingkou Rural and Township Enterprise Management Bureau	0.031	0.010	0.013	0.031	0.017
Yingkou Municipal Government	0.020	0.031	0.021	0.033	0.024

Table C-8 Daily Average for TSPUnit: mg/m³

Date Location	22 March	23 March	24 March	25 March	26 March
Broadcast/TV Station Launcher	0.182	0.294	0.260	0.386	0.264
Yingkou Environment and Sanitary Management Department	0.261	0.282	0.156	0.130	0.234
Yingkou Municipal No. 3 Pump Station	0.228	0.195	0.190	0.110	0.182
Cultural Palace of Xisu District	0.232	0.246	0.140	0.166	0.182
Lengyan Temple	0.091	0.134	0.117	0.075	0.220
Yingkou Rural and Township Enterprise Management Bureau	0.098	0.148	0.190	0.235	0.191
Yingkou Municipal Government	0.205	0.231	0.207	0.240	0.144
Transferring Coal Storage Area	0.182	0.295	0.263	0.389	0.262

Table C-9 Daily Average for PM₁₀Unit: mg/m³

Date Location	22 March	23 March	24 March	25 March	26 March
Broadcast/TV Station Launcher	0.083	0.137	0.123	0.183	0.126
Yingkou Environment and Sanitary Management Department	0.121	0.135	0.073	0.063	0.112
Yingkou Municipal No. 3 Pump Station	0.107	0.093	0.088	0.053	0.084
Cultural Palace of Xisu District	0.108	0.116	0.065	0.078	0.085
Lengyan Temple	0.043	0.061	0.054	0.034	0.101
Yingkou Rural and Township Enterprise Management Bureau	0.044	0.067	0.091	0.114	0.087
Yingkou Municipal Government	0.093	0.106	0.099	0.114	0.068

Table C-10 Hourly Average for SO₂Unit: mg/m³

Date Location	Time Period	22 March	23 March	24 March	25 March	26 March
Broadcast/TV Station Launcher	7: 00	0.056	0.043	0.039	0.029	0.032
	10: 00	0.044	0.022	0.016	0.016	0.018
	14: 00	0.017	0.018	0.022	0.019	0.024
	19: 00	0.018	0.021	0.022	0.018	0.026
Yingkou Environment and Sanitary Management Department	7: 00	0.042	0.052	0.033	0.034	0.029
	10: 00	0.022	0.041	0.016	0.017	0.018
	14: 00	0.015	0.016	0.015	0.024	0.023
	19: 00	0.024	0.019	0.022	0.027	0.019
Yingkou Municipal No. 3 Pump Station	7: 00	0.044	0.052	0.032	0.033	0.025
	10: 00	0.024	0.031	0.016	0.016	0.017
	14: 00	0.017	0.022	0.019	0.024	0.027
	19: 00	0.021	0.019	0.026	0.032	0.019
Cultural Palace of Xisu District	7: 00	0.046	0.045	0.038	0.035	0.036
	10: 00	0.034	0.023	0.021	0.017	0.022
	14: 00	0.019	0.016	0.022	0.021	0.024
	19: 00	0.017	0.022	0.014	0.015	0.022
Lengyan Temple	7: 00	0.043	0.045	0.036	0.034	0.037
	10: 00	0.025	0.032	0.019	0.018	0.019
	14: 00	0.017	0.025	0.019	0.028	0.025
	19: 00	0.022	0.023	0.024	0.031	0.019
Yingkou Rural and Township Enterprise Management Bureau	7: 00	0.035	0.032	0.025	0.046	0.047
	10: 00	0.018	0.017	0.016	0.034	0.026
	14: 00	0.018	0.025	0.027	0.018	0.013
	19: 00	0.026	0.030	0.019	0.017	0.022
Yingkou Municipal Government	7: 00	0.044	0.035	0.041	0.039	0.037
	10: 00	0.031	0.019	0.021	0.022	0.018
	14: 00	0.021	0.018	0.017	0.022	0.023
	19: 00	0.021	0.024	0.022	0.018	0.016

Table C-11 Hourly Average for NO₂Unit: mg/m³

Location	Time Period	22 March	23 March	24 March	25 March	26 March
Broadcast/TV Station Launcher	7: 00	0.054	0.105	0.067	0.070	0.091
	10: 00	0.094	0.047	0.038	0.029	0.030
	14: 00	0.041	0.024	0.025	0.026	0.024
	19: 00	0.039	0.044	0.038	0.039	0.037
Yingkou Environment and Sanitary Management Department	7: 00	0.052	0.085	0.074	0.073	0.082
	10: 00	0.083	0.061	0.044	0.029	0.046
	14: 00	0.042	0.053	0.028	0.044	0.037
	19: 00	0.038	0.027	0.036	0.038	0.045
Yingkou Municipal No. 3 Pump Station	7: 00	0.038	0.029	0.028	0.094	0.045
	10: 00	0.026	0.028	0.024	0.041	0.016
	14: 00	0.037	0.038	0.039	0.041	0.043
	19: 00	0.071	0.070	0.082	0.052	0.083
Cultural Palace of Xisu District	7: 00	0.061	0.043	0.105	0.067	0.072
	10: 00	0.053	0.026	0.044	0.039	0.043
	14: 00	0.024	0.032	0.011	0.022	0.023
	19: 00	0.026	0.028	0.042	0.035	0.031
Lengyan Temple	7: 00	0.052	0.081	0.072	0.070	0.084
	10: 00	0.022	0.024	0.021	0.041	0.011
	14: 00	0.040	0.052	0.025	0.041	0.032
	19: 00	0.041	0.022	0.024	0.026	0.031
Yingkou Rural and Township Enterprise Management Bureau	7: 00	0.061	0.082	0.074	0.071	0.082
	10: 00	0.083	0.060	0.043	0.026	0.044
	14: 00	0.042	0.051	0.026	0.041	0.038
	19: 00	0.031	0.029	0.034	0.037	0.042
Yingkou Municipal Government	7: 00	0.035	0.023	0.026	0.091	0.042
	10: 00	0.024	0.026	0.022	0.041	0.018
	14: 00	0.038	0.036	0.037	0.038	0.042
	19: 00	0.069	0.044	0.081	0.052	0.079

Table C-12 Air Emission Standard

Implementing Standard	Pollutant	Permitted Emission Density mg/m ³	Note
Air Emission Standard for Power Plant GB13223-1996	SO ₂	400	No. 3 Period
	Smoke	50	
	NO _x	450	
Comprehensive Air Emission Standard GB16297-1996-Class II	Dust	120	-

Table C-13 Monitoring Data for Pollutants from Boilers

Index	Date	Frequency	Inlet Density mg/m ³	Outlet Density mg/m ³	Emission m ³ /h	Standard
SO ₂	24 March	1	1604	383	125767	400
		2	1605	371	125346	
		3	1608	374	125312	
	25 March	1	1603	345	126637	
		2	1605	378	126871	
		3	1607	373	126925	
	26 March	1	1617	338	126174	
		2	1623	363	126432	
		3	1611	357	126354	
NO _x	24 March	1	122	118	126436	450
		2	124	121	127235	
		3	121	116	123867	
	25 March	1	123	119	125925	
		2	126	121	127568	
		3	124	121	127266	
	26 March	1	123	121	126812	
		2	126	122	126438	
		3	124	121	126847	
Smoke	24 March	1	7532.6	46.3	126897	50
		2	7493.4	43.8	128765	
		3	7538.2	48.2	126347	
	25 March	1	8326.5	48.5	126359	
		2	8417.3	47.8	126438	
		3	8378.9	46.7	126934	
	26 March	1	7436.7	47.6	126913	
		2	7452.6	44.9	126127	
		3	7584.2	48.4	126739	

Table C-14 Coal Conveyor Dust Monitoring Data

Index	Date	Number	Outlet Density (mg/ m ³)
Dust	24 March	1	36.3
		2	35.7
		3	38.2
	25 March	1	29.1
		2	27.8
		3	28.6
	26 March	1	29.7
		2	28.5
		3	27.4

Table C-15 Wastewater Monitoring Data for Yingkou Heating Plant

Date	Frequency	pH	SS	COD	NOx	% Compliance
24 March	1	7.81	76	46	3.011	100 %
	2	7.76	74	62	2.842	
	3	7.58	78	63	2.835	
25 March	1	7.68	83	78	2.801	
	2	7.61	81	75	2.782	
	3	7.66	82	77	2.824	
26 March	1	7.45	79	83	2.967	
	2	7.51	73	81	2.956	
	3	7.58	82	84	2.983	
Standard ¹		6-9	100	100	15	

Table C-16 Noise Monitoring for Yingkou Heating Plant

Locations	Sampling Date	NOISE Leq[dB(A)]				% Compliance
	20-21 March 2007	23 March 2008		24 March 2008		
		DAY ²	NIGHT ³	DAY	NIGHT	
East Plant border		59.3	48.7	58.7	49.1	100%
South Plant border		58.5	48.6	59.0	48.8	
West Plant border		53.6	45.8	52.8	47.1	
East Section of North Plant Border		58.8	48.2	49.3	48.6	
West Section of North Plant Border		57.1	49.3	55.4	48.4	
Residential Quarters at East of Plant		53.5	46.7	54.2	48.5	
Zhiyuan Residential Quarter		57.6	48.4	57.9	48.8	

¹ Integrated Standard for Wastewater Discharge² Standard of Noise at Boundary of Industrial Enterprises (GB 12348-90), Category II Daytime MCL = 60 db³ Standard of Noise at Boundary of Industrial Enterprises (GB 12348-90), Category II Nighttime MCL = 50 db.



Figure C-1 City of Yingko Central Environmental Monitoring Station



Figure C-2 Ambient Air Quality Monitoring Stations in Yingkou City

Table C-17 Ambient Air Quality for Yingkou City

SO ₂					
Year	Month	Concentration (mg/m ³)			
		Yingkou University	Liming Primary School	West Dian Huohua	West Fort
2001	January	0.112	0.098	0.166	0.043
	April	0.024	0.019	0.026	0.021
	July	0.013	0.010	0.009	0.010
	October	0.022	0.027	0.028	0.011
2002	January	0.122	0.107	0.097	0.034
	April	0.037	0.058	0.029	0.034
	July	0.005	0.005	0.006	0.009
	October	0.031	0.004	0.005	0.006
2003	January	0.084	0.023	0.011	0.006
	April	0.021	0.018	0.010	0.005
	July	0.010	0.008	0.007	0.006
	October	0.013	0.003	0.002	0.002
2004	January	0.050	0.002	0.232	6.2
	April	0.007	0.002	0.37	0.002
	July	0.005	0.002	0.016	0.002
	October	0.004	0.002	0.015	0.002
Year	Month	Concentration (mg/m ³)			
		Yingkou University	Botanical Garden	3rd Water Plant	Drainage Company
2005	January	0.016	0.143	0.12	0.02
	April	0.012	0.028	0.034	0.004
	July	0.015	0.016	0.009	0.001
	October	0.013	0.024	0.027	0.005
2006	January	0.041	0.143	0.172	0.089
	April	0.010	0.028	0.019	0.015
	July	0.006	0.010	0.006	0.010
	October	0.009	0.024	0.017	0.018
2007	January	0.099	0.150	0.135	0.087
	April				
	July				
	October				
Ave		0.031	0.038	0.063	0.266

TSP					
Year	Month	Concentration (mg/m ³)			
		Yingkou University	Liming Primary School	West Dian Huohua	West Fort
2001	January	0.34	0.34	0.41	0.21
	April	0.44	0.47	0.43	0.39
	July	0.15	0.17	0.18	0.16
	October	0.24	0.19	0.23	0.11
2002	January	0.23	0.20	0.27	0.11
	April	0.55	0.42	0.51	0.36
	July	0.153	0.11	0.14	0.08
	October	0.16	0.16	0.24	0.08
2003	January	0.22	0.22	0.34	0.14
	April	0.23	0.25	0.29	0.19
	July	0.16	0.23	0.19	0.07
	October	0.14	0.11	0.18	0.06
2004	January	0.18	0.27	0.21	0.10
	April	0.14	0.19	0.26	0.14
	July	0.15	0.22	0.20	0.08
	October	0.18	0.24	0.22	0.09
Year	Month	Concentration (mg/m ³)			
		Yingkou University	Botanical Garden	3rd Water Plant	Drainage Company
2005	January				
	April				
	July				
	October				
2006	January				
	April				
	July				
	October				
2007	January				
	April				
	July				
	October				
Ave		0.23	0.24	0.27	0.15

CO					
Year	Month	Concentration (mg/m ³)			
		Yingkou University	Liming Primary School	West Dian Huohua	West Fort
2001	January	1.69	0.97	0.94	0.46
	April	1.89	2.16	2.03	1.17
	July	2.70	1.54	3.22	1.09
	October	2.21	2.51	1.98	0.97
2002	January	2.30	2.23	2.76	0.92
	April	1.20	1.27	1.68	0.71
	July	0.82	0.82	1.02	0.64
	October	2.53	2.53	2.51	0.63
2003	January	0.86	1.17	0.98	0.63
	April	0.63	0.63	0.63	0.63
	July	1.30	2.34	1.80	0.82
	October	3.85	3.59	3.52	0.64
2004	January	1.01	0.62	3.42	0
	April	0.8	0.62	2.08	0
	July	0.89	0.63	2.45	0
	October	1.1	0.62	3.03	0
Year	Month	Concentration (mg/m ³)			
		Yingkou University	Liming Primary School	West Dian Huohua	West Fort
2005	January		2.1		
	April		1.1		
	July		1.0		
	October		1.3		
2006	January		2.1		
	April		0.9		
	July		0.9		
	October		1.4		
2007	January		2.0		
	April				
	July				
	October				
Ave		1.61	1.48	2.13	0.58

NO ₂					
Year	Month	Concentration (mg/m ³)			
		Yingkou University	Liming Primary School	West Dian Huohua	West Fort
2001	January	0.067	0.061	0.059	0.028
	April	0.028	0.019	0.023	0.012
	July	0.026	0.022	0.019	0.011
	October	0.023	0.014	0.017	0.008
2002	January	0.021	0.018	0.019	0.008
	April	0.014	0.028	0.028	0.018
	July	0.004	0.026	0.023	0.012
	October	0.016	0.024	0.02	0.009
2003	January	0.045	0.022	0.031	0.010
	April	0.018	0.019	0.020	0.010
	July	0.013	0.044	0.038	0.016
	October	0.027	0.026	0.023	0.012
2004	January	0.032	0.010	0.067	0.022
	April	0.032	0.010	0.063	0.023
	July	0.012	0.001	0.032	0.004
	October	0.014	0.069	0.003	0.012
Year	Month	Concentration (mg/m ³)			
		Yingkou University	Botanical Garden	3rd Water Plant	Drainage Company
2005	January	0.031	0.047	0.031	0.040
	April	0.031	0.028	0.020	0.021
	July	0.018	0.024	0.010	0.004
	October	0.011	0.026	0.015	0.019
2006	January	0.020	0.041	0.043	0.044
	April	0.007	0.026	0.021	0.020
	July	0.005	0.012	0.007	0.005
	October	0.018	0.032	0.027	0.020
2007	January	0.024	0.037	0.048	0.045
	April				
	July				
	October				
Ave		0.022	0.027	0.028	0.017

PM ₁₀					
Year	Month	Average	Minimum	Maximum	Rate Exceeding Standard
Year	Month	Concentration (mg/m ³)			
		Yingkou University	Botanical Garden	3rd Water Plant	Drainage Company
2005	January	0.097	0.148	0.103	0.09
	April	0.085	0.097	0.127	0.088
	July	0.055	0.110	0.163	0.074
	October	0.087	0.068	0.059	0.061
2006	January	0.122	0.115	0.148	0.130
	April	0.118	0.074	0.126	0.069
	July	0.053	0.065	0.069	0.035
	October	0.128	0.141	0.104	0.108
2007	January	0.134	0.174	0.151	0.119
	April				
	July				
	October				
Ave		0.098	0.110	0.117	0.086