Initial Environmental Examination (Update)

Project Number: 50096-002
July 2020

People's Republic of China: Air Quality Improvement in the Greater Beijing-Tianjin-Hebei Region – China National Investment and Guaranty Corporation's Green Financing Platform Project (Jinxiang 2x35t/h Micro-fine Coal Atomization Steam Supply Subproject)

Prepared by China National Investment and Guaranty Corporation for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 10 July 2020)

Currency Unit - Yuan (CNY)
CNY 1.00 = US$ 0.1430
USD 1.00 = 6.9942 CNY

ABBREVIATIONS

ACM	Asbestos-Containing Material
ADB	Asian Development Bank
AP	Affected Person
ASL	Above Sea Level
CSC	Construction Supervision Company
DCS	Distributed Control System
DI	Design Institute
EA	Executing Agency
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Monitoring Plan
EMS	Environmental Monitoring Station
EMU	Environment Management Unit
EPB	Environmental Protection Bureau
ETDZ	Economic and Technological Development Zone
FGD	Flue Gas Desulfurization
FSR	Feasibility Study Report
GHG	Green House Gas
GRM	Grievance Redress Mechanism
HES	Heat Exchange Station
IA	Implementing Agency
IEE	Initial Environmental Examination
JFIP	Jinxiang Circular Economy Demonstration Industrial Park
MEP	Ministry of Environmental Protection
NDRC	National Development and Reform Commission
PMO	Project Management Office
PPCU	Project Public Complain Unit
PPE	Personnel Protective Equipment
SCADA	Supervisory Control and Data Acquisition
SPS, ADB	Safeguard Policy Statement, ADB
TCE	Tons coal equivalent
US EPA	United States Environmental Protection Agency
WHO	World Health Organization

WEIGHTS AND MEASURES

BOD_5	Biochemical Oxygen Demand, five days
cm	Centimeter
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
dB(A)	A-weighted sound pressure level in decibels
DO	Dissolved Oxygen
GJ	Gega Joule
ha	Hectare
kcal	Kilo calorie
kg	Kilogram
km	Kilometer
kWh	Kilowatt Hour
m	meter
m/s	Meters per Second
m^3	Cubic Meters
mg/l	Milligrams per Liter
mg/m^3	Milligrams per Cubic Meter
mg/Nm^3	Milligrams per Normal Cubic Meter
MW	Megawatt
NH_3-N	Ammonia Nitrogen
Nm^3	Normal Cubic Meter
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxides
°C	Degrees Celsius
pH	A measure of the acidity or alkalinity of a solution
PM	Particulate Matter
PM_{10}	Particulate Matter smaller than 10 micrometers
$PM_{2.5}$	Particulate Matter smaller than 2.5 micrometers
SO_2	Sulfur Dioxide
SS	Suspended Solids
TN	Total Nitrogen
TSP	Total Suspended Particulates

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1 EXECUTIVE SUMMARY

1.1 Introduction

This is the Initial Environmental Examination (IEE) report for the Jinxiang 2x35t/h Micro-fine Coal Atomization Steam Supply Subproject of proposed People's Republic of China: Air Quality Improvement in the Greater Beijing-Tianjin-Hebei Region – China National Investment and Guaranty Corporation's (hereafter referred to as I&G) Green Financing Platform Project. Elion Technology Co., Ltd, (hereafter referred to as Elion) Jinxiang Subcompany is the subborrower and the total investment of entrust loan is 220 million RMB. The project is located at Jinxiang County, Jining City, Shandong Province which is at south of Dezhou City. The project started construction at August 2015 and is under trail operation now. Main content of the project is installation of two 35 t/h micro-fine coal atomization boilers for heat supply by steam.

ADB's environmental safeguard requirements are specified in the Safeguard Policy Statement (SPS 2009). The project has been screened and classified by ADB as Environment Category B, requiring the preparation of an IEE (this report) including an environmental management plan (EMP). Because construction of the project is completed, environmental impact during operation phase is analyzed in this report.

1.2 Project introduction

Domestic environment impact assessment (EIA) report was prepared and submitted to Jinxiang Environmental Protection Bureau (EPB) for approval. The domestic EIA was reviewed by the Jinxiang EPB and approved at June 20, 2015. This report has been prepared based on a domestic Feasibility Study Report (FSR), domestic EIA report, site visits undertaken by national EIA team hired by I&G and public consultations with key stakeholders and affected persons.

Construction of the project can meet the requirements in EIA report of Jinning Food Industrial Park (hereafter referred to as JFIP). The project area is divided into boiler area and chemical water treatment area. The main content of project includes installation of two boilers, one deaerator workshop, supporting facilities (ancillary

workshops for boilers, desulfurization building, chemical water treatment workshop and ancillary workshop, material storage room), storage facilities (dust storage tower, ash storage room, lime powder storage room, urea storage room and gypsum storage room), utilities (water supply system, power supply system, chemical water treatment system, cooling water system, ash and slag handling system and air compressor system) and environment protection facilities (desulfurization, denitration and dust removal system, septic tank, temporary storage room for solid waste and online monitoring system).

The parameters of the steam provided by project are: pressure is 1.6 MPa, degree is around 245 °C. If the users have different requirements on the steam, they can adjust the parameter by themselves. Maximum steam supply radius is 5.0 km and the steam pipeline is overhead installed.

1.3 Project benefits

The project will provide heat to enterprises in JFIP to instead of small coal-fired boilers owned by the enterprises. To mitigate environmental impacts, the project will use Micro-fine Coal Atomization technology to increase combustion efficiency of boilers, then coal consumption of will be reduces compared to traditional coal fired boilers. The project's implementation will: (i) significantly reduce heat cost; (ii) reduce coal consumption and pollutants emission; and (iii) improve air quality in JFIP. When compared to the equivalent production of heat through traditional coal-fired boilers, once operational the project will: (i) result in annual energy savings equivalent to 41,743 tons of standard coal, thereby providing a global public good by avoiding the annual emission of 104,065 tons of carbon dioxide (CO_2), a greenhouse gas; (ii) improve local air quality through the estimated annual reduction of emissions of sulfur dioxide (SO_2) by 178.42 tons, nitrogen oxides (NO_x) by 47.95 tons, and particulate matter (PM) by 24.69 tons; and (iii) eliminate the negative impacts of coal transportation through urban areas by truck.

1.4 Environmental impacts and mitigation measures

The project will establish a district steam heating system in JFIP and existing small coal fired boilers in JFIP will be demolished. The project's implementation will reduce coal consumption and pollutants emission and improve air quality in JFIP by combustion efficiency.

The project is located at JFIP. The project will not entail any permanent or temporary physical displacement or economic displacement because land acquisition of JFIP has been completed by authorities. Construction phase of the project is already completed now. During construction phase, mitigation measures were implemented according to the requirements in domestic EIA such as preparation of a reasonable construction schedule, control of construction area and plant afforestation after construction etc. Potential negative environmental impacts during construction phase were limited which were associated with soil, surface water, ground water, ambient air, flora and fauna, nearby residents and were disappeared after the construction was completed.

Potential negative environmental impacts during operation phase include flue gas (flue gas of boilers and dust-laden flue gas), waste water, noise (mainly from pumps and fans) and solid waste (fly ash and coal slag). The flue gas is treated before emission and can meet relevant standards. The report undertakes atmospheric dispersion modeling for SO_2, PM_{10}, TSP, ammonia and NOx using SCREEN3, a US EPA approved screening mode to estimate the effects to ambient air quality of the project. Based on the modeling result, the project will have very limited effects to the ambient air quality. The wastewater of the project will be treated by different methods according to wastewater quality. Most of the treated wastewater will be recycled or reused and only few will be discharged to municipal sewer. By noise reduction measures, noise levels at the site boundaries can meet relevant standards. Because there are no environmental sensitive receptors within 200m outside the boundaries, the project will not have negative noise impacts to the receptors. Production waste will be sold out for recycling. Domestic waste will be routinely collected by the local

sanitation department for recycling, if possible, or final disposal at an approved waste disposal site.

1.5 Environment management plan (EMP)

A comprehensive EMP for operation phase was developed to ensure: (i) implementation of identified mitigation and management measures to avoid, reduce, mitigate, and compensate for anticipated adverse environment impacts; (ii) implementation of monitoring and reporting against the performance indicators; and (iii) project compliance with the PRC's relevant environmental laws, standards and regulations and the ADB's SPS. The EMP includes an environment monitoring plan (EMoP) to monitor the environmental impacts of the project and assess the effectiveness of mitigation measures, and a capacity building and training program focused on environment, health and safety (EHS). Organizational responsibilities and budgets are clearly identified for execution, monitoring and reporting.

1.6 Grievance Redress Mechanism

A subproject-level grievance redress mechanism (GRM) has been established to receive and facilitate resolution of complaints about the project during the construction and operation phases. The GRM includes procedures for receiving grievances, recording/ documenting key information, and evaluating and responding to the complainants in a reasonable time period. Any concerns raised through the GRM will be addressed quickly and transparently, and without retribution to the affected person.

1.7 Information Disclosure and Public Consultations

The subborrower undertook first information disclosure from May 15, 2015 to May 25, 2015. Project public information was disclosed on the subborrower and Jinxiang EPB's website. Project public information was also disclosed at the communities where beneficiaries and potentially affected persons (AP) located by leaflets and posts on bulletin boards of the communities. The information included project content, potential environmental impacts, and mitigation measures. Public had a better understanding of the project by public consultation. Questions, suggestions

and feedback from the public were also collected to make the project reasonable.

EIA Institute conducted questionnaire survey on May 18, 2015. A total of 109 questionnaires were distributed to beneficiaries and AP and 109 completed questionnaires were received. 70% of respondents indicated that they thought the ambient air quality near the project site is ordinary, 80% of respondents thought the surface water quality near the project site is ordinary or good and 94% of respondents thought the acoustic environment near the project is ordinary or good. Overall support for the project is very strong; 100% of the respondents indicated that they supported the project.

The subborrower undertook one public consultation meeting in November 2, 2017. Meeting participants were asked to complete a questionnaire. A total of 31 questionnaires were distributed and 31 completed questionnaires were received.

54.8% of respondents indicated that the top environment issue was ambient air quality, 90.3% of respondents indicated that they concerned about the air pollution caused by the project, 74.2% of espondents indicated that they were satisfied or very satisfied with the mitigation measures of the project and 100% of respondents indicated that they supported the project.

The subborrower will continue to conduct regular information disclosure and public consultation to communicate with beneficiaries and AP during the operations phase. Ongoing consultation will ensure that public concerns are understood and dealt with in a timely manner.

1.8 EMP implementation agency

Elion Jinxiang subcompany is responsible for operation and management of the project. EHS department of Elion Jinxiang subcompany is responsible for environment protection and safety production of the project.

1.9 Conclusion

Based on domestic EIA report and environment due diligence, the project has identified potential negative environment impacts and appropriately established

mitigation measures. If the mitigation measures are well implemented and monitored, identified environmental impacts of the project will be reduced to an acceptable level. The project is environmentally feasible.

Overall, Micro-fine Coal Atomization technology is used in the project to achieve district steam to the JFIP. The project's implementation will improve air quality in JFIP and bring environmental and economic benefits for the development of JFIP.

2 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

This IEE has been prepared in accordance with both the PRC's national and local environmental legal and institutional framework and environmental assessment requirements, and applicable ADB policies, requirements and procedures.

2.1 PRC Environmental Legal Framework

The environmental protection and management system in the PRC consists of a well-defined hierarchy of regulatory, administrative and technical institutions. At the top level the People's Congress of the PRC has the authority to pass and revise national environmental laws; the Ministry of Environmental Protection (MEP) under the State Council promulgates national environmental regulations; and the MEP either separately or jointly with the Administration of Quality Supervision, Inspection and Quarantine issues national environmental standards. Provincial and local governments can also issue provincial and local environmental regulations and guidelines in accordance with the national ones. EIA procedures have been established in the PRC for over 20 years. Domestic EIA should follow national and local laws and regulations. Key applicable PRC laws and regulations are listed in Table 2-1.

Table 2-1 Applicable PRC laws and regulations

No.	**Title of the Law**	**Year Issued/Updated**
1	Environmental Protection Law	2014
2	Environmental Impact Assessment Law	2016
3	Water Law	2002
4	Water Pollution Prevention and Control Law	2008
5	Air Pollution Prevention and Control Law	2015修订
6	Noise Pollution Prevention and Control Law	1996
7	Solid Waste Pollution Prevention and Control Law	2004
8	Water and Soil Conservation Law	2010
9	Cultural Relics Protection Law	2015
10	Land Administration Law	2004
11	Cleaner Production Promotion Law	2002
12	Urban and Rural Planning Law	2008
13	Circular Economy Promotion Law	2009
14	Energy Conservation Law	2015

No.	Title of the Law	Year Issued/Updated
15	Environmental Protection Tax Law	2018
16	Construction project environment protection management regulations	2017
17	Management Guideline on EIA Categories of Construction Projects	2017
18	National Hazardous Wastes Catalogue	2016
19	Integrated Reform Plan for Promoting Ecological Progress	2015
20	Notice of the State Council on soil pollution prevention and control action plan	2016
21	Notice of the State Council on water pollution prevention and control action plan	2015
22	Notice of the State Council on air pollution prevention and control action plan	2013
23	Guiding Ideas on Promoting Public Participation in Environmental Protection	2015
24	Method of environmental information public disclosure for enterprises and institutions	2015
25	Provisional Regulations on Public Participation in Environmental Impact Assessment	2006
26	Comprehensive utilization management method of fly ash	2013

Applicable PRC environmental management and assessment guidelines are summarized in table2-2.

Table 2-2 Applicable PRC EIA guideline

No.	Guideline	Code and/or Year Issued/Updated
1	Technical Guidelines for EIA – General Program	HJ2.1-2016
2	Technical Guideline for EIA – Atmospheric Environment	HJ 2.2-2008
3	Technical Guideline for EIA – Surface Water	HJ/T 2.3-1993
4	Technical Guideline for EIA – Acoustic Environment	HJ 2.4-2009
5	Technical Guideline for EIA – Groundwater Environment	HJ 610-2016
6	Technical Guideline for EIA – Ecological Impact	HJ 19-2011
7	Technical Guidelines for Environmental Risk Assessment for Construction Projects	HJ/T 169-2004
8	Technical guidelines on water pollution control	HJ2015-2012

	engineering	
9	Technical guidelines for air pollution control projects	HJ2000-2010
10	Wet flue gas desulfurization project technical specification of industrial boiler and furnace	HJ462-2009
11	Engineering technical specification of flue gas selective non-catalytic reduction Denitration for thermal power plant	HJ563-2010
12	Engineering technical specification of flue gas selective catalytic reduction Denitration for thermal power plant	HJ562-2010
13	Technical specifications for collection, storage, transportation of hazardous waste	HJ2025-2012
14	Technical code for fire protection water supply and hydrant systems	GB50974-2014
15	Self-monitoring Technology guidelines for Pollutions Sources - General rule	HJ 819-2017
16	Self-monitoring guidelines for pollution sources -Thermal power generation and boiler	HJ 820-2017
17	Technical guidelines for fugitive emission monitoring of air pollutants	HJ/T 55-2000
18	Code of practice for selection of personal protective equipment	GB/T 11651-2008
19	Safety signs and guideline for the use	GB2894-2008
20	Guidelines for enterprises to develop emergency response plan	AQ/T 9002-2006

2.2 Applicable ADB Policies, Regulations and Requirements

The major applicable ADB policies, regulations, requirements and procedures for EIA are the *Safeguard Policy Statement* (SPS, 2009) which provides the basis for ADB financed project. The SPS promotes good international practice as reflected in internationally recognized standards such as the World Bank Group's *EHS Guidelines*[1]. When host country regulations differ from these levels and measures, the borrower/client is to achieve whichever is more stringent.

Domestic EIA is prepared based on PRC EIA approval procedure which required the construction and operation of the project to meet environment quality standards such as ambient air, water, noise etc.

The SPS establishes an environmental review process to ensure that projects

[1] *World Bank Group, Environmental, Health, and Safety Guidelines*, April 30, 2007, Washington, USA.

undertaken as part of programs funded through ADB loans are environmentally sound, are designed to operate in line with applicable regulatory requirements, and are not likely to cause significant environment, health, social, or safety hazards

At an early stage in the project cycle, typically the project identification stage, ADB screens and categorizes proposed projects based on the significance of potential project impacts and risks. A project's environment category is determined by the category of its most environmentally sensitive component, including direct, indirect, induced, and cumulative impacts. Project screening and categorization are undertaken to:

i) reflect the significance of the project's potential environmental impacts;

ii) identify the type and level of environmental assessment and institutional resources required for the safeguard measures proportionate to the nature, scale, magnitude and sensitivity of the proposed project's potential impacts; and,

iii) determine consultation and disclosure requirements.

ADB assigns a proposed project to one of the following categories:

i) **Category A.** Proposed project is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented; impacts may affect an area larger than the sites or facilities subject to physical works. A full-scale environmental impact assessment (EIA) including an environmental management plan (EMP), is required.

ii) **Category B**. Proposed project's potential environmental impacts are less adverse and fewer in number than those of category A projects; impacts are site-specific, few if any of them are irreversible, and impacts can be readily addressed through mitigation measures. An initial environmental examination (IEE), including an EMP, is required.

iii) **Category C**. Proposed project is likely to have minimal or no adverse environmental impacts. No EIA or IEE is required although environmental implications need to be reviewed.

iv) **Category FI**. Proposed project involves the investment of ADB funds to, or through, a financial intermediary.

The SPS 2009 requires a number of additional considerations, including: (i) project risk and respective mitigation measures and project assurances; (ii) project-level grievance redress mechanism; (iii) definition of the project area of influence; (iv) physical cultural resources damage prevention analysis; (v) climate change mitigation and adaptation; (vi) occupational and community health and safety requirements (including emergency preparedness and response); (vii) economic displacement that is not part of land acquisition; (viii) biodiversity conservation and natural resources management requirements; (ix) provision of sufficient justification if local standards are used; (x) assurance of adequate consultation and participation; and (xi) assurance that the EMP includes an implementation schedule and measurable performance indicators.

2.3 Relevant International Agreements

The PRC has signed a number of international agreements regarding environmental and biological protection. Those which have potential application to the project are listed in Table 2-3.

Table 2-3 Applicable international agreements

No.	Agreement	Year	Purpose
1	Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat	1975	Preventing the progressive encroachment on and loss of wetlands for now and the future
2	Convention on Biological Diversity	1993	Conservation and sustainable use of biodiversity.
3	UN Framework Convention on Climate Change	1994	Stabilizing greenhouse gas (GHG) concentrations in the atmosphere at a level that will prevent anthropogenic induced climate change.
4	Kyoto Protocol	2002	Controlling emissions of anthropogenic GHGs in ways that reflect underlying national differences in GHG emissions, wealth, and capacity to make the reductions.
5	Montreal Protocol on Substances That Deplete the Ozone Layer	1989	Protection of the ozone layer

2.4World Bank EHS Guideline

During the design, construction, and operation of a project the ADB SPS requires the borrower to follow environmental standards consistent with good international practice (GIP), as reflected in internationally recognized standards such as the World Bank Group's *Environment, Health and Safety Guidelines* (hereafter referred to as the *EHS Guidelines*).[2] The *EHS Guidelines* contain discharge effluent, air emissions, and other numerical guidelines and performance indicators as well as prevention and control approaches that are normally acceptable to ADB and are generally considered to be achievable at reasonable costs by existing technology. When host country regulations differ from these levels and measures, the borrower/client is to achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the borrower/client is required to provide justification for any proposed alternatives. Relevant guidelines referenced in this report include the *General EHS Guidelines* and the *EHS Guidelines for Thermal Power Plants.*

2.5 Applicable PRC standards

The environmental quality standard system in the PRC is classified into two categories by function: ambient environmental standards and pollutant emission/discharge standards. Standards applicable to the project are presented in Table 2-4.

Table 2-4 Applicable PRC environmental standards

No.	Standard	Code/Date
1	Surface Water Quality Standards	GB 3838-2002
2	Ambient Air Quality Standards	GB 3095-2012
3	Environmental Quality Standards for Noise	GB 3096-2008
4	Groundwater Quality Standard	GB/T 14848-93
5	Integrated emission standard of air pollutants	GB 16297-1996
6	Integrated emission standard of regional air pollutants in Shandong Province	DB37/2376-2013

[2] *World Bank Group, Environmental, Health, and Safety Guidelines*, April 30, 2007, Washington, USA. http://www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines

No.	Standard	Code/Date
7	Integrated Emission Standards of Particulate Matter from Stationary Source of Shandong Province	DB37/1996-2011
8	Emission Standards for odor pollutants	GB14554-93
9	Discharge standard of pollutants for municipal wastewater treatment plant	GB18918-2002
10	Noise Standards for Construction Site Boundary	GB 12523-2011
11	Noise Standards for Industrial Enterprises at Site Boundary	GB 12348-2008
12	Standard for pollution on the storage and disposal site for general industrial solid wastes	GB 18599-2001
13	Standard for pollution control on hazardous waste storage	GB 18597-2001

2.5.1 Ambient Air Quality

Ambient air quality limits are intended to indicate safe exposure levels for the majority of the population, throughout an individual's lifetime. Limits are given for one or more specific averaging periods, typically one-hour average, 24-hour average, and/or annual average. The PRC's *Ambient Air Quality Standards (*GB3095-2012) has two classes of limit values; Class 1 standards apply to special areas such as natural reserves and environmentally sensitive areas, and Class 2 standards apply to all other areas, including urban and industrial areas. Ambient air quality assessment area of the project is a circle with a radius of 2.5 km and circle center is the project center. Class 2 standards apply to this assessment area.

The World Health Organization (WHO) Air Quality Guidelines are recognized as international standards and are adopted by the World Bank Group's Environment, Health and Safety Guidelines (*EHS Guidelines)*. In addition to guideline values, interim targets (IT) are given for each pollutant by the WHO as incremental targets in a progressive reduction of air pollution. The WHO guidelines and corresponding PRC standards are presented in Table 2-5.

- For TSP, there are PRC standards but no corresponding WHO guidelines.
- For PM_{10}, PRC Class 2 annual average and 24-hour average standards meet WHO IT-1 guidelines (there are no 1-hour average standards or guidelines for either PRC or WHO).
- For $PM_{2.5}$ PRC Class 2 annual and 24-hour standards meet WHO IT-1

guidelines (there are no 1-hour standards or guidelines for either PRC or WHO).

- For SO_2 WHO only has a 24-hour average guideline (0.125 mg/m^3), which is slightly lower than the PRC standard (0.150 mg/m^3). However, SO_2 levels are low in the project area, and the project will only contribute extremely low levels of SO_2, so the very minor difference is inconsequential.
- For NO_2 the PRC standard is equivalent to the WHO annual average guidelines, there is no WHO 24-hour average guideline; and the 1-hour average PRC standard is equivalent to the WHO guideline.

Overall the PRC standards show a high degree of equivalency to the WHO guidelines or IT-1 values, and they are adopted for use in this IEE report

Table 2-5 PRC Ambient Air Quality Standards (*GB3095-2012)* and WHO ambient air quality guidelines, mg/m^3

Standard	TSP	PM_{10}	$PM_{2.5}$	SO_2	NO_2	O_3	CO
WHO Ambient Air Quality Guidelines							
Annual mean	-	0.020	0.010	-	0.040	-	-
Annual mean IT-1	-	0.070	0.035	-	-	-	-
24-hr mean	-	0.050	0.025	0.020	-	-	-
24-hr mean IT-1	-	0.150	0.075	0.125	-	-	-
8-hr mean	-	-	-	-	-	0.100	-
8-hr mean IT-1	-	-	-	-	-	0.160	-
1-hr mean	-	-	-	-	0.200	-	0.030
1-hr mean IT-1	-	-	-	-	-	-	-
PRC Ambient Air Quality Standard (Class 2)							
Annual mean	0.200	0.070	0.035	0.060	0.040	-	-
24-hr mean	0.300	0.150	0.075	0.150	0.080	-	0.004
8-hr mean	-	-	-	-	-	0.160	-
1-hr mean	-	-	-	0.500	0.200	0.200	0.010

Source: WHO Air Quality Guidelines (2006) in IFC EHS Guidelines (2007), and PRC GB 3095-2012.

2.5.2 Water

Because the project will not have impacts on surface water, ground water or sea water, no standard is applicable.

2.5.3 Noise

Table 2-6 presents the relevant PRC *Urban Noise Standards* compared with relevant international guidelines from the WHO (as presented in the *EHS Guidelines*). Category I and II standards are applicable to the project area. The classes within the

standards are not directly comparable, but the limits of PRC Category III standards are stringent than WHO Class II standards. Category III is utilized in this IEE report.

Table 2-6 PRC *Environmental Quality Standards for Noise* (GB3096-2008) and relevant international guidelines.

Category	PRC Standards Leq dB(A)		International Standards One Hour Leq dB(A)		Comparison
	Day 06-22h	**Night** 22-06h	**Day** 07-22h	**Night** 22-07h	
0: Areas needing extreme quiet, such as special health zones	50	40	WHO Class I: residential, institutional, educational: 55	WHO Class I: Residential, institutional, educational: 45	Classes are not directly comparable, but PRC Class III standards exceed WHO Class II standards. PRC standards are utilized in this report.
I: Mainly residential; and cultural and educational institutions	55	45			
II: Mixed residential, commercial and industrial areas	60	50	WHO Class II: industrial, commercial: 70	WHO Class II: Industrial, Commercial: 70	
III: Industrial areas	65	55			
IV: Area on both sides of urban trunk roads 4a	70	55			
4b	:70	60			

Source: Unofficial translation of Chinese original by the ADB PPTA consultant.

2.5.4 Boiler emission

Applicable PRC national boiler emission standards and regulations are *Emission Standards of Air Pollutants from Coal-Burning*, *Oil-Burning and Gas-Fired Boilers* (GB 13271-2014), *Emission Standards of Air Pollutants from Coal-Burning*, *Oil-Burning and Gas-Fired Boilers in Shandong Province* (DB 37/2374-2013) and *Guidance on promotion of ultra-low emission of coal-fired units and boilers in Shandong Province* (No. 98 order, 2015, Shandong EPB). Emission standard for boilers are also included in international standard *EHS Guidelines for Thermal Power Plants* of WB. Table 2-7 presents the relevant PRC standards compared with relevant international standards (EHS Guidelines).

The most stringent standard is *Guidance on promotion of ultra-low emission of coal-fired units and boilers in Shandong Province*. Because the EIA of the project was approved at June 20, 2015 and *Guidance on promotion of ultra-low emission of coal-fired units and boilers in Shandong Province* came into effect at August 13, 2015, thus, *Emission Standards of Air Pollutants from Coal-Burning*, *Oil-Burning and Gas-Fired Boilers in Shandong Province* (DB37/2374-2013) is applicable to the project.

Table 2-7 Relevant PRC Boiler Emission Standards and Relevant International Guidelines, mg/m^3

Standard	PM	SO_2	NO_X
EHS Guidelines for Thermal Power Plants	30	400	200
Emission Standards of Air Pollutants from Coal-Burning, *Oil-Burning and Gas-Fired Boilers* (GB 13271-2014)	50	300	300
Emission Standards of Air Pollutants from Coal-Burning, *Oil-Burning and Gas-Fired Boilers in Shandong Province* (DB37/2374-2013)	30	200	300
Guidance on promotion of ultra-low emission of coal-fired units and boilers in Shandong Province (No. 98 order, 2015, Shandong EPB)	10	50	200

2.5.5 Wastewater Emission

Table 2-8 presents the relevant PRC wastewater emission standards. The *EHS Guidelines* indicate that wastewater discharged to public or private wastewater treatment systems should: meet the pretreatment and monitoring requirements of the sewer treatment system into which it discharges; not interfere, directly or indirectly, with the operation and maintenance of the collection and treatment systems, or pose a risk to worker health and safety, or adversely impact characteristics of residuals from wastewater treatment operations; and be discharged into municipal or centralized wastewater treatment systems that have adequate capacity to meet local regulatory requirements for treatment of wastewater generated from the project.

Wastewater of the project during operation phase includes sewage water of boilers, sewage water from chemical water treatment system, wastewater from desulfurization process, sewage water from circulating cooling water system and

domestic wastewater. Sewage water of boilers is discharged to municipal rain water pipe network after neutralization and sedimentation treatment. Sewage water from chemical water treatment system is clean then part of it is reused in desulfurization system and the left is discharged to municipal rain water pipe network after neutralization and sedimentation treatment. Wastewater from desulfurization process is used for humidification in ash storage room. Sewage water from circulating cooling water system is used as spray water in the plant to control ash and dust. Domestic wastewater is reused as landscape water after treated by septic tank. All wastewater is required to meet Class 1A of *Discharge Standard of Pollutants for Municipal Wastewater Treatment Plants* (GB 18918-2002).

Table 2-8 PRC Wastewater Quality Standards for Discharge to Municipal Sewers (CJ 343-2010)

No.	Pollutants	Maximum acceptable concentration (MAC) mg/L (except pH and chromacity)
		Class 1A standard
1	pH	6~9
2	SS	10
3	COD	50
4	NH_3-N	5

2.5.6 Industrial noise emission

During operation phase, noise at site boundaries should comply with Class II of the PRC I*ndustrial Enterprise Boundary Noise Emission Standard* (GB12348-2008). Table 2-9 presents the relevant PRC and international standards for noise at the boundary of an industrial facility during operation. The classes within the standards are not directly comparable, but PRC Class III standards are stringent than WHO Class II standards. The PRC noise standards are utilized in this report.

Table 2-9 PRC *Noise Emission Standard for Construction Site Boundary* (GB12348-2008) and relevant international guidelines

Class	PRC Standards Leq dB(A)		International Standards Leq dB(A)		Comparison
	Day	Night	Day	Night	

	06-22h	22-06h	07-22h	22-07h	
0: recuperation areas	50	40	WHO Class I: residential, institutional, educational: 55	WHO Class I: residential, institutional, educational: 55	Classes are not directly comparable, but PRC Class III standards are stringent than WHO Class II standards. PRC standards are utilized in this report
I: mixed residential; and education areas	55	45			
II: mixed with residence, commercial and industrial areas	60	50	WHO Class II: industrial, commercial: 70	WHO Class II: industrial, commercial: 70	
III: industrial areas	65	55			
IV: areas within 10 m on both sides of traffic roadways	70	55			

2.6 PRC Environmental Impact Assessment Framework

Article 16 of the PRC *Law on Environmental Impact Assessment* (revised in 2016) stipulates that an EIA document is required for any capital construction project producing significant environmental impacts. Projects are classified into three categories for environment impact:

(i) **Category A:** projects with significant adverse environmental impacts, for which a full EIA report is required;

(ii) **Category B:** projects with adverse environmental impacts which are of a lesser degree and/or significance than those of Category A, for which a simplified tabular EIA report is required; and

(iii) **Category C:** projects unlikely to have adverse environmental impacts, for which an EIA registration form is required.

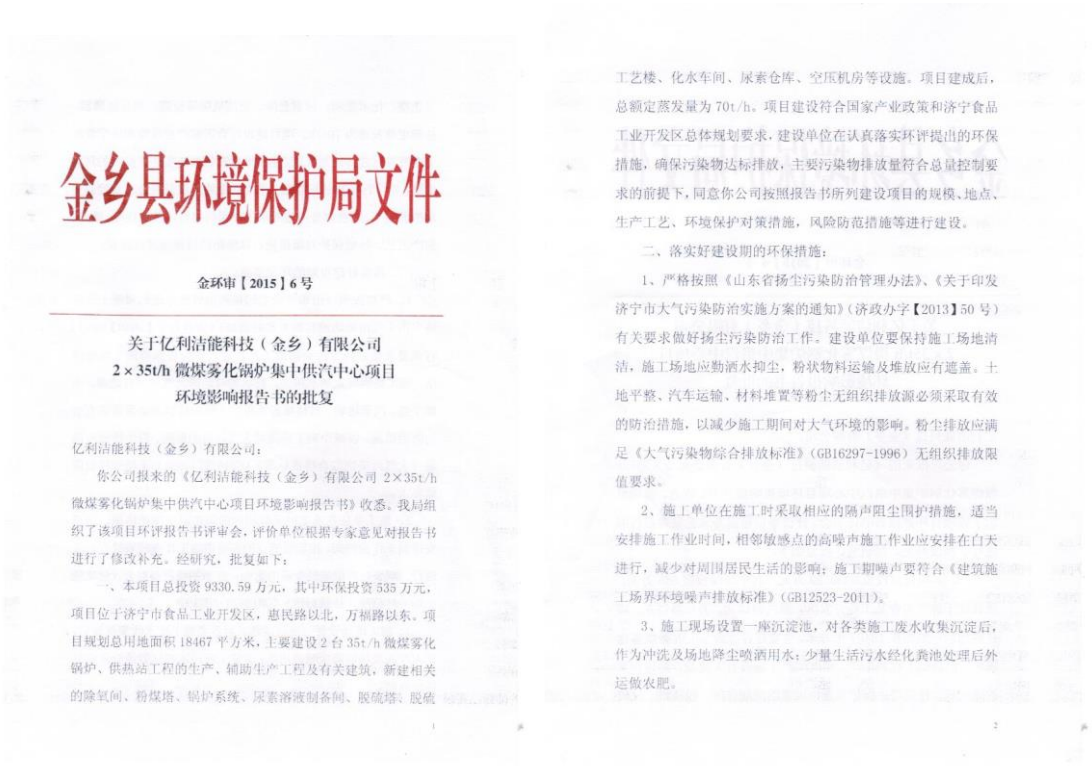
A full EIA report for category A project and a simplified tabular EIA report for category B project are similar to ADB's EIA and IEE reports, respectively. The registration form of an EIA is similar to an ADB Category C project.

In 2008 the MEP issued "Management Guideline on EIA Categories of Construction Projects" (revised in 2017). The MEP guidelines provide detailed EIA requirements for 50 sectors and 192 subsectors based on the project's size, type (e.g., water resources development, agriculture, energy, waste management, etc.), and site environmental sensitivity (e.g., protected nature reserves and cultural heritage sites).

The MEP's "Construction project catalogue of for EIA approved by MEP" (2015) and "Guidelines on Jurisdictional Division of Review and Approval of EIAs for Construction Projects" (2009) defines which construction project EIAs require MEP review and approval, and which EIAs are delegated to the provincial EPBs.

2.7 Domestic EIA report

The proposed subproject was categorized as A under the PRC National EIA Law. A full EIA Report was prepared by Shandong Mintong Environment and Safety Technology Co., Ltd and submitted to Jinxiang EPB for approval. Jinxiang EPB approved the EIA report on 20 June 2015 and a copy of the approval is presented in Figure 2-1.



金乡县环境保护局文件

金环审［2015］6号

关于亿利洁能科技（金乡）有限公司
2×35t/h 微煤雾化锅炉集中供汽中心项目
环境影响报告书的批复

亿利洁能科技（金乡）有限公司：

你公司报来的《亿利洁能科技（金乡）有限公司 2×35t/h 微煤雾化锅炉集中供汽中心项目环境影响报告书》收悉。我局组织了该项目环评报告书评审会，评价单位根据专家意见对报告书进行了修改补充。经研究，批复如下：

一、本项目总投资 9330.59 万元，其中环保投资 535 万元，项目位于济宁市食品工业开发区，惠民路以北，万福路以东。项目规划总用地面积 18467 平方米，主要建设 2 台 35t/h 微煤雾化锅炉、供热站工程的生产、辅助生产工程及有关建筑，新建相关的除氧间、粉煤塔、锅炉系统、尿素溶液制备间、脱硫塔、脱硝

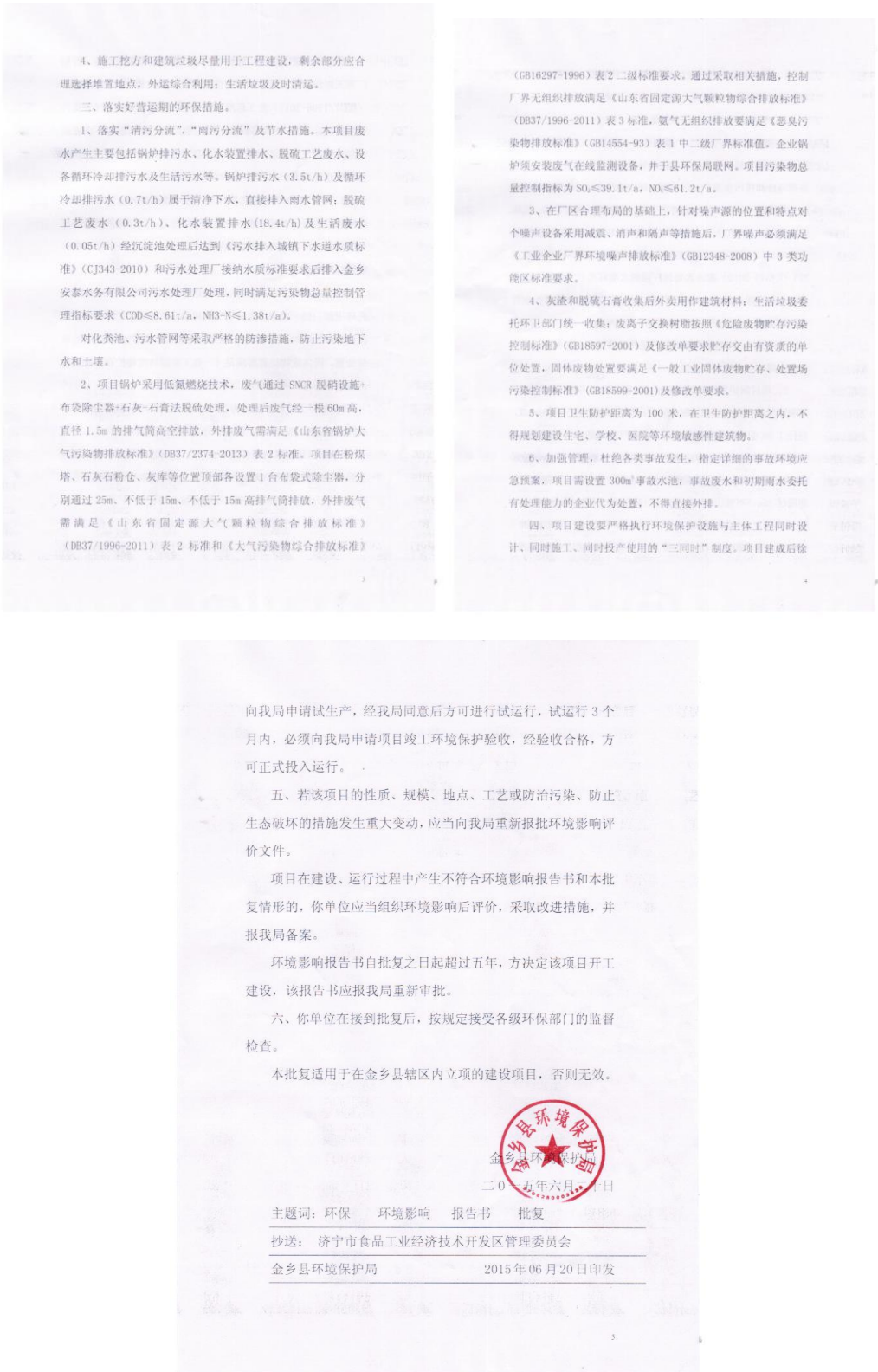
工艺楼、化水车间、尿素仓库、空压机房等设施。项目建成后，总额定蒸发量为 70t/h。项目建设符合国家产业政策和济宁食品工业开发区总体规划要求，建设单位在认真落实环评提出的环保措施，确保污染物达标排放，主要污染物排放量符合总量控制要求的前提下，同意你公司按照报告书所列建设项目的规模、地点、生产工艺、环境保护对策措施，风险防范措施等进行建设。

二、落实好建设期的环保措施：

1、严格按照《山东省扬尘污染防治管理办法》、《关于印发济宁市大气污染防治实施方案的通知》（济政办字【2013】50 号）有关要求做好扬尘污染防治工作。建设单位要保持施工场地清洁，施工场地应勤洒水抑尘，粉状物料运输及堆放应有遮盖。土地平整、汽车运输、材料堆置等粉尘无组织排放源必须采取有效的防治措施，以减少施工期间对大气环境的影响。粉尘排放应满足《大气污染物综合排放标准》（GB16297-1996）无组织排放限值要求。

2、施工单位在施工时采取相应的隔声阻尘围护措施，适当安排施工作业时间，相邻敏感点的高噪声施工作业应安排在白天进行，减少对周围居民生活的影响；施工期噪声要符合《建筑施工场界环境噪声排放标准》（GB12523-2011）。

3、施工现场设置一座沉淀池，对各类施工废水收集沉淀后，作为冲洗及场地降尘喷洒用水；少量生活污水经化粪池处理后外运做农肥。



4、施工挖方和建筑垃圾尽量用于工程建设，剩余部分应合理选择堆置地点，外运综合利用；生活垃圾及时清运。

三、落实好营运期的环保措施。

1、落实“清污分流”、“雨污分流”及节水措施。本项目废水产生主要包括锅炉排污水、化水装置排水、脱硫工艺废水、设备循环冷却排污水及生活污水等。锅炉排污水（3.5t/h）及循环冷却排污水（0.7t/h）属于清净下水，直接排入雨水管网；脱硫工艺废水（0.3t/h）、化水装置排水（18.4t/h）及生活废水（0.05t/h）经沉淀池处理后达到《污水排入城镇下水道水质标准》（CJ343-2010）和污水处理厂接纳水质标准要求后排入金乡安泰水务有限公司污水处理厂处理，同时满足污染物总量控制管理指标要求（COD≤8.61t/a，NH3-N≤1.38t/a）。

对化粪池、污水管网等采取严格的防渗措施，防止污染地下水和土壤。

2、项目锅炉采用低氮燃烧技术，废气通过 SNCR 脱硝设施+布袋除尘器+石灰-石膏法脱硫处理，处理后废气经一根 60m 高，直径 1.5m 的排气筒高空排放，外排废气需满足《山东省锅炉大气污染物排放标准》（DB37/2374-2013）表 2 标准。项目在粉煤塔、石灰石粉仓、灰库等位置顶部各设置 1 台布袋式除尘器，分别通过 25m、不低于 15m、不低于 15m 高排气筒排放，外排废气需满足《山东省固定源大气颗粒物综合排放标准》（DB37/1996-2011）表 2 标准和《大气污染物综合排放标准》（GB16297-1996）表 2 二级标准要求。通过采取相关措施，控制厂界无组织排放满足《山东省固定源大气颗粒物综合排放标准》（DB37/1996-2011）表 3 标准，氨气无组织排放要满足《恶臭污染物排放标准》（GB14554-93）表 1 中二级厂界标准值。企业锅炉须安装废气在线监测设备，并于县环保局联网。项目污染物总量控制指标为 SO_2≤39.1t/a，NO_x≤61.2t/a。

3、在厂区合理布局的基础上，针对噪声源的位置和特点对个噪声设备采用减震、消声和隔声等措施后，厂界噪声必须满足《工业企业厂界环境噪声排放标准》（GB12348-2008）中 3 类功能区标准要求。

4、灰渣和脱硫石膏收集后外卖用作建筑材料；生活垃圾委托环卫部门统一收集；废离子交换树脂按照《危险废物贮存污染控制标准》（GB18597-2001）及修改单要求贮存交由有资质的单位处置，固体废物处置要满足《一般工业固体废物贮存、处置场污染控制标准》（GB18599-2001）及修改单要求。

5、项目卫生防护距离为 100 米，在卫生防护距离之内，不得规划建设住宅、学校、医院等环境敏感性建筑物。

6、加强管理，杜绝各类事故发生，指定详细的事故环境应急预案，项目需设置 300m³事故水池，事故废水和初期雨水委托有处理能力的企业代为处置，不得直接外排。

四、项目建设要严格执行环境保护设施与主体工程同时设计、同时施工、同时投产使用的“三同时”制度。项目建成后须向我局申请试生产，经我局同意后方可进行试运行，试运行 3 个月内，必须向我局申请项目竣工环境保护验收，经验收合格，方可正式投入运行。

五、若该项目的性质、规模、地点、工艺或防治污染、防止生态破坏的措施发生重大变动，应当向我局重新报批环境影响评价文件。

项目在建设、运行过程中产生不符合环境影响报告书和本批复情形的，你单位应当组织环境影响后评价，采取改进措施，并报我局备案。

环境影响报告书自批复之日起超过五年，方决定该项目开工建设，该报告书应报我局重新审批。

六、你单位在接到批复后，按规定接受各级环保部门的监督检查。

本批复适用于在金乡县辖区内立项的建设项目，否则无效。

金乡县环境保护局

二〇一五年六月 日

主题词：环保　环境影响　报告书　批复

抄送：济宁市食品工业经济技术开发区管理委员会

金乡县环境保护局　2015年06月20日印发

Figure 2-1 EIA approval

3 Project Description

3.1 Introduction

The project will primarily build 2 × 35 t/h industrial pulverized coal-fired boilers which employs Micro-fine Coal Atomization technology in operation. Upon completion, the project will enable centralized steam provision to all enterprises in the project covered area and the existing boilers in the area will be entirely dismantled. The project involves zero domestic heating and provides steam solely for industrial purposes.

The project is located insde JFIP of Jining City, east of Wanfu Road, North of Huimin Road and south of Shandong Renhe Food Co., Ltd. The project location is shown in Figure 3-1 and sensitive receptors in project's surrounding areas are shown in Figure 3-2 and Table 3-1.

Table 3-1 Sensitive receptors near the project

Name	Direction	Distance (m)	Population
Lianchi Village	NE	450	120
Zhaodong Village	NE	650	410
Yanguangmiao Village	SE	800	230
Lishuanglou Village	S	800	210
Lihai Village	E	1650	270
Binggong Village	SE	1150	270
Yangwa Village	W	1900	330
Xilihai Village	SE	1800	130
Zhoulukou Village	SE	2000	380
Cuikou Village	SE	1700	580
Zhangzhaizhuang Village	SE	2450	580
Shiwulizhuang Village	SE	2450	890
Houlou Village	NE	2000	700
Beihelou Village	NE	2400	370
Suilou Village	SW	2150	530
Jingzhuang Village	SW	1500	730
Zhaotaizi Village	SW	2050	830
Xunfang Village	SW	2400	330
Xunlou Village	SW	2450	210
Beililou Village	NW	2300	470
Xiaolilou Village	SW	2700	290

Name	Direction	Distance (m)	Population
Zhangwangzhuang Village	SW	2900	190
Wenfeng Middle School	SW	2700	1100
Shidian Village	NE	2800	260
Sangyuan Village	NE	2700	490
Menglou Village	NE	2800	210
Xulou Village	SE	2800	830
Litonglou Village	S	2700	540

Figure 3-1 Location of the Project

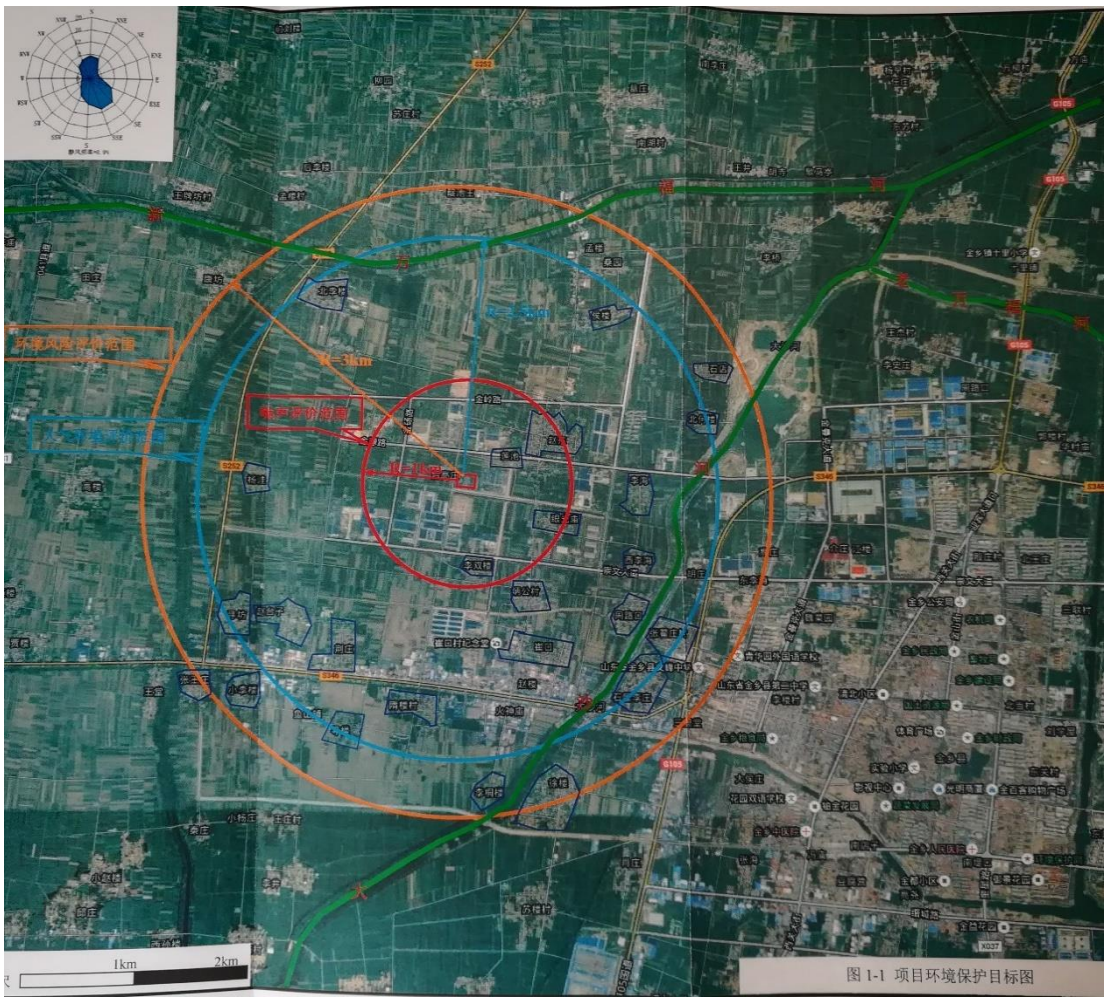


Figure 3-2 Location of the Sensitive Receptors in Project Surrounding Area

3.2 Project Background and Regional Steam Supply Status

At present, more than twenty major enterprises settled in JFIP include Hongda Food Co., Ltd, Yuanzhi Food Co., Ltd, Chenggong Biology Co., Ltd, Jinyuan Food Co., Ltd, Renhe Food Co., Ltd. These businesses all have continuous and stable production and thus maintain stable heat load, with thermal energy primarily used for heating and drying. Based on the heat load survey among enterprises in JFIP, the project team has strictly verified each and every enterprise's necessary heat load for production, properly considered their short-term development plans, and then estimated the short-term heat load of all the enterprises. Based on these results, with coincidence factor and transmission losses calculated, the computed superheated steam load of the project is 58.6 tons per hour.

In recent years, insufficient and unstable self-supply of steam has already

become the bottleneck that severely hampers the business development of settled enterprises. At the same time, in response to requirement set out in *China's Action Plan on Air Pollution Prevention and Control*, which reads that "by 2017 coal-fired boilers with the capacity of 10 t/h and below should be primarily phased out in cities at and above prefecture-level, unless otherwise deemed necessary to be kept", then Elion has invested in construction of the project.

3.3 Regional Heat Demand

Large quantities of enterprises operating in JFIP have stable demand for steam. Elion Jinxiang Subcompany conducted on-site survey and developed a list of heat demand and consumption for existing enterprises in JFIP, as shown in Table 3-2.

Table 3-2 Heat Load Status of Enterprises in JFIP

No.	Company	Steam Pressure (MPa)	Steam Temperature (°C)	Heat load		
				Maximum	Average	Minimum
1	Shandong Binbo Bio-product Co., Ltd	0.5	193	8.8	8.0	7.2
2	Shandong Yuanzhi Ejiao Co., Ltd	0.5	193	6.6	6	5.4
3	Jinxiang Chenggong Biology Co., Ltd,	0.5	193	4	3.5	3
4	Shandong Yukouqinye Co., Ltd	0.5	193	1.1	1	0.9
5	Jinin Jinyuan Food Co., Ltd	0.6	160	6.6	6	5.4
6	Shandong Renhe Food Co., Ltd	0.6	160	5.5	5	4.5
7	Shandong Xinnuo Food Technology Co., Ltd	0.5	193	5.5	5	4.5
8	Xindeshun Food Co., Ltd	0.5	193	1.4	1.3	1.2
9	Shandong DOngbao Food Co., Ltd	0.5	193	2.2	2	1.8
10	Shandong Qisheng Food Co., Ltd	0.6	160	3.3	3	2.7
11	Shandong Dongxinlong Food Co., Ltd	0.6	160	3.3	3	2.7
12	Shandong Hongsheng garlic product Food Food Co., Ltd	0.6	160	5.5	5	4.5

No.	Company	Steam Pressure (MPa)	Steam Temperature (°C)	Heat load		
				Maximum	Average	Minimum
13	Shandong Dongyun Food Co., Ltd	0.5	193	4.4	4	3.6
14	Jining Kangfusen Health Care Medicine Co., Ltd	0.6	160	9	8	7
Total				67.3	60.8	54.4

The project has taken into account the thermal load demand of both existing businesses and newly settled enterprises in JFIP, and such factors as JFIP's short-term heat consumption and future development needs, to determine the heat load parameters for the centralized heat provision, as shown in Table 3-3.

Table 3-3 List of Project Heat Load Parameters

1.6MPa and 245 °C Steam	Unit	Maximum	Average	Minimum
Heat load	GJ/h	188.4	170.4	152.4
	t/h	64.8	58.6	52.4

The project will realize district steam supply to all enterprises in JFIP after the project is completed and all existing boilers in JFIP will be demolished.

3.4Main project content

3.4.1 Project components

Table 3-4 presents components under the project.

Table 3-4 Project component

Category	Item	
Principal Facilities	Boiler	2 × 35 t/h industrial pulverized coal-fired boilers which employs the Micro-fine Coal Atomization technology in operation
	Deaerator worshop	One deaerator worshop will be installed at 6th floor of Control Building
	Chemical water treatment shop and its affiliated chamber	One 3-storeyed building, with an area of 1,280 m^2, consisting of chemical water treatment shop, its affiliated chamber, and water tank
	Ash storage chamber	One storage chamber, with a volume of 50 m^3
	Lime powder storehouse	One storehouse, with a volume of 25 m^3, capable of storing lime powder for 50-day desulfurization use for 2 boilers

Category	Item	
	Diesel tank area	One 10m^3 ground diesel tank area.
Utility Facilities	Water supply system	Both industrial water and domestic water comes from the water supply network of JFIP, and the freshwater consumption is 2,652 t/d.
	Power supply system	Power for industrial use and domestic use comes from the power supply network of JFIP.
	Chemical water preparation and treatment system	One set of chemical water preparation and treatment system installed in the chemical water treatment shop, using “filtration + ultra-filtration + reverse osmosis” treatment system, with a treatment capacity of 80 m^3/h
	Industrial water cooling	One counter-current mechanical draft cooling tower is installed, with a flow rate of 40 m^3/h.
	Air compressor system	This project has installed one compressed air station, three 8 Nm^3/min screw air compressors (one standby). Cooling system is industrial water cooling system
Environmental Protection Facilities	Exhaust Gas	Exhaust gas from boilers: Each boiler is equipped with one set of SNCR denitration system, with denitration efficiency ≥ 60.0%. Each boiler is connected to one bag filter, with dust removal efficiency ≥ 99.6%. Each boiler has one limestone-gypsum wet flue gas desulfurization system, with design desulfurization efficiency ≥ 90%. After processes of denitration, dust removal and desulfurization, exhaust gas is emitted through a chimney of 1.5-m diameter and 60-m height (one chimney shared by 2 boilers). Dust and exhaust gas from other sources: Each coal dust storage tower and the ash storage chamber are connected with a bag filter on the top, with design dust removal efficiency ≥ 99.9%.
	Wastewater	The domestic wastewater and wastewater from the desulfurization system and denitrogen system will be discharged to Jinxian Antai Wastewater treatment plant (WWTP). The boiler effluent and effluent from water recycling system are unpolluted wastewater and will be discharged into municipal stormwater sewer.
	Solid Waste	One ash storage chamber (50 m^3). Slag and gypsum will directly sold out after generation. There is no temporary storage room at the site.
	Noise	Measures include installing vibration reduction base, muffler, sound insulation room, etc.
	Online monitoring system	One online monitoring system will be installed in the chimney after the desulfurization system to monitor SO_2, NOx and PM and send the data to local EPB.

Construction of supporting steam distribution network in JFIP has already completed by Elion Jinxiang Subcompany. Maximum steam supply radius is 2.5 km and the steam pressure at the pipeline end is around 1.0 MPa.

3.4.2 Environmental Protection Investment

Environmental protection facilities for the project include dust removal facility, desulfurization system, denitration system, chimney, flue, noise reduction set-ups, environmental monitoring equipment, as well as greening arrangements. The total environment related investment amounts to RMB 5.35 million yuan (5.35 million CNY). Table 3-5 shows the details.

Table 3-5 Environmental protection investment

No.	Environmental Facilities	Investment (RMB 10,000 Yuan)
1	Bag filter	100
2	Limestone-gypsum wet flue gas desulfurization system	150
3	SNCR denitration system	150
4	Chimney	80
5	Flue	30
6	Septic tank	3.0
7	Noise mitigation measures	10
8	Ash storage chamber, gypsum storehouse, dumping site, etc.	5
9	Flue gas online monitoring system	10.0
Total		535

3.5 Project Current Status and Lay-out

At present, the project has been completed. It is located insde JFIP of Jining City, east of Wanfu Road, North of Huimin Road and south of Shandong Renhe Food Co., Ltd. The floor area of the project is 18,467 m^2. Based on the on-site configurations, its general lay-out is divided into different functional areas, including boiler facility area, chemical water facility area, and expansion area.

(1) Boiler facility area

The boiler facility area is located in the middle of project site. There are PC storage tower, boiler, dust removal equipment, induced draft fans, absorption tower, and chimney in sequence from south to north. Control building, pump station of desulfurization system, urea solution process workshop and urea storage room are located at east of the boilers.

The boilers are operated in open air and there is no boiler room. The pulverized coal is stored in the coal dust storage towers in front of the boilers and then sent to the boilers through pipelines. Therefore, it is not necessary for the project to set up any

deaerator and coal-bunker bay. Such auxiliary facilities as feed-water pump, drain tank, and drain pump are installed in the auxiliary shop to the south of the boilers.

(2) Chemical water treatment facility area

The chemical water treatment workshop and associated outdoor facilities are located on the east side of the central project site, mainly including chemical water treatment shop, pump station and water tanks. Wastewater emission point is located at south of the project site and is close to the municipal sewer pipeline in Huimin Road.

3.6 Heat source

The project will install 2 × 35 t/h Micro-fine Coal Atomization boilers. In accordance with the boiler capacity, coal source and coal quality, the project has selected the Micro-fine Coal Atomization boiler. Specific model and parameters are proposed as follows:

- Rated evaporation capacity: 35 t/h
- Rated pressure of superheated steam: 1.6 MPa
- Rated temperature of superheated steam: 245 °C
- Feed-water temperature: 104 °C
- Design efficiency: ≥ 90%

3.7 Fuel

The project will use coal produced in Shenmu County of Shaanxi Province as the main fuel. In this first phase project, feed coal will be transported via highway. The quality data of coal dust pulverized from raw coal for boilers are shown in Table 3-5.

Table 3-5 Coal analysis data

No.	Item	Symbol	Unit	Design Coal
1	Carbon As Received basis	Car	%	72.25
2	Hydrogen As Received basis	Har	%	3.99
3	Oxygen As Received basis	Oar	%	11.63
4	Nitrogen As Received basis	Nar	%	0.58
5	Sulfur As Received basis	Sar	%	0.39
6	Moisture As Received basis	Mar	%	4.6
7	Ash As Received basis	Aar	%	6.56
8	Moisture, Air Dried basis	Mad	%	4.61
9	Volatile Matter, Dry and Ash Free	Vdaf	%	33.46
10	Lower Heat Value As Received basis	Qnet.ar	KJ/kg	27,570

4 Description of the environment

4.1 Location

Located in JFIP of Jinxiang County, the intended project lies to the east of Wanfu Road and to the north of Huimin Road. Jinxiang County is located in the southwest of Jining City along the west shore of the four lakes in south Jining and neighbors Jiaxiang County to the north, Yutai County to the east, Chengwu and Juxian counties to the west, Shanxian County and Fengxian County of Jiangsu Province to the south. Fifty kilometers away from Jining City in the north, Jinxiang County has an east-west extent of 26km and a north-south extent of 41.5km. Covering a total area of 886 km2, the county has direct jurisdiction over 11 towns, 2 sub-districts, 1 provincial development zone, 2 city-level development zones and 659 village committees, with a total of 205,725 households, or 642,259 people. Jinxiang has an extensive road and waterway network including Beijing-Shanghai, Beijing-Kowloon and Lanzhou-Lianyungang railways and the Beijing-Hangzhou Grand Canal. Jining Qufu Airport is 26km away from the county to the north and China National Highway 105 (G105) runs through the county. Beijing-Kowloon and Beijing-Shanghai railways pass through the edge of Jinxiang. Its inland waterway is connected to the Beijing-Hangzhou Grand Canal. Jinxiang is also fully equipped with telecommunication facilities including PBX, mobile communication, international fax and internet.

Located in the north of Yushan New Town of Jinxiang County, Jining Food Industry Development Zone has a good location with a sophisticated transport network. It borders the old downtown district of Jinxiang and Jinxiang Economic Development Zone to the east, Dingfeng Provincial Highway to the south, G105 to the west and the northern ring road of Jinxiang to the north.

4.2 Geography and Topography

Jinxiang County is located on the vast alluvial plain of the Yellow River and its topography is highly influenced by the flooding and levee breaches of the river.

Interspersed amongst the plain are hummocks, slopes and depressions with subtle variation of height. With flat and low-lying terrain, the county takes on the shape of an ear with the length north to south much longer than the distance from east to west. As the west of the county is higher than the east, its terrain descends from the southwest to the northeast. Its gradient ranges from 1/6000 to 1/8000 and the altitude varies between 40.5m and 34.5m averaging 37.5m. The difference of elevation is 4.1m between the north and the south and 3.9m between the east and the west. The predominant landform in Jinxiang, as part of the Southwest Shandong Plain, consists of a relatively flat plain with no mountains but only two low hills (Yang Hill and Ge Hill in the northwest). By landform, the county can be divided into two parts: low hill and alluvial plain. The area of low hills and foothills, namely Yang Hill, Ge Hill and Guo Hill, is very small, of which all are green rocky hills consisted of Cambrian limestone with flat peaks measuring 90 to 105m high. Alluvial plain, whose complex structure was shaped by the changing flow direction and velocity of the flooding Yellow River, is the main landform of the county. There are five types of micro-relief structures in the county: desolate hillside, piedmont terrace, flat ground, gentle slope and depression. Situated on the alluvial plain of the Yellow River, the county has a gently sloping terrain with the gradient less than 1/8000 and an elevation of 35 to 37m which is proper for construction.

4.3 Climate

Jinxiang County has a warm temperate continental monsoon climate with four distinct seasons. It is dry and windy in spring, hot and wet in summer, clear and cool in autumn with decreasing solar radiation and temperature, and cold and dry in winter with little snow and rain. It is prone to drought in autumn when the rainfall is low.

The meteorological parameters of Jinxiang County are as follows:

(1) Temperature

Average annual temperature: 13.8 °C;

Hottest month each year: July, with an average temperature of 26.8 °C;

Coldest month each year: January, with an average temperature of -12 °C

Record maximum temperature: 40.6 °C (7 July 1988);

Record minimum temperature: –18.5 °C (3 Jan 1967).

(2) Rainfall

Average annual rainfall: 694.5mm;

Record maximum average annual rainfall: 1392.9mm in 1971;

Record minimum average annual rainfall: 464.5mm in 1988;

Record maximum daily rainfall: 117mm (9 August 1971);

The seasonal distribution of rainfall is extremely uneven. Summer is the wettest season with an average rainfall of 460.7mm, accounting for 66% of the annual total, whereas winter is the driest season with an average rainfall of 40.6mm, accounting for only 5.8% of the total.

(3) Humidity

Average annual relative humidity: 69%;

The relative humidity is highest in August at 81% and lowest in March at 62%;

Record low relative humidity: 0 (23 February 1977).

(4) Evaporation

Average annual evaporation: 1533mm;

Record maximum annual evaporation: 1828.2mm in1988;

Record minimum annual evaporation: 1488.0mm in 1980.

(5) Barometric Pressure

Average annual barometric pressure: 1011.6hPa;

Record maximum annual barometric pressure: 1013.5hPa (1980);

Record minimum annual barometric pressure: 1011.1hPa (1966).

(6) Wind Speed

Average annual wind speed: 2.2m/s;

Record maximum average annual wind speed: 3.5m/s (1963), record minimum average annual wind speed: 2.0m/s (1978);

Prevailing wind: southeastern wind (SE), frequency: 11%.

(7) Others

Maximum depth of permafrost: 27cm (1 January 1968);

Maximum snow depth ever measured: 19cm (2 January 1987);

Record maximum snow cover in a year: 39 days (1968).

4.4Hydrogeology

There are four aquifer groups in Jining Food Industry Development Zone: quaternary loose rock pore aquifer group, Permian sandstone fissure aquifer group, carboniferous limestone-laminated sandstone fissure aquiferr group and Ordovician limestone fissure karst aquifer group.

(1) Quaternary loose rock pore aquifer group

The thickness of the quaternary strata varies from 350 to 400m in the region which increases gradually from north to south. Medium sand, coarse sand with gravel, fine sand and silty fine sand are the main lithological components of the aquifer group. By mineralization and depth, the group can be further divided into shallow freshwater-bearing aquifer, intermediate saltwater-bearing aquifer and deep freshwater-bearing aquifer.

Shallow freshwater-bearing aquifer is at the depth of 25m with the depth of groundwater around 2.0m. The yield per well is between 200 and 1400 m3/d and mineralization less than 2.0g/l;

Intermediate saltwater-bearing aquifer is found from 35 to 40m below the land surface with yield per well from 40 to 280 m^3/d and mineralization higher than 2.0 g/l;

Deep freshwater-bearing aquifer is at the depth of 150 to 210m with the depth of groundwater between 21 to 28m. The yield per well is between 500 and 1000m^3/d, mineralization between 0.5 and 2.0g/l and water temperature around 15℃.

The main sources of groundwater recharge in the aquifer group include infiltration of precipitation and agricultural irrigation and lateral seepage of surface water; the main discharge methods are extraction and lateral runoff.

(2) Permian sandstone fissure aquifer group

With an average thickness of 260m, the aquifer group exists in most of the region. Its major lithological components include sandstone and conglomerate. The yield per well is less than 100 m^3/d and mineralization between 1.0 and 4.0 g/l. The

groundwater runoff is slow as the aquifer is not recharged directly by precipitation.

(3) Carboniferous limestone-laminated sandstone fissure aquifer group

The aquifer group, with sandstone and/or lamina conglomerate as the main components, is present in all parts of the region. With an average thickness of 220m, the aquifer group has weak water yield with yield per well lower than 100 m^3/d. The ground water is SO_{42}-saline water with a mineralization of 4.0g/l.

(4) Ordovician limestone fissure karst aquifer group

Analyses show that the aquifer group is most commonly found in the industrial park, with each section varying greatly in depth to groundwater and water content: the depth to Ordovician limestone is between 350 to 400m in Yangzaozhuang Village-Qiujing Village in the north of Heze Fault and Xihulou Village-Zhoudazhuang Village in the west of Jiaxiang Fault, which are directly covered by quaternary loose rock layer and feature high water yield; the depth in the coal exploration zone, located to the west of Jiaxiang Fault, north of Fu Mountain Fault and south of Heze Fault, varies from 400 to 900m with unevenly distributed karst fissures and low overall water yield; the depth is over 1200m in the region to the east of Jiaxiang Fault and south of Fu Mountain Fault and features low water yield.

According to the statistics of coal exploration, within the coal exploration zone, the main lithological components in Ordovician karst aquifer group are limestone, dolomite and argillaceous limestone. The aquifer group has no hydraulic connection with the superimposed Carboniferous and Permian aquifer groups. The water levels of the aquifers range from 33 to 34 m (depth of groundwater between 2.0 and 4.0m). The yield per well ranges widely from 1618.27m^3/d to 133.06 m^3/d. The permeability coefficient is between 0.08 and 3.32m/d and water temperature 33.7 to 40.7 °C. The aquifer is highly mineralized and the hydrochemical type of the groundwater is SO_4—Ca·Na.

4.5 Environmental Baseline Monitoring

Environmental baseline monitoring was conducted by Shandong Gelin Detection Technology Ltd.

4.5.1 Ambient air

According to *Technical Guideline for EIA – Atmospheric Environment* (HJ2.2-2008) and the identified ambient air quality assessment area with environmental sensitive receptors in this area, ambient air quality monitoring was undertaken at five locations regarding the prevailing wind direction. Monitoring was undertaken continuously over a 7 day period from May 30 to June 5, 2015. Locations are presented in Table 4-1 and Figure 4-1.

Table 4-1 Ambient air quality monitoring locations and parameters monitored

No.	Location	Distance and direction from site	Parameters Monitored	Note
1	Project site	——	SO_2, NO_2, PM_{10}, $PM_{2.5}$, TSP and ammonia	Project site
2	Binggong Village	ES, 1100		Sensitive receptor at the upwind
3	Zhaodong Village	NE, 700		Sensitive receptor at the 90° direction
4	South of Beili Village	NW, 1800		Sensitive receptor at the downwind
4	Zhaotaizi Village	SW, 2000		Sensitive receptor at the 270° direction

Monitoring results are presented in Table 4-2.

Table 4-2 Ambient air quality monitoring results, mg/m^3

Location	Item	1-hour average concentration range	24-hour average concentration range
No.1	SO_2	0.029-0.081	0.043-0.069
	NO_2	0.010-0.050	0.031-0.048
	PM_{10}	----	0.136-0.147
	TSP	----	0.077-0.084
	$PM_{2.5}$	----	0.234-0.245
	ammonia	ND-0.065	----
No.12	SO_2	0.021-0.080	0.038-0.066
	NO_2	0.013-0.059	0.028-0.043
	PM_{10}	----	0.115-0.122
	TSP	----	0.067-0.072
	$PM_{2.5}$	----	0.216-0.227
	ammonia	ND -0.0827	----
No.3	SO_2	0.020-0.070	0.030-0.067
	NO_2	0.011-0.053	0.025-0.038

Location	Item	1-hour average concentration range	24-hour average concentration range
	PM_{10}	----	0.116-0.123
	TSP	----	0.067-0.074
	$PM_{2.5}$	----	0.211-0.222
	ammonia	ND -0.011	----
No.4	SO_2	0.020-0.053	0.033-0.042
	NO_2	0.011-0.055	0.025-0.041
	PM_{10}	----	0.115-0.124
	TSP	----	0.067-0.071
	$PM_{2.5}$	----	0.203-0.216
	ammonia	ND -0.010	----
No.5	SO_2	0.020-0.060	0.031-0.060
	NO_2	0.011-0.058	0.022-0.035
	PM_{10}	----	0.115-0.124
	TSP	----	0.066-0.074
	$PM_{2.5}$	----	0.203-0.216
	ammonia	ND -0.010	----

Note: ND means No detection

Table 4-3 Applicable ambient air quality standard mg/m^3

Pollutants	Parameter	Standard	Note
SO_2	1-hour average	0.50	Class II of *Ambient Air Quality Standards* (GB3095-2012)
	24-hour average	0.15	
NO_2	1-hour average	0.20	
	24-hour average	0.08	
PM_{10}	24-hour average	0.15	
TSP	24-hour average	0.30	
$PM_{2.5}$	24-hour average	0.075	
NO_x	24-hour average	0.10	
O_3	8-hour average of top 8 hourly concentration	0.16	
ammonia	once	0.20	*Hygienic standard for design of industrial enterprises* (TJ36-79)

The results indicate that all results for TSP, ammonia, SO_2, and NO_2 were in

compliance with Class II PRC standards except $PM_{2.5}$ monitoring results at No.1 location exceeded the 24-hour average. The reason is now project site is undeveloped land without any vegetation cover and is easy to generate dust during windy days. The results indicate that the overall air quality at the surroundings of the project site is good.

4.5.2 Surfacewater

Surface water quality monitoring data is collected from EIA report for Urine products futhur process project of Shandong Binbo Bio-product Co., Ltd. which is 1 km away from the project site. Surfacewater baseline monitoring was undertaken at six sections. The locations are presented in Table 4-4 and Figure 4-1.

Table 4-4 Surfacewater quality monitoring locations

No.	Locations	Note
1	200m from the wastewater emission point of WWTP, upstream	Water quality at upstream of WWTP
2	500m from the wastewater emission point of WWTP, downstream	Water quality at downstream of WWTP
3	Junction between Sangangou and Dasha River, 200m at the upstream of Sangangou	Self cleaning capacity of Sangangou
4	Junction between Sangangou and Dasha River, 200m at the upstream of Dasha River	Self cleaning capacity of Dasha River
5	Junction between Sangangou and Dasha River, 500m at the downstream of Dasha River	Self cleaning capacity of Dasha River
6	Junction between Lowanfu River and Dasha River, 3000m at the downstream of Lowanfu River	Self cleaning capacity of Laowanfu River

Monitoring results are presented in Table 4-5.

Table 4-5 Surfacewater monitoring results

No.	Sample time	Parameters																	
		pH	COD_{Cr}	BOD_5	NH_3-N	Petroleum	TN	TP	Volatile phenol	Dissolved oxygen	Sulfide	F^-	Cr^{6+}	Sn	Pb	Cd	Hg	Total salt content	Fecal coliforms
1#	4:23AM	0.39	0.80	0.85	0.72	0.14	4.10	0.90	0.30	0.81	0.01	0.97	0.04	0.001	0.10	0.10	0.03	2.99	0.03
	4:23PM	0.37	0.73	0.77	0.64	0.10	3.93	0.80	0.20	0.76	0.01	0.93	0.04	0.001	0.10	0.10	0.03	3.03	0.04
	4:24AM	0.50	0.70	0.70	0.63	0.06	3.85	0.87	0.10	0.75	0.01	0.96	0.04	0.001	0.10	0.10	0.03	2.94	0.03
	4:24PM	0.37	0.83	0.90	0.73	0.08	3.99	0.70	0.30	0.83	0.01	1.05	0.04	0.001	0.10	0.10	0.03	3.05	0.02
2#	4:23AM	0.34	0.77	0.78	0.77	0.10	4.05	0.80	0.20	0.77	0.01	1.01	0.04	0.001	0.10	0.10	0.03	3.10	0.01
	4:23PM	0.47	0.87	0.92	0.67	0.14	4.21	0.97	0.40	0.86	0.01	1.10	0.04	0.001	0.10	0.10	0.03	3.16	0.03
	4:24AM	0.21	0.73	0.73	0.64	0.08	3.95	0.83	0.20	0.74	0.01	0.97	0.04	0.001	0.10	0.10	0.03	3.07	0.02
	4:24PM	0.29	0.80	0.82	0.66	0.08	3.90	0.90	0.30	0.82	0.01	1.10	0.04	0.001	0.10	0.10	0.03	3.13	0.01
3#	4:23AM	0.76	0.93	1.00	0.37	0.16	2.05	0.63	0.10	0.90	0.01	0.93	0.04	0.001	0.10	0.10	0.03	1.74	0.01
	4:23PM	0.82	1.10	1.18	0.44	0.14	2.33	0.80	0.20	1.30	0.01	0.97	0.04	0.001	0.10	0.10	0.03	1.77	0.01
	4:24AM	0.86	0.87	0.90	0.39	0.08	1.95	0.70	0.05	0.85	0.01	0.89	0.04	0.001	0.10	0.10	0.03	1.72	0.01
	4:24PM	0.95	1.00	1.10	0.41	0.12	2.08	0.60	0.10	0.94	0.01	0.87	0.04	0.001	0.10	0.10	0.03	1.73	0.02
4#	4:23AM	0.57	0.53	0.55	0.20	0.10	1.59	0.43	0.05	0.65	0.01	1.01	0.04	0.001	0.10	0.10	0.03	1.87	0.01
	4:23PM	0.45	0.47	0.43	0.21	0.06	1.45	0.33	0.10	0.53	0.01	0.93	0.04	0.001	0.10	0.10	0.03	1.85	0.01
	4:24AM	0.45	0.47	0.45	0.19	0.08	1.40	0.30	0.05	0.57	0.01	0.97	0.04	0.001	0.10	0.10	0.03	1.82	0.01
	4:24PM	0.48	0.50	0.50	0.21	0.06	1.51	0.40	0.05	0.60	0.01	0.93	0.04	0.001	0.10	0.10	0.03	1.89	0.01
5#	4:23AM	0.72	0.47	0.47	0.18	0.06	1.43	0.23	0.05	0.56	0.01	0.95	0.04	0.001	0.10	0.10	0.03	1.76	0.01
	4:23PM	0.60	0.40	0.37	0.17	0.04	1.33	0.30	0.20	0.43	0.01	0.89	0.04	0.001	0.10	0.10	0.03	1.73	0.01
	4:24AM	0.63	0.43	0.42	0.16	0.10	1.29	0.27	0.10	0.50	0.01	0.79	0.04	0.001	0.10	0.10	0.03	1.71	0.01

	4:24PM	0.66	0.40	0.38	0.17	0.06	1.37	0.30	0.05	0.45	0.01	0.85	0.04	0.001	0.10	0.10	0.03	1.74	0.01
6#	4:23AM	0.425	1.4	1.475	0.982	1.2	6.11	1.5	0.02	2.62	0.013	8.25	0.124	0.01	0.16	0.28	0.001	1.63	0.01
	4:23PM	0.305	1.55	1.675	1.17	1.4	6.48	1.75	0.04	3.88	0.013	7.9	0.12	0.01	0.16	0.28	0.001	1.6	0.01
	4:24AM	0.295	1.15	1.2	0.936	0.8	5.87	1.3	0.02	1.9	0.013	7.55	0.104	0.01	0.16	0.28	0.001	1.58	0.01
	4:24PM	0.32	1.35	1.4	1.23	1.2	6.2	1.55	0.06	2.98	0.013	7.9	0.114	0.01	0.16	0.28	0.001	1.59	0.01

Note：1. Unit is mg/l, pH is dimensionless and fecal coliform’s unit is No./l.
2. The results are from domestic EIA.

Applicable standards are Class IV of *Surface Water Ambient Quality Standard* (GB3838-2002) for Dasha River (No. 1-5 sections) and Class III for Laowanfu River (No. 6 section). The standards are presented in Table 4-6.

Table 4-6 Applicable surfacewater standards

Item	pH	COD_{Cr}	BOD_5	Dissolved oxygen	NH_3-N	TP
Class IV limit	6-9	≤30	≤6	≥3	≤1.5	≤0.3
Class III limit	6-9	≤20	≤4	≥5	≤1.0	≤0.2
Item	Volatile penol	Petroleum	Sulfide	Mercury	Cr^{6+}	cadmium
Class IV limit	≤0.01	≤0.5	≤0.5	0.001	≤0.05	≤0.005
Class III limit	≤0.005	≤0.05	≤0.2	0.0001	≤0.05	≤0.005
Item	Arsenic	Fluoride	TN	Total salt content	Lead	Fecal coliform
Class IV limit	≤0.1	≤0.2	≤1.5	≤1000	≤0.05	≤20000
Class III limit	≤0.05	≤0.2	≤1.0	≤1000	≤0.05	≤10000

The results indicate that all results for total nitrogen and total salt content of No.1- No. 5 sections exceeded the standard. Other parameters at all monitoring points were in compliance with relevant standards excep some COD, BOD_5, fluoride and total phosphorus monitoring results exceeded relevant standard. All results for COD, BOD_5, fluoride, total nitrogen, total phosphorus, total salt content and dissolved oxygen of No.6 section exceeded the standard and some ammonia and petroleum exceeded the standard. Water quality of Dasha River, Laowanfu River and Sangangou were not in compliance with relevant standards.

4.5.3 Groundwater

Groundwater baseline monitoring was undertaken at four locations along the ground water flow direction. Monitoring locations were presented in Table 4-7.

Table 4-7 Groundwater monitoring locations

No.	Location	Distance and direction from site	Note
1	Yangwa Village	W, 1890	Groundwater quality at upstream
2	Shandong Binbo Bio-product Co., Ltd	NW, 1000	Groundwater quality near the project site
3	Houlou Village	NE, 1900	Groundwater quality at downstream
4	Project site	——	Groundwater quality baseline

Table 4-8 Monitoring results

Item	No.1	No.2	No.3	No.4
pH	7.44	7.29	7.58	7.43
Total hardness	1635	956	671	814
Total dissolved solids	3351	2373	1915	2144

Item	No.1	No.2	No.3	No.4
Sulfate	1089	629	352	491
Chloride	605	389	402	396
Volatile penol	0.0013	0.0018	0.0014	未检出
Permangnate index	1.14	0.98	1.06	1.02
Nitrate nitrogen	2.1	13.8	8.6	11.2
Nitrite nitrogen	0.008	0.015	0.017	0.016
Ammonia nitrogen	0.04	0.03	0.04	0.03
Fluoride	0.27	0.53	0.85	0.69
Cyanide	ND	ND	ND	ND
Mercury	ND	ND	ND	ND
Asenic	ND	ND	ND	ND
Cadium	ND	ND	ND	ND
Chromium VI	ND	ND	ND	ND
Lead	ND	ND	ND	ND
Total coliform	3.0	3.0	80	3.0

Applicable groundwater quality standard is Class III of *Ground Water Ambient Quality Standard* (GB/T14848-1993).

Table 4-9 Class III of Ground Water Ambient Quality Standard (GB/T14848-1993)

No.	Unit	Item	Class III of GB/T14848-1993
1	----	pH	6.5-8.5
2	mg/L	Total hardness	≤450
3	mg/L	Total dissolved solids	≤1000
4	mg/L	Sulfate	≤250
5	mg/L	Chloride	≤250
6	mg/L	Permangnate index	≤3.0
7	mg/L	Nitrate nitrogen	≤20
8	mg/L	Ammonia nitrogen	≤0.2
9	mg/L	Volatile phenol	≤0.002
10	mg/L	Nitrite nitrogen	≤0.02
11	No./L	Total coliform	≤3.0

The results indicate that all results for total hardness, total dissolved solids, sulphate, chloride, and total coliform exceeded the standard. Other parameters were in compliance with Class III of *Ground Water Ambient Quality Standard* (GB/T14848-1993). The results indicate that the overall ground water quality near of the project site is good.

4.5.4 Noise

Noise at the site boundaries was undertaken at four points conducted by Shandong Gelin Detection Technology Ltd. The locations are presented in Figure 4-1.

Monitoring results were presented in Table 4-10.

Table 4-10 Noise monitoring results at site boundaries

Monitoring time		Monitoring results L_{eq} dB (A)			
		No. 1 at east boundary	No. 2 at south boundary	No. 3 at west boundary	No. 4 at north boundary
2015.5.30	Daytime	52.5	54.6	55.9	52.0
	Nighttime	43.5	45.9	46.8	44.3
2015. 5.31	Daytime	52.6	55.7	56.3	51.9
	Nighttime	43.2	46.3	46.7	44.7

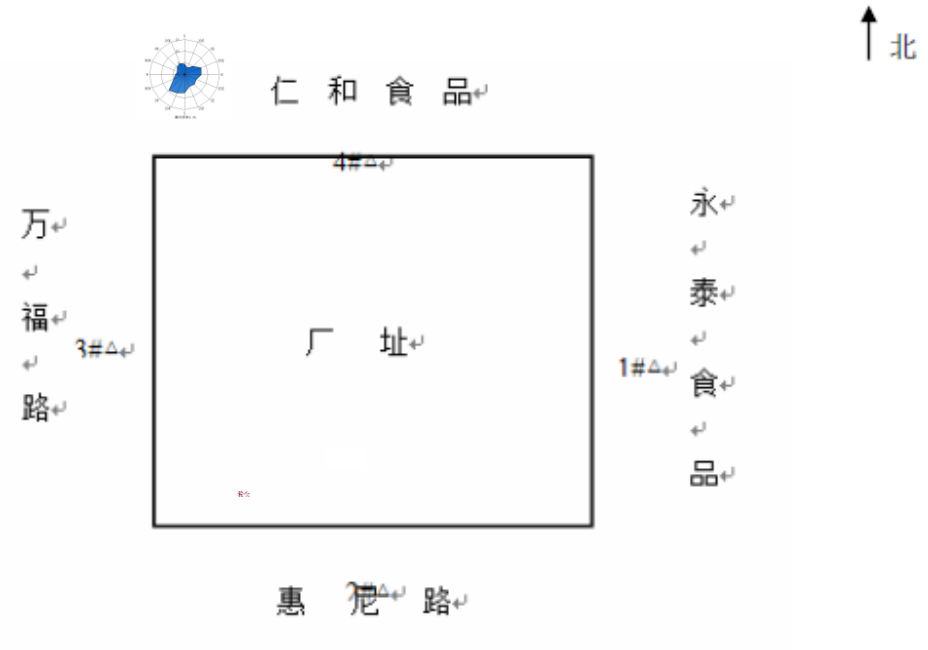


Figure 4-1 Noise monitoring locations

Applicable standard is Class III of *Emission standard for industrial enterprises noise at boundary* (GB 12348—2008). The limit is: 65 dB (A) at daytime and 55dB (A) at nighttime.

The results indicated that noise level at site boundaries were compliance with class III of *Emission Standard for Industrial Enterprises Noise at Boundary* (GB12348-2008). There is no sensitive receptor within the 200-m scope from the project boundary, thus the project has relatively low impact on the surrounding acoustic environment.

5 Environmental Impacts and Mitigation Measures

5.1 Anticipated Positive Effects

(1) Regional Environmental Improvement

This project aims to provide heat load for enterprises in the JDIP to substitute for these businesses' self-operated coal-fired boilers and effectively prevent industrial companies in the region from building small boilers on their own. The project makes use of Micro-fine Coal Atomization technology, which is able to raise the combustion efficiency to 98%, the thermal efficiency to over 90%, and the steam production of one ton of coal from 5 tons to more than 9 tons. Compared with the conventional coal-fired boilers, the project will result in annual energy savings equivalent to 41,743 tons of standard coal and improve local air quality through the estimated annual reduction of emissions of sulfur dioxide (SO_2) by 178.42 tons, nitrogen oxides (NO_x) by 47.95 tons, and particulate matter (PM) by 24.69 tons and carbon dioxide (CO_2) by 104,065 tons. The project is beneficial to mitigating air pollution in the region and conducive to reducing secondary pollution during transportation of fuel and combustion products.

(2) Local Economic Development

The project offers steam source for centralized steam supply in JFIP. Its completion and operation will facilitate the cluster development of industrial initiatives and conserve energy. The project abides by the principle of "concentrated production, centralized pollution treatment and intensive development" set out in the local planning and serves as an integral part of circular development. By guaranteeing stable and high quality steam supply, it will help foster an improved environment for investors in JFIP and push forward regional development, making positive contributions to the regional investment promotion and economic growth.

5.2 Identification of Potential Impacts

The project's potential impacts have been identified according to Environmental Impact Assessment Law of People's Republic of China and associated regulations, as well as requirements articulated in ADB's SPS 2009.

The identification results reveal that during construction phase, adverse environmental impacts are associated with potential soil erosion, construction noise and dust emissions generated in plant construction. In operation phase, the major negative environmental impacts are from the pollutants discharged from the project. In addition, transportation of fuel coal will also bring noise issue.

These impacts fall into three main categories: physical-chemical ones, biological ones and socio-economic ones. The impacts from design, construction and operation phases should be analyzed respectively. Potential impacts are further divided into the following

categories: (1) direct impact, as a direct result of the project itself; (2) indirect impact, resulting from a series of activities triggered by the project, but not directly caused by the project; and (3) cumulative impact, which is generated from the combination of above two kinds of impact and grows as time goes by.

5.3 Anticipated Pre-construction Phase Impacts

(1) Land Acquisition

This project is located in the established JFIP and involves neither land acquisition nor resettlement.

(2) Cultural Relics and Rare Species under Protection

The project is located in an industrial park. No cultural relics, historical sites, archaeological sites, or rare and endangered species are observed in the project site.

5.4 Anticipated Construction Phase Impacts and Mitigation Measures

The project construction has been completed already. A spectrum of measures have been taken during the construction phase, including control and treatment measures for exhaust gas, wastewater and noise; solid waste treatment and disposal measures; soil and water conservation measures, strengthened environmental management, sound storage and management of hazardous waste, properly arranged construction plan, strict control of operation scope of the construction personnel and machinery, giving occupational health and safety training and protection to the workers, etc. During the construction period, through strict compliance to EIA requirements, this project imposed relatively limited impacts on soil, surface water, groundwater, ambient air, fauna and flora, and nearby residents, and such impacts have ceased with the completion of the construction phase.

5.5 Anticipated Operation Phase Impacts and Mitigation Measures

The environmental impacts during operation phase are mainly from exhaust gas emissions (dust-laden exhaust gas and boiler flue gas), wastewater discharge, noise (primarily from water pumps and fans), and solid waste (fly ash and slag in general). Based on relevant laws and regulations of China, no prohibited substances such as Polychlorinated Biphenyls (PCBs) and asbestos are used in the project.

5.5.1 Exhaust Gas

5.5.1.1 Dust-laden Exhaust Gas

No coal pulverizing system is installed in this project. The pulverized coal required for project operation is supplied by a nearby centralized milling center and transported by tanker trucks to the project site. Each boiler is equipped with a coal dust storage tower. The pulverized coal is stored in the coal dust storage towers in front of the boilers and then sent to

the boilers for combustion through pipelines.

Dust-laden exhaust gas is mainly produced in the processes of loading and unloading coal in coal dust storage tower and in ash storage chamber and lime powder storehouse. For each and every coal dust storage tower, as well as ash storage chamber and lime powder storehouse, one bag filter (flow rate Q = 65,000 m^3/h) is installed on the top of the facility. The generated dust-laden exhaust gas goes through the filter material where the dust particles are filtered. The filter material collects coarse dust by collision under inertia effect, and traps fine dust by diffusion and sieving effect. Exhaust gas treated by bag filter is then emitted through exhaust funnel into upper air. As the dust collection efficiency of the bag filter is above 99.9%, the treated exhaust gas has a concentration value of 4.83 mg/m^3, which stays within the maximum emission concentration limit (30 mg/m^3) set out in Table 2 of the *Integrated Emission Standards of Particulate Matter from Stationary Source of Shandong Province* (DB37/1996-2011).

5.5.1.2 **Boiler Flue Gas**

The Micro-fine Coal Atomization technology used in this project enables a full-seal mode operation in the entire process, thus no soot can be seen. The control center adopts the centralized control system and realizes automatic operation and management of boilers. The efficient and stable operation of Micro-fine Coal Atomization boilers is therefore effectively guaranteed. Pulverized coal purchased for the project is processed from raw coal to micron-sized coal dust through washing and selecting, grinding, and preparation. During such process, ash and sulfur content in the coal dust is substantially reduced and pollution is thus cut from the source. As the micron-sized pulverized coal is much finer than ordinary pulverized coal, coal use efficiency and combustion efficiency has been significantly improved.

In coal dust storage and feed process, Elion's Micro-fine Coal Atomization technology adopts fully-enclosed coal transportation equipment and powerful unloading device to avoid furnace shut-down and associated coal dust leakage caused by coal supply device failure such as blockage, thus reducing on-site pollution. The automatic ignition device in Elion's Micro-fine Coal Atomization boiler realizes immediate start and shutoff of boiler, and the cutting-edge low NOX burners achieve low-temperature combustion, which effectively cuts down NOX emissions. The vortex technology is well applied to transforming regular boilers into Micro-fine Coal Atomization boilers. Multiple vortex atomization enables thorough mix of pulverized coal and air; while adjustment of air distribution direction and volume can alter the flame size and shape to accommodate to changes in furnace and coal type. Such technological practice fosters breakthroughs in combustion performance of conventional boilers and raises burn-out rate and thermal efficiency to 98% and above 90% respectively,

and the steam amount generated per ton of coal from 5 tons to over 9 tons.

SO_2, dust and NO_X are the main pollutants generated from combustion in boilers. Going through a series of treatment measures including SCR-SNCR combined denitration process, limestone-gypsum wet desulfurization process and bag filter, the emitted SO_2, dust and NO_X has the concentration of 73.68 mg/m^3, 28.68 mg/m^3, and 115.33 mg/m^3 respectively, all of which stay below the emission concentration limits of *Emission Standards of Air Pollutants from Coal-Burning*, *Oil-Burning and Gas-Fired Boilers in Shandong Province* (DB 37/2374-2013) and below those articulated in World Bank's Environmental, Health, and Safety General Guidelines.

(1) Sulfur Dioxide (SO_2)

SO_2 is an irritant gas that is absorbed by the nose. It can be easily absorbed by the moist mucosal surface and generate sulfite and sulfuric acid. As SO_2 has strong stimulating effect on eyes and respiratory mucosa, inhalation of large amount can cause pulmonary edema, laryngeal edema, and vocal cord spasm and finally result in suffocation. Mild SO_2 poisoning will lead to symptoms of lacrimation, photophobia, cough, as well as burning pain in pharynx and laryngeal; while severe poisoning can trigger pulmonary edema within few hours. Inhalation of gas with extremely high concentration of SO_2 will cause reflex glottis spasm and then suffocation. Direct exposure of skin or eye to SO_2 will cause inflammation and burns. Long-term low concentration exposure will lead to headache, dizziness, weakness and other systemic symptoms as well as chronic rhinitis, pharyngitis, bronchitis, smell and taste loss, and so on.

The project uses the processes of limestone-gypsum wet flue gas desulfurization. Lime powder is prepared into slurry as absorber. The 2 boilers share one set of desulfurization facility, with desulfurization efficiency above 93.5%. SO_2 concentration in exhaust gas from boilers reaches 29.20 mg/m^3 after above desulfurization treatment, which stays within the emission concentration, limit (50 mg/m^3) for Key Control Areas in Table 2 of the *Integrated Emission Standards of Regional Air Pollutants of Shandong Province* (DB37/2376-2013).

(2) Nitrogen dioxide (NO_2)

Nitrogen dioxide is an irritant gas that can be absorbed by mucous membranes. NO_2 is corrosive and physiologically irritating. People with respiratory problems, such as asthma, are more susceptible to nitrogen dioxide. Exposure may cause impaired lung development in children. Long-term inhalation may cause lung structural changes.

At present, two denitration processes are widely accepted globally, namely, selective catalytic reduction (SCR) and selective non-catalytic reduction (SNCR). Both SCR and SNCR are methods of converting nitrogen oxides (NO_X) in the flue gas into harmless diatomic nitrogen (N_2) and water through reduction reaction at a certain temperature, typically with the aid of a reductant such as ammonia or urea. Taking into account such factors as furnace

model and fuel, as well as desulfurization process, the project adopts SNCR-SCR combined denitration technology, which integrates SNCR's advantage of saving investment and SCR's merit of high technical effectiveness. The project uses urea as reductant, which requires the highest investment and operating costs. However, it is not necessary to take any special precautionary measures during the transportation, storage and use of urea and no harm will be produced in such process. Therefore, urea has the best safety performance. Through the treatment, NO_X concentration in boiler-released exhaust gas is 54.84 mg/m^3, which is below the emission concentration limit (100 mg/m^3) for Key Control Areas in Table 2 of the *Integrated Emission Standards of Regional Air Pollutants of Shandong Province* (DB37/2376-2013).

(3) Dust and Soot (Total Suspended Particulate, TSP)

Human nose can block out particles with a diameter greater than 10 μm. Particulate matter with a particle size from 2.5 μm to 10 μm can enter the upper respiratory tract; however, some of them can be excreted through the sputum, thus posing a relatively small hazard to human health. Fine particles with diameter below 2.5 μm can be inhaled into bronchi and interfere with gas exchange in lungs, causing such diseases as asthma, bronchitis and cardiovascular diseases. Fine particles can also enter the blood through the bronchi and alveoli, with the harmful gases and heavy metals borne by them dissolving in the blood and bringing greater harm to human health. Long-term exposure to pollutant particles in the air increases the risk of developing lung cancer, even if the particle concentration is below the legal limit. These particles or other air pollutants may increase in concentration in a short term and give rise to risk of heart disease. European epidemiologists have discovered a clear correlation between lung cancer and airborne particles in some areas.

Due to rapid economic growth, industrial expansion and intensified urbanization, haze frequently hits China in recent years. China is the world's largest energy producer and consumer, the largest coal consumer and the largest emitter of environmental pollutants and greenhouse gases. Both production and domestic life is highly dependent on fossil fuels such as coal and oil. The share of coal in its energy consumption is much higher than that in developed countries. Unreasonable structures of energy production and consumption as well as pollutants emitted from such process are among the critical causes for haze formation. The war against haze has become one of the important tasks in China's Action Plan on Air Pollution Prevention and Control (generally referred to as the Action Plan or "Air Ten Plan").

The project installs bag filters to remove dust and control flue gas emission, with the dust removal efficiency no less than 99.9%. With these measures, dust concentration in exhaust gas from boilers remains 4.83 mg/m^3, within the emission concentration limit (10 mg/m^3) for Key Control Areas in Table 2 of the *Integrated Emission Standards of Regional Air Pollutants of Shandong Province* (DB37/2376-2013).

5.5.1.3 **Ambient Air Quality Standard**

The Ambient Air Quality Standard (AAQS) is formulated to protect and improve living environment, ecological environment and human health, as well as to implement Environmental Protection Law and Atmospheric Pollution Prevention and Control Law of People's Republic of China. AAQS specifies functional zone categories, standards classification, average time and concentration limits, monitoring methods, data and statistics validity, implementation, as well as supervision. Standard limits are designed for one or multiple specific averaging periods, typically 1 hour, 24 hours, or 1 year. This environmental impact assessment (EIA) applies Level II standards of the *Ambient Air Quality Standards* (GB3095-2012) (Table 5-2).

Table 5-2 Limit of ambient air quality standard Unit: mg/m^3

Pollutant	Averaging Time	Limit mg/m^3	Notes
SO_2	1 hour average	0.50	Class II of *Ambient Air Quality Standards* (GB3095-2012)
	Daily average	0.15	
NO_2	1 hour average	0.20	
	Daily average	0.08	
PM_{10}	Daily average	0.15	
$PM_{2.5}$	Daily average	0.075	
TSP	Daily average	0.30	

5.5.1.4 **Exhaust Funnel Height and Inner Diameter**

Design height of the exhaust funnel should meet requirements for air pollutant diffusion and be given considerations to the investment cost, with the ultimate purpose to ensure that the ground level of pollutant concentration shall not exceed the AAQS limits. In this project, exhaust gas from 2 boilers is emitted through one chimney of 60-m height and 1.5-m inner diameter. The chimney height satisfies the requirements on minimum allowable exhaust funnel height put forward by the *Integrated Emission Standards of Regional Air Pollutants of Shandong Province* (DB37/2376-2013).

5.5.1.5 **Emission Concentration**

Air pollutant emissions are calculated based on formulas provided by the *Textbook on Thermal Power Plants* from *Textbook Series for Vocational Qualification Registration of Environmental Impact Assessment Practitioners*. In operation phase, the emission concentrations of SO_2, dust and NO_X generated from boiler with combustion of design coal and check coal (Table 5-3) are all within the emission concentration limits of the *Integrated Emission Standards of Regional Air Pollutants of Shandong Province* (DB37/2376-2013).

Table 5-3 Pollutants in the Project's Boiler Flue Gas

Item		Unit	Check Coal	Design Coal
Flue Gas	Wet Flue Gas Volume	m^3/h	96,345.7	95,191.4

Item			Unit	Check Coal	Design Coal
Emissions	Dry Flue Gas Volume		m^3/h	89,752.1	89,001.0
SO_2	Generation	Concentration	mg/ m^3	764.54	449.20
		Rate	kg/h	73.66	42.76
		Volume	t/a	589.28	342.08
	Emission	Concentration	mg/ m^3	49.72	29.20
		Rate	kg/h	4.79	2.78
		Volume	t/a	38.32	22.24
	Emission Standard		mg/ m^3	50	
PM	Generation	Concentration	mg/ m^3	9,703.91	4,856.85
		Rate	kg/h	934.93	462.33
		Volume	t/a	7,479.44	3,698.64
	Emission	Concentration	mg/ m^3	9.65	4.83
		Rate	kg/h	0.93	0.46
		Volume	t/a	7.44	3.68
	Emission Standard		mg/ m^3	10	
NO_x	Generation	Concentration	mg/ m^3	338.68	342.78
		Rate	kg/h	32.63	32.63
		Volume	t/a	261.04	261.04
	Emission	Concentration	mg/ m^3	54.18	54.84
		Rate	kg/h	5.22	5.22
		Volume	t/a	41.76	41.76
	Emission Standard		mg/ m^3	100	

Source: domestic EIA .The emission concentrations are collected at full load operating conditions.

5.5.1.6 **Atmospheric dispersion modeling**

The report undertakes atmospheric dispersion modeling for SO_2, PM_{10}, TSP, ammonia and NOx using SCREEN3, a US EPA and PRC approved screening mode to estimate the effects to ambient air quality of the project. SCREEN3 is a single source gaussian plume model that can calculate maximum ground level concentration of different pollutants from point source, torch source, area source and body source under normal condition and special condition such as downwash condition and shoreline fumigation condition. Various meteorological combination conditions including worst weather conditions are incorporated and preset in SCREEN3. The worst weather conditions may occur in the project area or not. Therefore, the SCREEN3 modeling result is the conservative calculation result for maximum impacts and range from one pollution source to ambient air quality.

The modeling result is presented in Table 5-4.

Table 5-4 Modeling result Unit: mg/m^3

Distance from pollution source (m)	SO_2		PM		NO_x	
	Ci	Pi(%)	Ci	Pi(%)	Ci	Pi(%)
10	0	0	0	0	0	0
100	1.998E-9	0.00	7.764E-10	0.00	3.128E-9	0.00
200	0.0008906	0.18	0.0003461	0.08	0.001394	0.70
300	0.006168	1.24	0.002404	0.53	0.009683	4.84

Distance from pollution source (m)	SO_2		PM		NO_x	
	Ci	Pi(%)	Ci	Pi(%)	Ci	Pi(%)
400	0.009752	1.95	0.003789	0.84	0.01527	7.63
500	0.0113	2.26	0.004391	0.98	0.01769	8.85
564	0.01209	2.42	0.004698	1.04	0.01892	9.46
600	0.0119	2.38	0.004624	1.03	0.01863	9.31
700	0.01067	2.13	0.004147	0.92	0.01671	8.35
800	0.009539	1.91	0.003707	0.82	0.01493	7.46
900	0.008815	1.76	0.003425	0.76	0.0138	6.90
1000	0.008656	1.73	0.003364	0.75	0.01355	6.77
Maximum GLC (564m)	0.01209	2.42	0.004698	1.04	0.01892	9.46

Source: Domestic EIA

Note: GLC=ground level concentration

The modeling results indicate that the project's flue gas will have limited contribution to the SO_2, NOx, PM_{10}, TSP and ammonia 1-hour average concentration then the project has limited impacts to the ambient air quality in the assessment range. After accumulative analysis of combined worse case GLC of the project and background ambient air quality, the result indicates that the project's flue gas will have limited impacts on sensitive receptors and will not significantly change the ambient air quality of the sensitive receptors.

Table 5-5 Accumulative analysis result, mg/m^3

Item	SO_2	NOx	PM_{10}*
Predicted downwind worst case GLC	0.01209	0.01892	0.014094
Background (average of baseline monitoring)	0.042936	0.029979	0.123514
Accumulative result	0.055	0.049	0.138
Limit	0.5	0.25	0.15

Note: Because there is no 1-hour concentration standard for PM_{10}, 3 times of worst case GLC is combined with background data to be compared with standard limit.

5.5.2 Wastewater

Wastewater generated by the project mainly includes: boiler effluent, chemical water facilities drainage, wastewater from desulfurization process, sewage from equipment circulating cooling process, as well as domestic sewage.

The domestic sewage is treated by the septic tank and then used for site greening. Wastewater from the desulfurization system is used for humidifying ash storage chamber. Concentrated water produced by the chemical water system is unpolluted wastewater, part of which will be used in desulfurization system and the rest will be discharged into municipal drainage network after neutralization and sedimentation. The boiler effluent is unpolluted wastewater and will be discharged into municipal drainage network after neutralization and sedimentation. Effluent from water recycling system is unpolluted wastewater and will be used for spraying to control dust-fall in project site.

Table 5-6 Predicted annual wastewater concentrations and emissions

No.	Source	Emission quantity (m^3/a)	Pollutant concentration (mg/L)				Emission
			pH	COD	Ammonia Nitrogen	SS	
1	Boiler effluent	3.5	8.0	≤30	≤10	≤10	Discharged to municipal sewer
2	Chemical water facilities drainage	18.4	6.5-9.5	≤60	≤10	≤50	Jinxiang Antai WWTP
3	Wastewater from desulfurization process	0.3	6.5-9.5	≤240	≤20	≤400	
4	Sewage from equipment circulating cooling process	0.7	6～9	≤30	≤10	≤50	Discharged to municipal sewer
5	Domestic wastewater	0.05	6-9	≤400	≤30	≤200	Jinxiang Antai WWTP
6	Emission wastwater	18.75	6-9	63.8	10.2	65.6	Jinxiang Antai WWTP
7	Clean wastewater	4.2	6-9	≤30	≤10	≤65	Discharged to municipal storm sewer
Wastewater quality standards for discharge to municipal sewers (CJ343-2010)			6.5-9.5	500	45	400	NA

5.5.3 Noise

The permanent noises of this project mainly consist of mechanical noise generated from equipment operation and aerodynamic noise produced by various fan and steam pipes (Table 5-7). The intensity of noise sources from each device ranges from 75 dB(A) to 120 dB(A). Measures should be taken to control the mechanical noise from equipment below 85 dB(A). If such control result is not technically possible, additional personal protective equipment needs to be provided to the employees. In addition to the above measures, reasonable greening in the project site can also facilitate mitigation of noise impacts. Workers should regularly examine and repair equipment and environmental facilities regularly to ensure that they are in good working conditions.

Table 5-7 Main project noise sources

No.	Name	Number	Location	Mitigation measures	Noise level after mitigation measures dB(A)
1	Blower	2	Boiler room	Damping and noise elimination	75
2	Induced draft fan	1	Outdoor	Damping and noise elimination	75
	Induced draft fan	1	Outdoor	Damping and noise elimination	75
3	Desulfurization blower fan	1	Outdoor	Damping and noise elimination	75
	Desulfurization blower fan	1	Outdoor	Damping and noise elimination	75
4	Cooling tower	1	Outdoor	No	72
5	Pump	6	Pump station	Sound insulation of the	70

				station	
6	Air compressor	3	Air compressor room	Sound insulation of the room	70

Given the existence of multiple noise sources, higher sound level and compact layout, a spectrum of noise reduction measures have been adopted to lessen the project's impacts on the surroundings.

(1) Noise control actions have been taken on the sound source equipment. During the equipment selection and ordering process, noise level requirements were raised to the manufacturers.

(2) Pumps will be installed at the main workshop and the building envelop enclosure can reduce the noise by 20 dB(A)

(3) High efficiency mufflers have been installed at fans, induced draft fan, blower to reducet the exhaust noise by 20-30 dB(A)

(4) Blowers will be installed at outdoor with noise insulation shield to reduce the noise by 15 dB (A).

(5) When blowing the pipe, the direction of the pipe hole should be controlled to avoid facing the residential area; and the operation time should avoid resting period of the general public. Prior to the pipe blowing, announcement should be made to notify the neighborhood residents of the pipe blowing time and noise intensity and then remind them of shutting doors and windows firmly, so as to minimize impacts of exhaust noise on environment.

(6) The overall layout of the project site was planned in a coordinated manner, with rational distribution of facilities and proper spacing for noise prevention. Green belts were widely established in the plant (project site), front area of the plant, and along the plant walls to further reduce the noise impact on surroundings and meet noise control standards.

(7) Windows of pump station, air compressor, and industrial water recycle pump station will be sealed installed with noise insulation meterails.

(8) Drivers of the ash transport vehicles are required to slow down and reduce whistle when passing the villages to minimize impacts on the villages.

Noise monitoring locations are presented in Figure 4-1. Table 5-8 shows the contribution of the main noise equipment to the noise prediction sites and the evaluation results.

Table 5-8 Contribution of noise equipment to site boundaries Unit: dB (A)

Prediction Sites	Daytime		Nighttime	
	Contribution	Superscale	Contribution	Superscale
1# Est Boundary	40.53	-24.47	40.53	-14.47
2# West Boundary	40.73	-24.27	40.73	-14.27

3# North Boundary	41.27	-23.73	41.27	-13.73
4# South Boundary	45.4	-19.6	45.4	-9.6

The prediction results indicate that the daytime and nighttime noise level at four boundaries can meet the Class 3 Standard of *Emission Standard for Industrial Enterprises Noise at Boundary* (GB12348-2008). There is no sensitive receptors within the 200-m scope from the project boundaries, thus the project has relatively low impact on the surrounding acoustic environment.

5.5.4 Solid waste

A positive pressure dense phase pneumatic conveying system is set up to handle ash and slag. The system uses compressed air to blow the fly ash and slag into ash storage chamber (a bag filter is installed at the top of ash storage chamber). After calculation, ash and slag generation quantity of the project is 1.32 tons per hour, which is equal to 9,504 tons per year. This project has constructed a steel ash storage chamber with a volume of 50 m^3, which is capable of storing ash and slag produced by 2 × 35 t/h boilers in 35 hours under rated load.

The project uses the processes of limestone-gypsum wet flue gas desulfurization. Lime powder is prepared into slurry (i.e. lime reacts with water to form calcium hydroxide) as absorber. Desulfurization performance is automatically controlled via adjustment of pH value and slurry concentration by automatic control system. The external oxidation fan blows evenly distributed oxidation air into slurry in the reaction tank at the bottom of absorption tower and the stirrer continuously mixes content in the tank to facilitate transformation of sulfite into gypsum. Gypsum slurry produced in the absorption tower is pumped out by gypsum pump and concentrated through the primary and secondary hydrocyclones to form gypsum cakes containing < 10% moisture, which is then sent to gypsum storehouse by transfer belt.

The ash storage chamber and gypsum storehouse satisfy the requirements set out by the *Standard for Pollution Control on the Storage and Disposal Site for General Industrial Solid Wastes* (GB18599-2001). Their ground floor is laid in cement (with geomembrane inside), and the thickness of impermeable layer is equivalent to the impermeability of clay layer with permeability coefficient of 1.0 × 10^{-7} cm/s and 1.5-m thickness. Drainage is constructed around these facilities. Necessary rain-proof measures are also taken on temporary storage sites to prevent leaching of solid waste leachate, so as to eliminate impacts of solid waste leachate on the aqua-environment.

Ash, slag and desulfurization gypsum belongs to general waste. The project has signed contract with Jinxiang Baimaoxin Construction and Installation Engineering Co. Ltd. to sell all the ash and gypsum as raw material for cement production. The total ash, slag and gypsum generated by the project amounts to 10,519 ton/year; based on a price of RMB 6.0 yuan/ton,

they can create RMB 63,114 yuan each year.

5.5.5 Occupational Health and Safety

Compared with conditions in general industrial enterprises, the operation of this project involves lower temperature and pressure, a high degree of automation, and a quite safer operating system. In the normal course of production and operation, this project has a relative high safety level. The project operator is expected to take proper measures to protect employees' occupational health and safety of workers, including:

(1) Operation phase EHS plan will be developed and implemented and workers will be trained regularly on their implementation;

(2) The EHS plan will be aligned with relevant government regulations and guidelines on COVID-19 prevention and control, or with international good practice guidelines as updated in the future[3]. The plan shall be reviewed by I&G in consultation with local public health inspectors, local medical officers, or other relevant health specialists, with a recommendation forwarded to the subborrower for clearance. The plan will include COVID-19 prevention and control measures, including disinfection/cleaning of offices, and operation sites, on-site temperature checks, social distancing measures, mandatory use of personal protective equipment such as facemasks, provision of handwashing stations and hand sanitizers etc., and procedures to be adopted in the event any staff/worker is infected with COVID-19.

(3) Provide personal protective equipment (PPE) to the employees based on their job responsibilities and circumstances;

(4) Regularly check the heating supply system and repair defects in time;

(5) A Technical Safety Division is set up in the plant headquarter to take charge of safety education, safety supervision and safety performance evaluation for the whole plant. One safety supervisor is assigned to monitoring boiler operation and one to electricity operation to inspect safety performance of the plant.

(6) Comply with provisions on vocational health, safety and safe production in related laws of the People's Republic of China.

5.5.6 Abnormal Operating Conditions

The main environmental impact of this project is brought by air pollutants emitted in the

[3] See e.g.: World Health Organization. 2020. Considerations for public health and social measures in the workplace in the context of COVID-19. Geneva. Available at: https://www.who.int/publications-detail/considerations-for-public-health-and-social-measures-in-the-workplace-in-the-context-of-covid-19. HM Government. 2020. Working safely during COVID-19 in construction and other outdoor work. Guidance for employers, employees and the self-employed. Available at: https://assets.publishing.service.gov.uk/media/5eb961bfe90e070834b6675f/working-safely-during-covid-19-construction-outdoors-110520.pdf. The Canadian Construction Association–COVID-19 Standard Protocols. Available here: https://www.cca-acc.com/wp-content/uploads/2020/04/CCA-COVID-19-Standardized-Protocols-for-All-Canadian-Construction-Sites-04-16-20.pdf

boiler flue gas. Should any failure occur in desulfurization, denitration and dust removal device, non-compliance in air pollutant emissions would appear. With the help of estimation model, it is anticipated that under abnormal operating conditions, the pollutant emission concentrations would be very high and exceed the emission limits to varied extent. However, no sensitive receivers such as residential area are located within the outreach of maximum ground level concentrations of air pollutants. As the maximum pollutant concentrations in downwind direction of flue gas emission surpass limits in Level II standards of the Ambient Air Quality Standards (GB3095-2012), once the abnormal operating conditions occur, air quality in sensitive receivers' locations in project adjacent area will be affected. During the project operation, there should be strengthened maintenance and management of environmental protection facilities to avoid occurrence of abnormal operating conditions to the maximum extent. In case of any such occurrence, efforts should be made to minimize the duration of abnormal operating conditions.

The Elion Jinxiang Subcompany has developed the Emergency response plan for environmental emergencies (Appendix 1) and established a relatively sound emergency response mechanism.

6 Alternatives Analysis

All the project alternatives are usually compared during feasibility study phase, with the purposes to minimize adverse environmental impacts and improve environmental benefits based on satisfaction of environmental standards. Common selective factors include: (1) energy efficiency; (2) emission reduction rate; (3) land use; (4) impacts on goals for environmental protection; and (5) resettlement etc. In addition, “absence of this project” is often analyzed as an alternative.

6.1 No Project Alternative

No Project Alternative aims to identify the potential impacts when this project has never been implemented. At present, a quantity of enterprises has settled in JFIP. These businesses have continuous and stable production and thus maintain stable heat load, with thermal energy primarily used for heating and drying. However, development of regional steam provision capacity cannot catch up with the pace of steam demand growth, and steam supply is unable to satisfy the soaring demand for heat load. In absence of this project, all industrial enterprises would have to build self-operated small-scale boilers for steam supply. Such self-built small boilers usually have lower combustion efficiency and higher pollution emissions, which is not conducive to improvement of regional environmental quality. In addition, decentralized storage and transportation of fuel coal and ash/slag by enterprises will bring negative impacts to local area as well. On the basis of strictly verifying current heat load for production in each and every industrial enterprise and giving due consideration to their short-term development plan, this project performs centralized steam supply to JFIP. Such centralized steam supply will raise coal use efficiency, reduce pollutant discharge, and improve regional environmental quality. The project is in favor of facilitating local investment, boosting regional economic development and safeguarding public health. Therefore, “Absence of This Project” is not a reasonable option.

6.2 Project location

This project is located in the planned area for steam supply which belongs to industrial land. The site selection is in conformity of provisions in JFIP planning and land use plan. Jinxiang Municipal Urban Planning Bureau issued “Opinions on Planned Site of Centralized Heat/Steam Supply Project in Jinxiang Circular Economy Demonstration Park of Shandong Province”. In addition, the site selection has incorporated full consideration of steam demand of both existing enterprises and newly settled businesses in JFIP as well as the range of heat-supply service. The project location is reasonable. It is beneficial to energy conservation and guarantees the safe and reliable operation of steam supply system.

6.3 Fuel/Energy Alternatives

Multiple fuels or energy sources can be used to generate heat or as source for indirect heating, including: natural gas, solar power, wind power, geothermal power, biomass, coal and so on.

6.3.1 Natural gas

Natural gas is a clean, environmentally friendly, and high-quality energy source that contains almost no sulfur, dust, and other harmful substances. It produces less carbon dioxide than other fossil fuels when burning, reduces emissions of sulfur dioxide and dust by nearly 100%, reduces carbon dioxide emissions by 60% and nitrogen Oxygen emissions by 50%, all of which help lessen the formation of acid rain and mitigate global warming. China's natural gas reserves are mainly distributed in the basins in Central and Western China. At present, demand for natural gas in China is increasing year by year. However, the general quality of natural gas reserves is not satisfactory and the resource use is often affected by geographic factors. At the same time, the cost of fuel natural gas is higher than that of fuel coal. Thus, natural gas is not suitable to be the fuel for centralized steam supply in JFIP.

6.3.2 Solar power

Solar power is the most critical basic energy source among various renewable energies and the most abundant energy available to human beings. The energy embedded in solar radiation striking the earth surface annually is up to 1.05×10^{18} kWh (3.78×10^{24} J), equivalent to 1.3×10^{6} billion tons of standard coal. China has a vast land territory and the majority of the territory lies in mid-latitude zone, with a large solar elevation angle. The annual radiation amount ranges from 80 kcal/cm^2 to 220 kcal/cm^2.

Currently, solar power is generally applied in two ways: electricity generation and water heating. The solar water heater is only good for domestic water use. Solar power heating still suffers from disadvantages of low efficiency, high price and large area requirement. As this project supplies steam to industrial enterprises in JFIP, there are certain requirements on steam temperature and pressure. Therefore, solar heating solution does not apply to this project.

6.3.3 Wind power

Wind power is the use of air flow through wind turbines to generate energy in various forms such as electricity, thermal energy and mechanical energy for the purposes of power generation, water lifting, navigation assistance, cooling and heating, etc. Wind power volume depends on wind speed and air density. China lies on the verge of the Pacific Ocean, with strong monsoon and a coastal line stretching more than 18,000 km, and multiple mountain

ranges inland change the distribution of air pressure, all of which fosters widely distributed wind power resources. The first step of wind power heating requires the conversion of wind power into electricity, which has relatively higher costs. In addition, wind power output fluctuations will render the continuous reliable heating impotent. Therefore, additional backup heating sources such as coal, natural gas or electricity storage system are needed if wind power is used as fuel, which substantially reduce the economic efficiency.

6.3.4 Geothermal Power

Most of the geothermal power comes from the renewable heat in the depths of the earth, which starts from the earth's molten magma and the decay of radioactive material. A small portion of the geothermal power comes from the sun, accounting for about 5% of the total geothermal energy; and the surface geothermal energy is primarily originated from the sun. The deep groundwater cycle and invasion of magma at significant depth into the earth crust brings heat from deep underground to near-surface. The use of geothermal energy has great geographical constraints and requires available geothermal resources in project adjacent areas. However, no available geothermal energy source has been observed in project surroundings.

6.3.5 Biomass

Biomass energy refers to the chemical energy that plant chlorophyll converts from solar power and then stores in the biomass. The current technology for bio-energy use includes thermochemical conversion of solid biomass into flammable gases and tar; biochemical conversion of biomass into biogas and alcohol through microorganism fermentation; and physical conversion of biomass into high-density solid fuel through densification molding technology. Biomass energy mainly consist of agricultural residual, forest production and processing waste, industrial wastewater, municipal solid waste, etc.

However, current practice of applying biomass energy to heating or power generation has the following problems: (1) absence of systematic framework for raw biomass collection and energy production; (2) excessive investment costs; (3) higher fuel costs than coal; and (4) sources of raw materials are subject to seasonal restrictions. Thus, biomass energy is not a feasible option for fuel.

6.3.6 Coal

The project uses coal produced in Shenmu County of Shaanxi Province as the main fuel. Shenmu area in Shaanxi Province is a coal accumulation center of in Shenfu Jurassic coalfield. The coal reserve has an area of over 4,500 km^2, accounting for 60% of the county's total area, with the proven reserve exceeding 50 billion tons. The coal seam has a simple geological structure and stable storage. The coal deposit is shallow and easy to be mined.

With excellent quality, extra-low ash content, extra-low phosphorus content, extra-low sulfur content, and high calorific value, Shenmu coal belongs to high volatile weak caking or non-caking long flame coal, which is environmentally friendly. At present, Shenmu County has 13 key state-owned coal mines, 8 local state-owned coal mines, and 128 township coal mines. The fuel supply is sufficient to support long-term stable operation of boilers of the project.

6.4 Boiler Alternatives

6.4.1 Grate-fired Boiler

Grate firing refers to the combustion of fuel staying fixed on grates, also known as fixed-bed combustion method. It has features of slow combustion and clearly phased combustion process. Given these combustion features, regular grate-fired boiler has the following characteristics: (1) Poor adaptability to coal type. Grate-fired boiler is only suitable for combusting high volatile bituminous coal with caloric value over 4,000 kcal. (2) Low combustion efficiency. There is huge heat loss due to incomplete combustion in the furnace, in particular the combustion of low-quality coal, resulting in high carbon content in slag and energy waste. (3) Low heat transfer performance in furnace. The heat transfer mainly relies on simple radiation and thus boiler's thermal efficiency is quite low, merely reaching 75% on average. (4) The gaps between grates and large coal feed hopper lead to severe coal leakage and air leak. (5) Heavy structure. The structure causes large steel consumption and easy failure in grate movement, which will cause damages and even destroy the motor.

6.4.2 Circulating Fluidized Bed Boiler

Circulating fluidized bed boiler is an efficient, low polluting and clean combustion technology developing over the past decade. It boasts of such advantages as high combustion efficiency, large adaptability to coal types, low concentrations of harmful components in flue gas, wide load adjustment range, comprehensive use of ash and slag, etc. This technology has been developing rapidly in China and the world given the growing energy shortage and environmental protection requirements.

Due to the strong circulation disturbance inside the gas-solid bed in the circulating bed, the heat and mass transfer processes in the furnace are strengthened. As a result, the fresh fuel particles are heated to the furnace temperature (≈ 850 ℃) as soon as they enter into the furnace. Combustion and heat transfer at the furnace height can be carried out at a constant temperature, thus extending the combustion time. The fuel is circulated back to the furnace through separator for several times, prolonging the residence and reaction time of the fuel particles and reducing heat loss from incomplete combustion. The circulating fluidized bed boiler can achieve combustion efficiency of 88% up to 95%, which is quite close to that of

pulverized coal-fired boiler. Because of its unique combustion method, circulating fluidized bed boiler has the following advantages that differentiate it from other boilers:

(1) Circulating fluidized bed boiler can accommodate to a wide range of fuels, for instance various types of coal, including low volatile, low calorific value, conventional inferior fuels and even some special low quality fuels.

(2) Circulating fluidized bed boiler has little requirement on fuel preparation. Fuel prepared by a simple single-stage crusher will meet the design requirement for furnace use. In the existence of centralized coal feeding device, a 100 t/h boiler only needs one coal feed point to maintain operation. Such feature is in favor of the future capacity enlargement of boiler unit.

(3) The combustion process is stable. Due to high temperature of original fuels on bed, the thorough mixture of gas and solid and that of fuel particles on the bed, as well as the relatively low share of new fuels in total fuels on bed (less than 5%), there are no obvious changes of furnace temperature.

(4) Circulating fluidized bed boiler boasts of high combustion efficiency. Recovery and separation of fuel particles guarantees continuous combustion of fuel. For large particle size fuel, the sufficient residence time in furnace ensures combustion effect. Therefore, the carbon content in slag is low.

(5) Adjustment of operating parameters can ensure stable combustion under different operating load and conditions.

However, problems exist in circulating fluidized bed boiler’s actual operation. High combustion efficiency can only be achieved as long as the coal in use and operating parameters conform to the boiler design. At present, changes of fuel coal type highly frequently take place in real operation of circulating fluidized bed boilers, and operation under designed conditions is hard to realize. The operation cannot give timely response when the fuel coal is different from design coal, and the operating parameters cannot be identified and adjusted accordingly. Therefore, it is difficult to maintain stable and safe boiler operation and directly leads to the lessened thermal efficiency and increased power consumption of the boiler system.

6.4.3 Micro-fine Coal Atomization Boiler

Micro-fine Coal Atomization boiler is built on the German technology for superfine pulverized coal combustion and introduces vortex technology in aviation sector into the operation. The prepared micro-fine pulverized coal is efficiently atomized for multiple times and fully mixed with air for combustion. Micro-fine Coal Atomization operation has the advantages of low emission, low coal consumption, high thermal efficiency, and high cost-effective performance, known as “two lows and two highs” advantages, thus is widely

acknowledged in the market and among users. At present, Elion's Micro-fine Coal Atomization technology application projects have been implemented in many provinces and municipality including Shandong, Hebei, Tianjin, Jiangsu, Jiangxi, and Zhejiang, and the corresponding technology is relative mature.

Micro-fine Coal Atomization boiler boasts of the following advantages:

(1) Centralized supply of pulverized coal is used, i.e. coal is pulverized in centralized mills and then distributed to the boilers, which guarantees the stable quality of fuel coal.

(2) Micro-fine Coal Atomization boiler creates a friendly working environment. The boiler is operating in a fully-enclosed system in which coal is automatically fed in, fly ash is discharged in a centralize way, and no fly ash is leaked.

(3) The boiler can be started and shut down easily. Immediate start and shutoff of boiler system is achieved, i.e. 30-second ignition will initiate boiler operation and cut off coal supply will lead to boiler shutoff at once.

(4) Boiler system is under high level monitoring. Automatic monitoring and adjustment of operating parameters maintains the best operating conditions, and at the same time reduce labor intensity and human impacts on boiler operation.

(5) Micro-fine Coal Atomization boiler has a high efficiency and excellent energy saving performance, with full combustion of pulverized coal, good heat exchange result, small coefficient of excess air, and high thermal efficiency. Large power consuming equipment is connected with frequency converters and remarkable energy conservation results are achieved.

(6) The boiler system contributes to land saving. As there is neither coal-bunker bay nor slag site beside boiler, reduction in land use area and investment is achieved.

(7) The main fans use energy-efficient technologies (e.g. selecting variable moving blade axial flow fan as blower and stationary blade adjustable axial flow fan as draft fan) to save energy.

(8) Distribution of pipelines for flue gas, air blow and pulverized coal is optimized to reduce local resistance loss and conserve power.

In general, by comparing processes of three common coal-fired boilers and with proper consideration of local steam demand and heat load scale, it is concluded that Micro-fine Coal Atomization boiler is a reasonable option for the project.

6.5 Desulfurization Alternatives

At present, there are dozens of flue gas desulphurization (FGD) technologies. FGD can be achieved by three major types of processes, including wet FGD process, semi-dry FGD process and dry FGD process, the differences among which are the water input in desulfurization process and the form of desulfurization product. Wet FGD technology is

relatively mature, with high efficiency and simple operation.

6.5.1 Magnesium Oxide FGD Process

Magnesium oxide FGD process is also known as magnesia FGD slurry process, which employs magnesia slurry (magnesium hydroxide) as absorbent to scrub sulfur dioxide in the flue gas and generate magnesium sulfite and magnesium sulfate. These sulfates will be dehydrated, dried, and then calcined. A small amount of coke is added in the calcining furnace to reduce magnesium sulfate and the sulfates and sulfites decompose into high-concentration sulfur dioxide and magnesium oxide. Magnesium oxide turns into magnesium hydroxide after reaction with water and is reused in the system as absorbent. High-concentration sulfur dioxide can be used to produce sulfuric acid or sulfur. At present, technology for Magnesium oxide FGD process has become mature and been applied to large-scale industrial installations. Corresponding desulfurization rate exceeds 90%.

Magnesium oxide FGD process is a desulfurization process which is secondary only to calcium-based FGD process in terms of technical maturity. It is widely used worldwide, with more than 100 projects in Japan, application in 95% of power plants in Chinese Taiwan, and application cases in the United States and Germany. The magnesia reserve in China is remarkable and the current proven reserve amounts to 16 billion tons, taking up to around 80% of the world's total reserve. The magnesia resources are distributed in Liaoning, Shandong, Sichuan and Hebei provinces. Therefore, magnesium oxide can definitely be used as a desulfurizer in the FGD system.

6.5.2 Double-alkali Scrubbing Process

Double-alkali scrubbing process uses sodium-based scrubbing reagent in the absorption tower to remove sulfur dioxide in the flue gas. As sodium-based scrubbing reagent is strong, the solution formed after scrubbing sulfur dioxide has high solubility and will not create supersaturated crystallization to block the facility. Desulfurization products are discharged into regeneration tank to react with calcium hydroxide and regenerate the sodium-based scrubbing reagent which is sent back to the scrubbing tower for reuse. Double-alkali scrubbing process reduces investment and operation costs, which is more suitable for desulfurization renovation in medium and small-sized boilers.

6.5.3 Limestone-gypsum FGD Process

Limestone-gypsum wet FGD process is the most technically mature and extensively applied conventional flue gas desulfurization process at present. It has a spectrum of advantages, including high desulfurization efficiency, mature technology and reliable operation, rich sources of desulfurization agents, low price, and high utilization rate. According to the *Notice on Issuing the Technical Policy on Pollution Prevention and Control of*

Thermal Power Plant (Ministry of Environmental Protection Announcement No. 1 of 2017) and the *Guideline on Available Technologies of Pollution Prevention and Control for Thermal Power Plant* (Draft for Comments), wet FGD process which uses limestone slurry to scrub SO_2 and form gypsum is the best available technology to cope with all coal types and achieve ultra-low SO_2 emission.

Table 6-1 Comparison of Common Wet FGD Processes

No.	Item	Limestone-gypsum FGD Process	Magnesium Oxide FGD Process	Double-alkali Scrubbing Process
1	Requirements for absorbent	Lime powder (purity ≥ 80%, and 90% should be 200 mesh powder)	Magnesia powder (purity ≥ 85%, and 90% should be 200 mesh powder)	Lime powder (purity ≥ 80%, and 90% should be 200 mesh powder) Soda ash (purity ≥ 90%)
2	Advantages	(1) Cheap absorbent (2) Mature technology and easiest and most reliable operation (3) Desulfurization efficiency > 90% (4) Byproduct (gypsum) can be used as cement additive (5) Stable operation (6) Easy to use (7) Low operation costs	(1) Advanced and mature technology, reliable equipment, high cost-effectiveness, excellent desulfurization results, and remarkable economic benefits from magnesium sulfate heptahydrate recovery (2) Desulfurization efficiency > 90% (3) Mature process and reliable operation (4) Recovered byproduct can be used to produce magnesium sulfate heptahydrate as fertilizer additives, reducing secondary pollution and generating economic benefits (5) Much smaller amount of slag than other processes and easy follow-up operation	(1) Mature technology and reliable operation (2) Use of sodium based alkali as desulfurization agent creates better reaction environment in the desulfurization tower than that of limestone-gypsum FGD process (3) Desulfurization efficiency > 90%
3	Disadvantages	High quality requirement for byproduct (gypsum) as cement additive	The one-time investment is slightly higher than those of double-alkali scrubbing process and limestone-gypsum FGD process	Water content in byproduct is high and actual operation requires large quantity of sodium based alkali replenishment, causing excessive operation costs

The above comparison shows that limestone-gypsum FGD process has such features as mature technology, stable operation, high desulfurization efficiency, high degree of byproduct

utilization, and low one-time investment, facilitating its wide use in China. Therefore, the project's selection of limestone-gypsum wet FGD system is reasonable and feasible.

6.6 Dust Removal Alternatives

Fly ash generated from pulverized coal combustion enters into the rear part of the boiler with flue gas, and then is removed by various dust removal collectors to a maximum extent. Based on their operating principles, dust collectors can be divided into dry dust collector, wet dust collector, electrostatic precipitator and bag filter.

6.6.1 Electrostatic Precipitator

Electrostatic precipitator (ESP) uses high-voltage electric field to trigger ionization in flue gas to separate dust with induced electrostatic charge from the airflow. Four inter-related physical processes are involved in applying electrical power to capture dust in flue gas in ESP: (1) ionization of flue gas, (2) electrostatic charge of dust particle, (3) movement of charged dust particles toward electrode, and (4) charged dust collection. ESP's dust removal efficiency is influenced by multiple factors such as temperature and flow rate of the flue gas, ESP's working condition, and space between dust collection plates.

Compared with other dust collectors, ESP has lower energy consumption and high dust removal efficiency for removing dust particles of 0.01 – 50μm in size. It can be applied to high temperature and pressure flue gas. Practice shows that the greater the amount flue gas treated, the more cost-effective the ESP investment and operation becomes.

The main advantages of ESP include:

(1) ESP has high dust removal efficiency, with capability of capturing superfine particulate with a diameter greater than 0.01 μm. The desired dust removal efficiency can be achieved through selection of different operating parameters in design.

(2) ESP has small pressure drop which is usually below 20 mmWc. Compared with cyclone dust collector, its total power consumption is relatively small even with power consumption of the power supply unit and rapper unit being considered.

(3) ESP has a high acceptable operating temperature. For instance, the SHWB model can be operated at a maximum acceptable temperature of 250 ^{o}C, and other models can accept temperature ranging 350 – 400 ^{o}C or even higher.

(4) ESP is capable of treating a wide range of air volume fully under automatic control.

ESP has the following major disadvantages:

(1) ESP has complicated structure which imposes higher requirements on equipment transfer, installation, maintenance and management.

(2) ESP has certain requirements to dust resistivity. Therefore, ESP is selective and unable to guarantee high dust removal efficiency on all types of dust.

(3) ESP is susceptible to operating conditions such as gas temperature and operating temperature. Treatment of same type of dust particles will generate different results under different operating temperature and humidity.

(4) ESP needs large one-time investment, and horizontal ESP takes up a large area.

(5) ESP's practical performance in some enterprises cannot achieve the designed performance.

6.6.2 Bag Filter

Bag filter is a type of dry dust collector. It is suitable for capturing small, dry, and non-fibrous dust. The filter bag is made of textile cloth or non-woven felt to use the filtering effect of fiber fabric to handle dust-laden gas. When the dust-laden gas enters the bag filter, large and heavy particulates will settle and fall into hopper due to gravity effect; and the finer dust-contained gas will be cleaned when passing through filter materials which will block the fine dust.

Bag filter's high dust removal efficiency is firmly related to its dust removal mechanism. The dust-laden gas goes into the inlet duct in the lower part of the dust collector and is directed by the baffle plate to the hopper where coarse dust will settle due to collision with baffle plate and gas velocity decrease. The remaining fine dust particles flow with gas into the filtration chamber where the dust and ash is blocked due to inertia, diffusion, blockage, capture, and electrostatic effect of the filter fabric. The cleaned gas flows out of the chamber and is discharged via outlet duct. Accumulated dust on the filter bag is removed by reverse blowing approach and then falls into hopper to be further emitted through double rotary valves to the discharge device. Bag filter's high dust removal efficiency is also attributed to the filter materials whose performance is directly linked with bag filter's overall performance and operation life. Bag filter has the following advantages:

(1) High dust removal efficiency, which generally surpasses 99%, and relatively higher sorting performance on superfine dust with submicron particle size.

(2) A wide range of gas treating capacity.

(3) Simple structure and easy maintenance.

(4) Lower cost than the electrostatic precipitator with same dust removal efficiency.

(5) Ability to operate at 200 ℃ when high temperature resistance filter materials such as glass fiber and PTFE are used.

(6) Insensitive to dust characteristics and free of impacts from dust and resistance.

In summary, analysis of dust removal efficiency, operational stability, investment and equipment space shows that bag filer is better than the electrostatic precipitator. This project's selection of bag filter is reasonable.

7 Information disclosure and public consultation

7.1 Information disclosure

Information disclosure involves delivering information about a proposed project to the general public and to affected communities and other stakeholders, beginning early in the project cycle and continuing throughout the life of the project. Information disclosure is intended to facilitate constructive engagement with affected communities and stakeholders over the life of the project. It can directly reflect the public's perceptions of environmental quality in the project's area of influence

Elion Jinxiang Subcompany has undertaken public consultation and information disclosure in 2015 in accordance with the *Regulations on the Administration of Construction Project Environmental Protection* (1998), *Interim Guidelines on Public Consultation for EIA* (2006) and *Note on Enhance of Supervision and Management* of *Public Consultation for EIA of Construction Project* (2012, No. 138, Shandong EPB). The Information disclosure methods were questionnaire distribution, information posted at bulletin board, leaflet distribution and information disclosed on websites.

The project's information will be disclosed by the following methods;

(1) Domestic EIA was disclosed on the Jinxiang EPB's website;

(2) This IEE will be disclosed on the ADB website (www.adb.org);

(3) Copies of domestic EIA will be provided as required;

(4) All environmental monitoring reports will be disclosed on the ADB website (www.adb.org).

7.2 PRC and ADB Requirements for Public Consultation

7.2.1 PRC Requirements

Relevant provisions in the PRC *Environmental Impact Assessment Law* (2015) and the *Regulations on the Administration of Construction Project Environmental Protection* (No. 253 Order of the State Council, 1998), *Interim Guidelines on Public Consultation for EIA* (2006) and *Technical guideline for environmental impact assessment of construction project General Programme* (HJ 2.1-2016) require that for an environmental Category A project, full EIA reports are required including two rounds of public consultations.

7.2.2 ADB Requirements

ADB's SPS has specific requirements for information disclosure and public consultation. Information disclosure involves delivering information about a proposed project to the general public and to affected communities and other stakeholders, beginning early in the project cycle and continuing throughout the life of the project. Information disclosure is intended to

facilitate constructive engagement with affected communities and stakeholders over the life of the project.

The SPS also requires that the borrower carry out consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation.

7.3 Public consultation of the project

7.3.1 Information disclosure on website

(1) First information disclosure

The first information disclosure was undertaken from May 15, 2015 to May 25, 2015. The information included project name, project content, name and contact information of construction companies, name and contact information of EIA Institute, EIA procedures and content, type of EIA notification notice and request for questions, suggestions and feedback from the public.

(2) Second information disclosure

The second information disclosure was undertaken from June 5, 2015 to June 15, 2015. The information included

a) Project introduction;
b) Potential environmental impacts;
c) Mitigation measures;
d) Key conclusions of the EIA report;
e) Method to get questions, suggestions and feedback from the public; and
f) Contact information to get abridged versions of the EIA report.

7.3.2 Questionnaire survey

Questionnaire survey was undertaken in May 18, 2015. A total of 109 questionnaires was distributed and 109 completed questionnaires were received, a recovery rate of 100%. Table 7-1 presents summary information on the questionnaire respondents.

Table 7-1 Summary data on questionnaire respondents

Parameter		No.	Percentage (%)
Age	18-34	39	35.8
	35-55	58	53.2
	Above 55	12	11.0
Education level	Below primary school	3	2.8
	Primary school	35	32.1
	Middle school	56	51.4
	Technical secondary school or above	15	13.8
Occupation	Farmer	73	67.0
	Worker	25	22.9
	Other	11	10.1

The summary data indicated that the respondents covered a range of ages, education levels and occupation. The respondents were surroundings residents and workers from surrounding enterprises and can reflect the public attitude to the project.

Public consultation questionnaire results were presented in Table 7-2.

Table 7-2 Public consultation questionnaire results

Question	Item	No.	Percentage (%)	Dominant alternative
1. Do you know this project before this survey?	Yes	96	88	√
	No	13	12	
2. In your opinion, how is ambient environmental quality near project area?	Good	76	70	
	Slightly polluted	33	30	√
	Relatively high	0	0	
	Seriously polluted	0	0	
3. In your opinion, how is ambient air quality in the project area?	Good	44	40	
	Slightly polluted	65	60	√
	Relatively high	0	0	
	Seriously polluted	0	0	
4. In your opinion, how is surface water quality in the project's surrounding area?	Good	83	76	√
	Slightly polluted	26	24	
	Relatively high	0	0	
	Seriously polluted	0	0	
5. In your opinion, how is ground water quality in the project's surrounding area?	Good	44	40	√
	Slightly polluted	65	60	
	Relatively high	0	0	
	Seriously polluted	0	0	
6. In your opinion, how is acoustic environment quality in the project's surrounding area?	Excellent	96	88	√
	Good	7	6	
	Ordinary	7	6	
	Poor	0	0	
7. Based on mitigation measures on noise, do you accept the projects' impacts to acoustic environment?	Yes	102	94	√
	No	0	0	
	No opinion	7	6	
8. Based on mitigation measures on exhaust gas, do you accept the projects' impacts to ambient air?	Yes	89	82	√
	No	0	0	
	No opinion	20	18	
9. Based on mitigation measures on wastewater, do you accept the projects' impacts to surface water?	Yes	102	94	√
	No	0	0	
	No opinion	7	6	
10. Based on mitigation measures on groundwater, do you accept the projects' impacts to ground water?	Yes	109	100	√
	No	0	0	
	No opinion	0	0	
11. Based on mitigation measures on solid waste, do you accept the projects' impacts to environment by solid waste?	Yes	109	100	√
	No	0	0	
	No opinion	0	0	
12. Do you think risk control measures of the project are feasible?	Yes	109	100	√
	No	0	0	
	Uncertain	0	0	
13. Do you accept the project's impacts to ecology environment?	Yes	109	100	√
	No	0	0	
	No opinion	0	3	
14. Do you think the project's	Yes	102	94	√

Question	Item	No.	Percentage (%)	Dominant alternative
mitigation measures can reduce the impacts to environment?	No	0	0	
	Uncertain	7	6	
15. What are the major environmental concerns of this subproject in your opinion?	Air pollution	109	100	
	Water pollution	0	0	√
	Noise pollution	0	0	
	Others	0	0	
16. Do you accept the project's location?	Yes	109	100	√
	No	0	0	
	Barely accept	0	0	
17. After comprehensive analysis about advantages and disadvantages of this project, do you agree with the construction of this project?	Yes	109	100	√
	No	0	0	
	No opinion	0	0	

The questionnaire survey results are summarized below:

(1) 88% of respondents indicated that they knew the project before the public consultation which means public had a good understanding of the project;

(2) 40% of respondents indicated that they thought the ambient air quality was slightly polluted;

(3) 76% of respondents indicated that they thought the surface water quality was good while 24% thought it was slightly polluted;

(4) 94% of respondents indicated that they thought the acoustic environment was good while 6% thought it was slightly polluted;

(5) The top environment issues respondents identified are air pollution (100%);

(6) 100% of respondents indicated that they support the proposed project. Overall support for the project is very strong.

7.4 Public consultation meeting

Based on requirements from Environment and Social Management System (ESMS) and ADB SPS 2009, the project should undertake public consultation meeting.

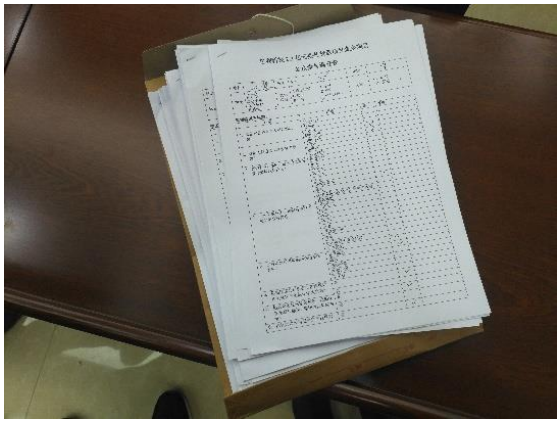
With the assistance of ADB's environment specialist, public consultation meeting was undertaken at Elion Jinxiang Subcompany's meeting room by Elion Jinxiang Subcompany on November 2, 2017. 31 participants were invited to attend this meeting. During the meeting information was presented about the project information including project content, project status, potential environmental impacts, environmental risk control measures and proposed mitigation measures by the staff from Elion Jinxiang Subcompany. The following process was question & answer process and no question or suggestion from public was received.

At last, participants were asked to complete a questionnaire and a sample of completed questionnaire and participants list were presented in Figure 7-1. A total of 31 completed questionnaires were received. Table 7-2 presents summary data on the questionnaire respondents while Table 7-3 presents a summary of the questionnaire results

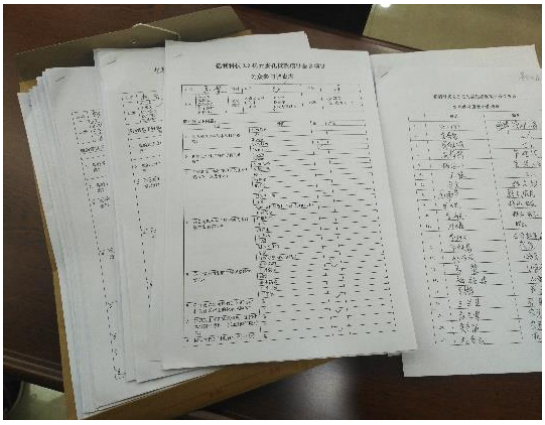
74.2% of the respondents worked within a 3 km radius of the project while 25.8% lived within a 3 km radius of the project. Before this public consultation, 96.8% of respondents knew about project before this public consultation meeting. The top concerned environment issues were ambient air (54.8%), solid waste (22.6%), ground water (16.1%), noise (9.7%), soil (5.6%), surface water (6.5%), odor (3.2%) and risk by chemicals and hazardous chemicals (3.2%). The top environment issues of the operation of Elion Jinxiang Subcompany identified by respondents were ambient air (67.7%), others (12.9%), soil (6.5%), risk to community health and safety (6.5%), noise (3.2%), surface water (3.2%), ground water (3.2%) and solid waste (3.2%). 93.5% of respondents indicated that they were satisfied or very satisfied with the environment protection measures of Elion Jinxiang Subcompany. 77.4% of respondents knew that production process of Elion Jinxiang Subcompany can result in chemical risk and 87.17% of respondents knew how to respond to emergency. 96.8% of respondents indicated that they accepted the impacts to surroundings environment and residents by production process of Elion Jinxiang Subcompany. The top critical areas that the project should focus on were exhaust air efficiency treatment (66.7%), make use of recyclable resources to reduce solid waste (22.6%), control fugitive emission (12.9%), protection for community health and safety (9.7%), ground water protection (9.7%), soil protection (6.5%), wastewater treatment (3.2%) and protection to workers health and safety (3.2%). Before this public consultation, 3.2% of respondents didn't understand the project. After this public consultation, 9.7% of respondents didn't understand negative and positive environmental impacts of the project and 6.5% of respondents indicated that they didn't understand anticipated adverse health and safety impacts of the project during operation phase. 93.5% of respondents indicated that they understood anticipated adverse health and safety impacts of the project during operation. 87.1% of respondents indicated that they understood the proposed mitigation measures during the project operation. 87% of respondents accepted or barely accepted the impacts to ambient air quality; 90.3% of respondents accepted or barely accepted the impacts to ecology environment by this project. 87.1% of respondents accepted or barely accepted the impacts to surface water by the project; 93.5% of respondents accepted or barely accepted the impacts to ground water by the project, 93.6% of respondents accepted or barely accepted the impacts to acoustic environment by the project and 87.1% of respondents accepted or barely accepted the impacts to community health and safety by the project. The top three concerns of this project identified by the respondents were ambient air (90.3%), groundwater (9.7%) and solid waste (9.7%). 93.5% of respondents

indicated that they support the proposed project.

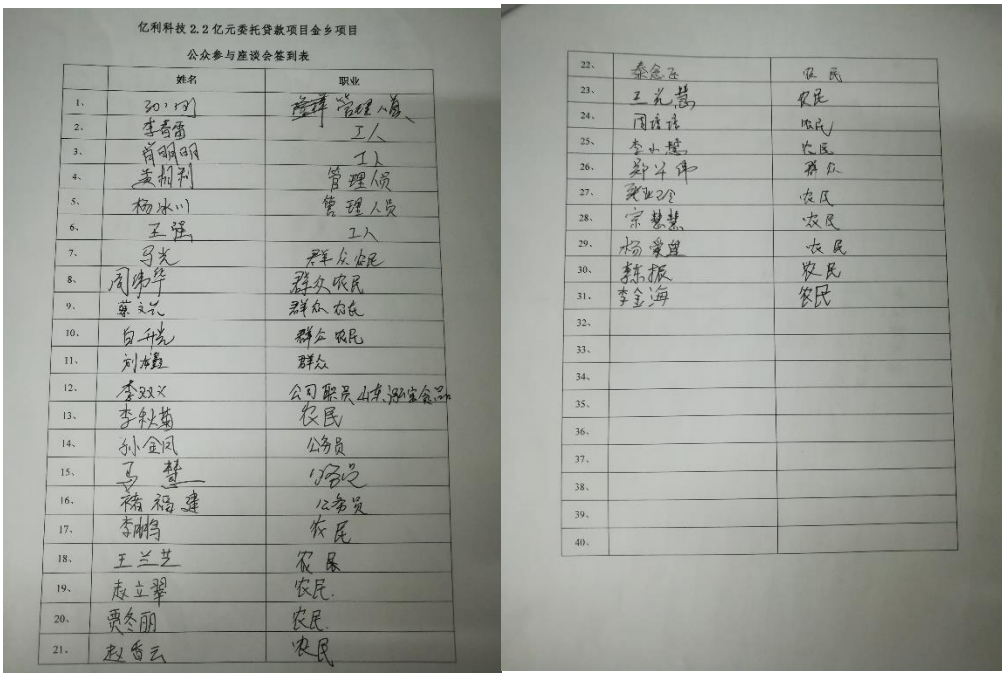
Public consultation photographs



Sample of completed questionnaire



All completed questionnaires



亿利科技 2.2 亿元委托贷款项目金乡项目

公众参与座谈会签到表

	姓名	职业
1、	刘	管理人员
2、	李香雷	工人
3、	肖明明	工人
4、	姜桐利	管理人员
5、	杨水川	管理人员
6、	王强	工人
7、	马光	群众农民
8、	周伟华	群众农民
9、	董文兴	群众 农民
10、	白千龙	群众 农民
11、	刘海霞	群众
12、	李双义	公司聚氨酯泡沫
13、	李秋菊	农民
14、	孙金凤	公务员
15、	马慧	公务员
16、	褚福建	公务员
17、	李娜	农民
18、	王兰芝	农民
19、	赵立翠	农民
20、	贾冬丽	农民
21、	赵香云	农民

22、	秦念正	农民
23、	王光慧	农民
24、	国建强	农民
25、	李小慧	农民
26、	郭华伟	群众
27、	就业办	农民
28、	宋慧慧	农民
29、	杨豪超	农民
30、	韩振	农民
31、	李金海	农民
32、		
33、		
34、		
35、		
36、		
37、		
38、		
39、		
40、		

Sign in table

Figure 7-1 Public consultation photographs, questionnaire and sign in table

Table 7-1 Public consultation questionnaire

Public consultation questionnaire of Elion entrusted loan project					
Name		Sex	A. Male B. Female	Age	
Occupation	A. worker B. farmer C.civil servants D. Self-employed entrepreneurs E. Other ( )	Education level	A. Never attend any school B. Primary school C. Junior school D. High school E. Technical secondary school F. Junior college or above	Nationality	A. Han B. Other ( )

Please answer the following questions			
Question	**Answer**	**Yes**	**Comments**
1. Distance between your living place and project site	<1 km		
	1-3 km		
	3-5 km		
	> 5km		
2. Distance between your working place and project site	<1 km		
	1-3 km		
	3-5 km		
	> 5km		
3. In your opinion, what are the major environment pollution issues in your areas?	Ambient air		
	Noise		
	Surface water		
	Ground water		
	Soil		
	Solid waste		
	Odor		
	Risks associated with chemicals and hazardous chemicals		
	Other concern		
4. Which are the impacts to surrounding environment by Elion Jinxiang Subcompany during existing production process?	Ambient air		
	Noise		
	Surface water		
	Ground water		
	Soil		
	Solid waste		
	Odor		
	Risks to community health and safety		
	Other concern		
5. Are you satisfied with environment protection measures of Elion Jinxiang Subcompany?	Very satisfied		
	Satisfied		
	Barely satisfied		
	Very disappointed		
	Do not understand		
6. Are you aware of chemical risks to the community associated with existing process of Elion Jinxiang Subcompany?	Yes		
	No		
7. If any emergency, such as chemical spill, leaks, and explosion, occurs, do you know how to respond?	Yes		
	No		

8. Do you consider the impacts of existing production process of Elion Jinxiang Subcompany to surrounding environment and your lifestyle are acceptable?	Yes		
	No		
	I do not know		
9. Before the survey, did you hear about the proposed subproject components by of Elion Jinxiang Subcompany?	Yes		
	No		
10. Before the survey, did you understand environmental impacts associated with the proposed subproject components by of Elion Jinxiang Subcompany?	Understand		
	Barely understand		
	Do not understand		
11. After knowing about the EIA findings, is it clear to you all the potential positive and adverse impacts of the proposed subproject components by of Elion Jinxiang Subcompany?	Clearly understand		
	Somewhat understand		
	Barely understand		
	Do not understand		
12. In your opinion, what should be the most critical area that the subproject should focus on?	Exhaust air efficiency treatment		
	Controlling fugitive emissions		
	Wastewater treatment		
	Groundwater protection		
	Soil protection		
	Chemicals handling		
	Odor control		
	Make use of recyclable resources to reduce solid waste		
	Noise disturbing to residents		
	Protection for community health and safety		
	Protection to workers health and safety		
	Others		
13. Do you understand all the anticipated environmental adverse impacts of the subproject during operation?	Clearly understand		
	Somewhat understand		
	Barely understand		
	Do not understand		
14. Do you understand all the anticipated health and safety adverse impacts of the project during operation?	Clearly understand		
	Somewhat understand		
	Barely understand		
	Do not understand		
15. Do you understand the proposed mitigation measures during the project operation?	Clearly understand		
	Somewhat understand		
	Barely understand		
	Do not understand		
16. Do you accept the impacts to ambient air quality by this project?	Accept		
	Barely accept		
	Do not accept		
	Have no idea		

17. Do you accept the impacts to surface water quality by this project?	Accept		
	Barely accept		
	Do not accept		
	Have no idea		
18. Do you accept the impacts to ground water quality by this project?	Accept		
	Barely accept		
	Do not accept		
	Have no idea		
19. Do you accept the impacts to acoustic environment quality by this project?	Accept		
	Barely accept		
	Do not accept		
	Have no idea		
20. Do you accept the impacts to solid waste pollution by this project?	Accept		
	Barely accept		
	Do not accept		
	Have no idea		
21. Do you accept the impacts to ecology environment by this project?	Accept		
	Barely accept		
	Do not accept		
	Have no idea		
22. Do you accept the impacts to environment, health and safety by this project?	Accept		
	Barely accept		
	Do not accept		
	Have no idea		
23. What are the major concerns of this subproject	Ambient air		
	Noise		
	Surface water		
	Ground water		
	Soil		
	Solid waste		
	Odor		
	Risks associated with chemicals and hazardous chemicals		
	Other concern		
24. Which is your top concern of this subproject?	Ambient air		
	Noise		
	Surface water		
	Ground water		
	Soil		
	Solid waste		
	Odor		
	Risks associated with chemicals and hazardous chemicals		
	Other concern		
25. Do you support the project?	Yes		
	No		
	I do not know		

Table 7-2 Summary data on questionnaire respondents

Parameter	**Indicator**	**No.**	**%**
Sex	Male	21	67.7
	Female	10	32.3
Age	Below 30	13	42
	31-40	9	29
	Above 40	9	29

Nationality	Han people	31	100
	Other	0	0
Education level	Never attend any school	3	9.7
	Primary school	8	25.8
	Junior school	5	16.1
	High school	15	48.4
	Technical secondary school	6	19.3
	Junior college or above	19	61.3
Occupation	Worker	2	6.5
	Farmer	0	0
	Civil servants	4	12.9
	Self-employed entrepreneurs	21	67.7
	Others	10	32.3

Table 7-3 Public consultation questionnaire results

Question	Answer	No.	Percentage (%)
1. Distance between your living place and project site	<1 km	5	16.1
	1-3 km	15	16.1
	3-5 km	6	19.3
	> 5km	5	16.1
2. Distance between your working place and project site	<1 km	15	16.1
	1-3 km	5	16.1
	3-5 km	6	19.3
	> 5km	5	16.1
3. In your opinion, what are the major environment pollution issues in your areas?	Ambient air	17	54.8
	Noise	3	9.7
	Surface water	2	6.5
	Ground water	5	16.1
	Soil	0	0
	Solid waste	7	22.6
	Odor	1	3.2
	Risks associated with chemicals and hazardous chemicals	1	3.2
	Other concern	0	0
4. Which are the impacts to surrounding environment by Elion Jinxiang Subcompany during existing production process?	Ambient air	21	67.7
	Noise	1	3.2
	Surface water	1	3.2
	Ground water	1	3.2
	Soil	0	0
	Solid waste	1	3.2
	Odor	0	0.0
	Risks to community health and safety	2	6.5
	Other concern	4	12.9
5. Are you satisfied with environment protection measures of Elion Jinxiang Subcompany?	Very satisfied	23	74.2
	Satisfied	6	19.3
	Barely satisfied	2	6.5
	Very disappointed	0	0.0
	Do not understand	0	0.0
6. Are you aware of chemical risks to the community associated with existing process of Elion Jinxiang Subcompany?	Yes	24	77.4
	No	7	22.6
7. If any emergency, such as chemical spill, leaks, and explosion, occurs, do you know how to	Yes	27	87.1
	No	4	12.9

respond?			
8. Do you consider the impacts of existing production process of Elion Jinxiang Subcompany to surrounding environment and your lifestyle are acceptable?	Yes	30	96.8
	No	1	3.2
	I do not know	0	0.0
9. Before the survey, did you hear about the proposed subproject components by of Elion Jinxiang Subcompany?	Yes	30	96.8
	No	1	3.2
10. Before the survey, did you understand environmental impacts associated with the proposed subproject components by of Elion Jinxiang Subcompany?	Understand	17	54.8
	Barely understand	12	38.7
	Do not understand	2	6.5
11. After knowing about the EIA findings, is it clear to you all the potential positive and adverse impacts of the proposed subproject components by of [name of subproject plant]?	Clearly understand	15	48.4
	Somewhat understand	11	35.5
	Barely understand	2	6.5
	Do not understand	3	9.7
12. In your opinion, what should be the most critical area that the subproject should focus on?	Exhaust air efficiency treatment	21	67.7
	Controlling fugitive emissions	4	12.9
	Wastewater treatment	1	3.2
	Groundwater protection	3	9.7
	Soil protection	2	6.5
	Chemicals handling	0	0
	Odor control	0	0
	Make use of recyclable resources to reduce solid waste	7	22.6
	Noise disturbing to residents	0	0
	Protection for community health and safety	3	9.7
	Protection to workers health and safety	1	3.2
	Others	1	3.2
13. Do you understand all the anticipated environmental adverse impacts of the subproject during operation?	Clearly understand	15	48.4
	Somewhat understand	8	25.8
	Barely understand	6	19.3
	Do not understand	2	6.5
14. Do you understand all the anticipated health and safety adverse impacts of the project during operation?	Clearly understand	16	51.6
	Somewhat understand	8	25.8
	Barely understand	5	16.1
	Do not understand	2	6.5
15. Do you understand the proposed mitigation measures during the project operation?	Clearly understand	17	54.8
	Somewhat understand	5	16.1
	Barely understand	5	16.1
	Do not understand	4	12.9
16. Do you accept the impacts to ambient air quality by this project?	Accept	21	67.7
	Barely accept	6	19.3
	Do not accept	3	9.7
	Have no idea	1	3.2
17. Do you accept the impacts to surface water quality by this project?	Accept	21	67.8
	Barely accept	6	19.3
	Do not accept	4	12.9
	Have no idea	0	0.0
18. Do you accept the impacts to ground water	Accept	25	80.6

quality by this project?	Barely accept	4	12.9
	Do not accept	2	6.5
	Have no idea	0	0.0
19. Do you accept the impacts to acoustic environment quality by this project?	Accept	27	87.1
	Barely accept	2	6.5
	Do not accept	2	6.5
	Have no idea	0	0.0
20. Do you accept the impacts to solid waste pollution by this project?	Accept	26	83.9
	Barely accept	2	6.5
	Do not accept	2	6.5
	Have no idea	1	3.2
21. Do you accept the impacts to ecology environment by this project?	Accept	27	87.1
	Barely accept	1	3.2
	Do not accept	3	9.7
	Have no idea	0	0
22. Do you accept the impacts to environment, health and safety by this project?	Accept	25	80.6
	Barely accept	2	6.5
	Do not accept	4	12.9
	Have no idea	0	0.0
23. What are the major concerns of this subproject	Ambient air	28	90.3
	Noise	0	0
	Surface water	1	3.2
	Ground water	3	9.7
	Soil	0	0
	Solid waste	0	0
	Odor	0	0
	Risks associated with chemicals and hazardous chemicals	0	0
	Other concern	0	0
24. Which is your top concern of this subproject?	Ambient air	25	80.6
	Noise	1	3.2
	Surface water	1	3.2
	Ground water	3	9.7
	Soil	2	6.5
	Solid waste	3	9.7
	Odor	0	0
	Risks associated with chemicals and hazardous chemicals	0	0
	Other concern	1	3.2
25. Do you support the subproject?	Yes	29	93.5
	No	0	0.0
	I do not know	2	6.5

7.5 Future Consultation Activities

The subborrower will continue to undertake public consultation activities and conduct regular community liaison activities during the operations phase as needed. Ongoing consultation will ensure that public concerns are understood and dealt with in a timely manner. During operation phase, if complain is received or unexpected adverse environmental impacts occurs, the subborrower will undertake public consultation activities by questionnaire survey, household interview, seminar and public consultation meeting.

8 Grievance redress mechanism

8.1 Introduction

A Project grievance can be defined as an actual or perceived Project related problem that gives ground for complaint by an affected person (AP). As a general policy, the subborrower will work proactively toward preventing grievances through the implementation of impact mitigation measures and community liaison activities that anticipate and address potential issues before they become grievances. In addition, as the Project has strong public support and will not involve any involuntary land or property acquisition or resettlement, significant grievance are unlikely. Nonetheless, during construction and operation it is possible that unanticipated impacts may occur if the mitigation measures are not properly implemented, or unforeseen issues arise.

In order to address complaints if or when they arise, a Project grievance redress mechanism (GRM) has been developed in accordance with ADB requirements and Government practices. A GRM is a systematic process for receiving, recording, evaluating and addressing AP's Project-related grievances transparently and in a reasonable period of time.

The ADB's SPS requires the subborrower to establish a GRM to receive and facilitate resolution of affected person's concerns and complaints about the project's environmental performance during construction as well as operation phase of the project. The GRM should be scaled to the risks and adverse impacts of the project; should address affected people's concerns and complaints promptly, using an understandable and transparent process; should be readily accessible to all sections of the community at no cost and without retribution; and, should not impede access to the PRC's judicial or administrative remedies.

8.2 Current Practice in the PRC

At the national level a framework to address grievance has been established. State Council Decree No. 431 "Regulations on Letters and Visits" (January 2005) codifies a complaint mechanism at all levels of government, and safeguards the complainants from any retaliation. The Ministry of Environmental Protection (MEP) "Decree No. 34 Environmental Letters and Visits System" provides specific guidelines to establish a system and address environmental complaints.

Currently, when APs are negatively affected by project activities, such as noise, dust or safety issues caused by construction activities, they may complain to the contractors and the project IA by themselves or through their community organizations, or complain directly to local EPBs. If the issue is not resolved they may take legal action, though that is typically considered as a last option.

8.3 Proposed Project GRM

The overall approach of the GRM is to deal with grievances at a local level first in an efficient manner, and escalate to higher level of authority if the grievance cannot be resolved. The construction phase of the project has already completed and no complain was received. Public grievances will most likely relate to environmental issues encountered during operation phase. If complain is received during operation phase, EHS department of Elion Jinxiang Subcompany will identify if the complain is reasonable. Reasonable complain means: (1) the complain is associated with the project; and (2) the complain can be addressed through the GRM. Unreasonable compliance means: (1) the complain is obviously not associated with the project; (2) the complain can not be addressed through the GRM; and (3) the complain is better to be addressed through process of other company or community. If the compliance is rejected, reason and conclusion for rejection will provided to the complainer.

8.4 GRM process

The GRM will be implemented through five escalating steps which is presented in Figure 8-1, advancing to the next level only if the grievance was unable to be redressed at the previous level：

(1) Step 1: If a concern arises, the AP should try to resolve the issue of concern directly with the EHS department of the subborrower (Elion Jinxiang Subcompany) via GRM access points. If the concern is resolved successfully no further follow-up action is required. Nonetheless, EHS department shall record any complaint and actions taken to resolve the issues. If no solution is found within 10 working days or if the complainant is not satisfied with the suggested solution under Step 1, proceed to Step 2. The AP may also skip step 1 and directly file the complaint with the subborrower;

(2) Step 2: The AP will submit the grievance to the subborrower, who will record the grievance, assess its eligibility and report back to the AP within 5 working days. If the grievance is eligible, proceed to step 3;

(3) Step 3: The subborrower will investigate the complaint, and consult with the local EPB and other stakeholders as appropriate to identify a solution. The subborrower. will give a clear reply to the AP within 10 working days with the suggested solution, and the subborrower will ensure that implementation of the agreed-upon redress solution begins within 10 working days. If no solution is found or if the complainant is not satisfied with the suggested solution under Step 3, proceed to Step 4;

(4) Step 4: The subborrower will inform the EA as to the grievance, and will organize a multi-stakeholder meeting within 10 days, where all relevant stakeholders, including the complainant, the EA, subborrower and local EPB, can discuss the issue. The

multi-stakeholder meeting will aim to find a solution acceptable to all, and identify responsibilities and an action plan. The subborrower will ensure that the implementation of agreed-upon redress solution begins within 10 working days of the completion of the multi-stakeholder meeting;

(5) Step 5: If the complainant is not satisfied with the suggested solution under Step 4, the grievance will be directed to ADB. ADB will direct the EA to organize a hearing process and shall determine a solution acceptable to all. Based on the hearing results, an action plan shall be developed and the subborrower will ensure that the implementation of the agreed-upon redress solution begins within 10 working days of the completion of the hearing.

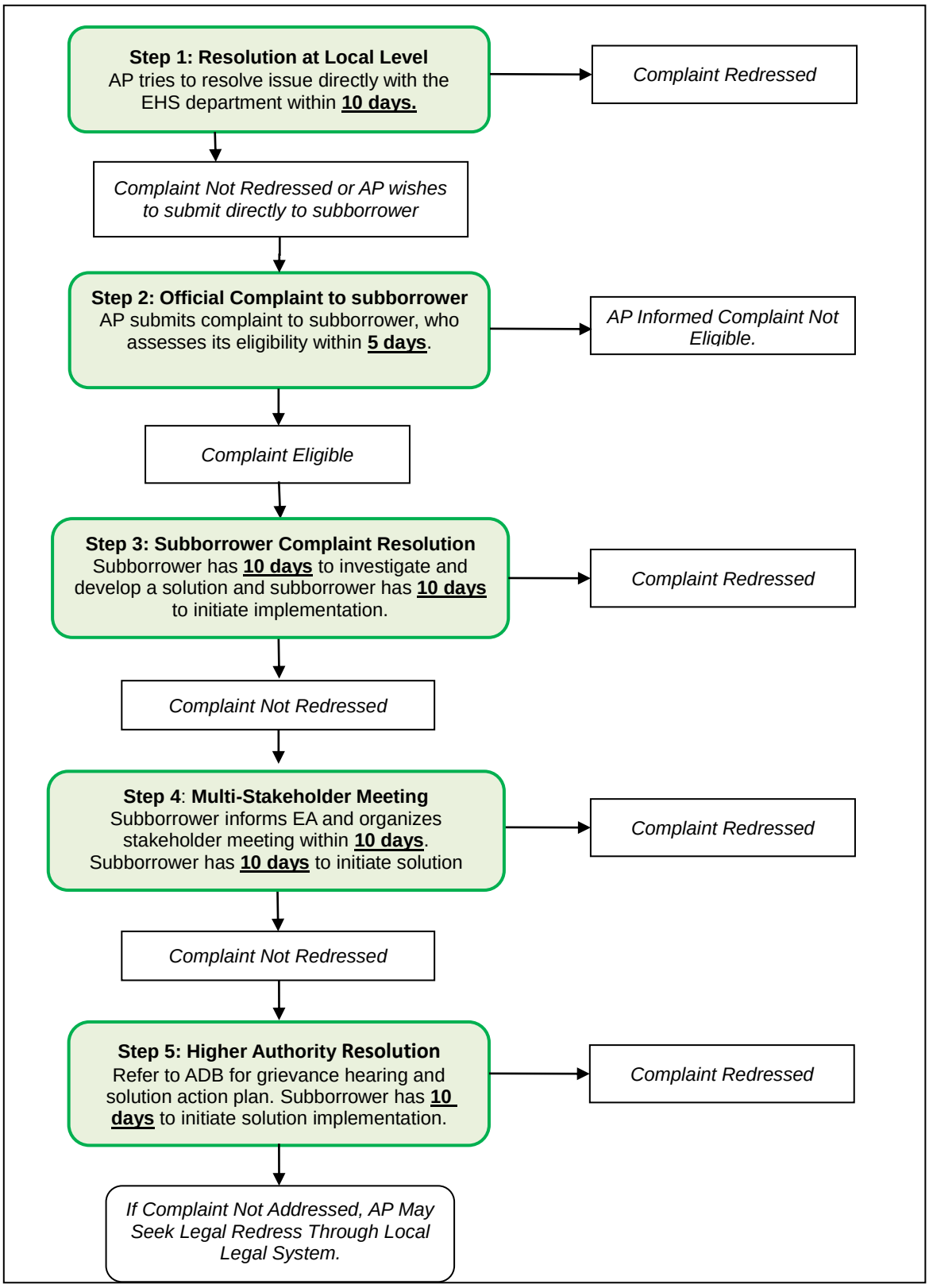

Step 1: Resolution at Local Level
AP tries to resolve issue directly with the EHS department within 10 days.
Complaint Redressed
Complaint Not Redressed or AP wishes to submit directly to subborrower
Step 2: Official Complaint to subborrower
AP submits complaint to subborrower, who assesses its eligibility within 5 days.
AP Informed Complaint Not Eligible.
Complaint Eligible
Step 3: Subborrower Complaint Resolution
Subborrower has 10 days to investigate and develop a solution and subborrower has 10 days to initiate implementation.
Complaint Redressed
Complaint Not Redressed
Step 4: Multi-Stakeholder Meeting
Subborrower informs EA and organizes stakeholder meeting within 10 days.
Subborrower has 10 days to initiate solution
Complaint Redressed
Complaint Not Redressed
Step 5: Higher Authority Resolution
Refer to ADB for grievance hearing and solution action plan. Subborrower has 10 days to initiate solution implementation.
Complaint Redressed
If Complaint Not Addressed, AP May Seek Legal Redress Through Local Legal System.

Figure 8-1: Five Step Subproject GRM.

The grievance procedures will remain valid throughout the duration of the project construction and until project closure. If a concern arises, the AP can provide feedback to resolve the issue and complaints/grievances lodged by the AP is free of charge. Any cost incurred should be covered by the subborrower.

9 Environment Management Plan（EMP）

9.1 Objectives

This is the Environmental Management Plan (EMP) for the proposed Jinxiang 2x35t/h Micro-fine Coal Atomization Steam Supply Subproject. The Project will provide district steam supply to the enterprises in JFIP. The objectives of the EMP are to ensure (i) implementation of identified mitigation and management measures to avoid, reduce, mitigate, and compensate for anticipated adverse environment impacts; (ii) implementation of monitoring and reporting; and (iii) the Project compliance with the PRC's relevant environmental laws, standards and regulations and ADB's SPS 2009. Organizational responsibilities and budgets are clearly identified for execution, monitoring and reporting.

9.1.1 Implementation Arrangements

I&G will be the EA. The EA will form an ESMS Department including an ESMS manager.

Elion Jinxiang Subcompany is the subborrower with one EHS department consists of one manager and two staff. The subborrower is responsible for: (1) pollutants emission monitoring; (2) implementation of capacity building plan; (3) incorporation of environment management, environmental monitoring and mitigation measures into EMP during operation phase, (4) regularly report to EA on EMP implementation; and (5) efficiently response to emergency.

Jinxiang EPB is responsible for: (1) project is compliance with relevant environment regulations; (2) supervision of project pollutants emission; and (3) GRM implementation. Jinxiang EPB also participates in environment compliance monitoring of the project.

ADB will conduct regular review mission to provide environmental due diligence on environmental issues. I&G will prepare environmental monitoring reports semi-annually and submit them to ADB. ADB will review the reports and disclose them on ADB's website. If the project is incompliance with the EMP's requirements,

appropriate corrective actions will be provided by ADB and following actions will be implemented as required by ADB.

The roles and responsibilities of the participating agencies related to EMP implementation are presented in Table 9-1.

Table 9-1 Roles and responsibilities of the agencies for EMP implementation

Organization	Role and Responsibility
I&G	Will serve as the EA and establish an ESMS department with qualified full time staff. ESMS department is responsible for the implementation of all subprojects, including: ➢ Formulating subproject management and operating procedures, implementation plans, and budget; ➢ Ensuring subproject's compliance with loan and project agreements, and with the safeguards requirements as specified in the ESMS; ➢ Participant in capacity building and training activities; ➢ Overseeing the implementation of different subproject outputs; ➢ Monitoring the subproject's physical and financial progress, and compliance with subproject's reporting requirements, ensuring subproject progress reports are prepared and submitted to ADB on time; ➢ Addressing complaints received from APs; ➢ Coordinating the activities of and meeting the requirements of the ADB review missions; ➢ Supervision implementation of EMP and EMoP; ➢ Conducting regular site visits and safeguard review missions in accordance with the requirements set forth in the ESMS; ➢ Preparing and submitting consolidated semi-annual and annual environmental monitoring reports as required by the ESMS to ADB; ➢ Requiring subborrowers to prepare corrective action plans in the event of noncompliance with EMP or EMoP.
Subborrower	Main responsibilities include: ➢ Contracting and administering contractors and suppliers. ➢ Ensuring compliance with EMP, EMoP, engaging external environmental safeguard consultants if needed; ➢ Preparing subproject progress reports for submission to the ESMS department of I&G; ➢ Operation and maintenance of the subproject; ➢ Coordinating with and assisting the PMO in developing subproject management procedures and detailed implementation plan, and monitoring achievement thereof; ➢ Preparing semi-annual and annual environmental monitoring reports and submit to ESMS department of I&G.
Environmental	A qualified independent environmental monitoring company will be recruited to

Organization	Role and Responsibility
Monitoring Company	implement the ambient monitoring portion of the EMoP.
ADB	Responsible for the following: ➢ -Providing the EA and ESMS department with guidance to ensure smooth subproject implementation and achieve the desired development impacts and their sustainability; ➢ -Conducting regular review missions; ➢ -Monitoring the implementation of EMP and EMoP; ➢ -Monitoring status of compliance with loan and project covenants, including safeguards; ➢ -Reviewing environmental monitoring reports and disclosing them on ADB website; ➢ -Regularly updating the subproject information documents for public disclosure at ADB website, including the safeguards documents. ➢ -Requiring EA to develop corrective action plan for any non-compliance issues.

9.1.2 Institutional Strengthening and capacity building

The institutional strengthening and capacity building focus on the safeguards requirements of relevant PRC laws and regulations and ADB's SPS 2009. Institutional strengthening and training program are presented in Table 9-2 including developed EHS plan, training topic, training content, budget and numbers of participants.

Table 9-2 Institutional strengthening and training program

Training Topic	Trainers	Attendees	Contents	Times	Days	# Persons	Budget (USD)	Funding sources
Operation Phase EHS Plan Training	Consultant	Subborrower	**ADB and PRC laws, regulations and policies** ➢ ADB's safeguard policy statement ➢ Project applicable PRC environmental, health and safety laws, policies, standards and regulations ➢ International EHS management practice **GRM** ➢ GRM structure, responsibilities, and timeframe ➢ Types of grievances and eligibility assessment **Implementation of Operation Phase EMP** ➢ Impacts and mitigation measures ➢ Monitoring and reporting requirements ➢ Non-compliance and corrective actions	1	2	20	**Training Development** Fixed costs: $2000 per **EHS Plan Training Course Development** (fees and per diem) 2days x $400/day = $800 **Course Delivery** (fees and per diem): 2 days x 400/day = $800 Total = $ 3,600	Counterpart Financing
	Total			1	2	20	$ 3,600	

9.2 Potential Impacts and mitigation measures

The potential impacts of the project during operation phase have been identified and appropriate mitigation measures developed (see Chapter V of the IEE). Detailed impacts and mitigation measures are presented in Table 9-3.

9.3 Environmental monitoring plan

An environment monitoring plan (EMoP) to monitor the environmental impacts of the Project and assess the effectiveness of mitigation measures is presented in Table 9-4. The EMoP includes noise, wastewater and flue gas monitoring undertaken during operation phase. The environmental monitoring will follow PRC's regulation, laws and technical specifications.

The data and results of environmental compliance inspection and monitoring activities will be used to assess: (1) the extent and severity of actual environmental impacts against the predicted impacts and baseline data collected before the project implementation; (2) performance or effectiveness of environmental mitigation measures or compliance with pertinent environmental rules and regulations; (3) trends in impacts; (4) overall effectiveness of EMP implementation; and (5) the need for additional mitigation measures and corrective actions if non-compliance is observed.

Table 9-3 Environmental impacts and mitigation measures

Item	Potential impacts	Mitigation measures	Responsibility		Funding sources
			Implemented by	Supervised by	
Exhaust gas	Boiler flue gas	➢ Proper operation and maintenance of desulphurization, denitration and dust removal equipment ➢ Installation of online monitoring equipment which is connected to local EPB	Subborrower	EA, Jinxiang EPB, ADB	Operational budget
	Dust-laden exhaust gas in ash storage room	➢ Water spray during coal transportation, load and unload process for dust control ➢ Ash and slag transportation in sealed trucks ➢ Water spray in ash and slag storage rooms for dust control ➢ Regular monitoring of fugitive flue gas emission	Subborrower	EA, Jinxiang EPB, ADB	Operational budget
Noise	Impacts to sensitive area by noise from fan, air compressor and pump	➢ Installation of noise enclosure, barrier or shield to reduce noise; ➢ Reasonable landscape inside and outside the project site to reduce noise; ➢ Appropriate noise PPE will be provided to the workers who are likely to be exposed to high noise level environments; ➢ Install silencer on air vents of boiler and fan and noise enclosure on equipment to reduce noise; ➢ Conduct noise monitoring if needed and implement extra noise control measures such as noise barrier.	Subborrower	EA, Jinxiang EPB, ADB	Operational budget
Solid waste	Unreasonable treatment of coal slag may result in soil and	➢ All ash and slag will be temporally stored at the project site, then sold to local construction material enterprises as material; ➢ Permanent storage of ash and slag at project site is	Subborrower	EA, Jinxiang EPB, ADB	Operational budget

Item	Potential impacts	Mitigation measures	Responsibility		Funding sources
			Implemented by	Supervised by	
	water pollution	prohibited.			
Wastewater	Emission of production wastewater and domestic wastewater	➢ Wastewater will be recycled as much as possible after treatment; ➢ Domestic wastewater is recycled as landscape water after treated by septic tank; ➢ Wastewater from the desulfurization system is used for humidifying ash storage chamber; ➢ Concentrated water produced by the chemical water system is unpolluted wastewater, part of which will be used in desulfurization system and the rest will be discharged into municipal drainage network after neutralization and sedimentation; ➢ The boiler effluent is unpolluted wastewater and will be discharged into municipal storm water sewer after neutralization and sedimentation; ➢ Effluent from water recycling system is unpolluted wastewater and will be used for spraying to control dust in project site.	Subborrower	EA, Jinxiang EPB, ADB	Operational budget
Occupational Health and Safety	Risks to Workers	➢ Project operation phase occupational health and safety plans including fire prevention and control will be developed and implemented, and workers will be trained regularly on their implementation. ➢ The EHS plan will be aligned with relevant government	Subborrower	EA, Jinxiang EPB, ADB	Operational budget

Item	Potential impacts	Mitigation measures	Responsibility		Funding sources
			Implemented by	Supervised by	
		regulations and guidelines on COVID-19 prevention and control, or with international good practice guidelines as updated in the future (footnote 3). The plan will include COVID-19 prevention and control measures, including disinfection/cleaning of offices and operation sites, on-site temperature checks, social distancing measures, mandatory use of personal protective equipment such as facemasks, provision of handwashing stations and hand sanitizers etc., and procedures to be adopted in the event any worker/staff is infected with COVID-19; ➢ The project will be designed in strict compliance with relevant PRC fire, health and safety standards; ➢ Fire-alarm and suppression systems will be installed and tested regularly to ensure it functions properly; ➢ PPE, including goggles, gloves, safety shoes, will be provided to workers; ➢ Authorized personnel must have appropriate PPE at all times.			
Emergency	Emergency Response Plan	Project emergency response plans will be established in accordance with the “National Environmental Emergency Plan” (24 January 2006) and other relevant PRC laws, regulations and standards. The plan must be established and in place before the plant is operational. Indicative plan requirements are as follows:	Subborrower	EA, Jinxiang EPB, ADB	Operational budget

Item	Potential impacts	Mitigation measures	Responsibility		Funding sources
			Implemented by	Supervised by	
		➢ Procedures for responding to different types of emergency situations will be identified in the response plan. ➢ Emergency exercises will be conducted and they should include different emergency scenarios. **Training Requirements** Appropriate operating and maintenance employees will be trained to ensure that they are knowledgeable of the requirements of emergency response plan. Training will be provided as follows: ➢ Initial training to all employees before the project is put in operation; ➢ When new equipment, materials, or processes are introduced. ➢ When emergency response procedures have been updated or revised. **Annual Emergency Simulation** Simulated emergency exercises will be conducted at least annually. **Communication with Public Officials** When an emergency resulting in a hazard to the public safety occurs, the local fire department, police, the city medical emergency center and other relevant public officials should be notified. An emergency call list will be prepared and make it available at the project site.			

Table 9-4 Environmental monitoring plan

Item	**Parameter**	**Location**	**Frequency**	Implemented by	Supervised by	Funding sources
Boiler flue gas	SO_2, NOx and PM	Boiler chimney	Online continuous monitoring	3rd party environment monitoring company	EA	Operational budget
Dust-laden exhaust gas of ash and slag storage room	Fugitive emission of TSP and PM_{10}	Site boundaries	Semi-annual	3rd party environment monitoring company	EA	Operational budget
Noise at the site boundaries	Noise monitoring at the site boundaries	Site boundaries	Semi-annual	3rd party environment monitoring company	EA	Operational budget
Wastewater	Compliance inspection of wastewater treatment measures	Wastewater emission point	Semi-annual	3rd party environment monitoring company	EA	Operational budget
Occupational health and safety	Compliance inspection of development and implementation of EHS plan	Project operation site	Semi-annual	Subborrower	EA	Operational budget

9.4 Reporting requirements

The subborrower will submit annual EMP implementation reports during operation phase to the EA on the implementation and compliance with the EMP. EA will review the reports and submit them to ADB. All the reports will be disclosed on ADB's website.

The environmental reporting requirements are summarized in Table 9-5.

Table 9-5 Reporting Requirements

Report	Prepared by	Submitted to	Frequency
Environmental monitoring reports	Subborrower	EA reviews and submits to ADB	Annually

9.5 Performance indicators

Performance indicators (Table 9-6) have been developed to assess the implementation of the EMP. These indicators will be used to evaluate the effectiveness of environmental management.

Table 9-6 Performance Indicators

No.	Description	Indicators
1	Staffing	1) 3rd party environmental monitoring entity engaged
2	Budgeting	1) Environment mitigation cost during operation is sufficiently and timely allocated. 2) Environment monitoring cost is sufficiently and timely allocated. 3) Budget for capacity building is sufficiently and timely allocated.
3	Monitoring	1) Compliance monitoring is conducted by I&G as per EMP and EMoP. 2) Operation phase ambient and effluent monitoring is conducted by 3rd party environmental monitoring entity.
4	Supervision	1) I&G reviews the implementation of EMP; 2) ADB reviews consolidated environmental monitoring reports.
5	Reporting	1) Annual EMP implementation reports during operation phase are prepared by the subborrower are submitted to I&G; 2) Annual environmental monitoring reports are prepared by I&G and submitted to ADB
6	Capacity Building	1) Training on ADB safeguard policy, EMP implementation, and GRM is provided during project implementation

No.	Description	Indicators
7	Grievance Redress Mechanism	1) GRM contact persons are designated at all subborrowers and I&G, and GRM contact information disclosed to the public before construction 2) All complains are recorded and processed within the set time framework in the GRM of this IE
8	Compliance with PRC standards	1) Subproject complies with the PRC's environmental laws and regulations and meets all required standards.

9.6 Feedback and adjustment mechanism

The effectiveness of mitigation measures and monitoring plans will be evaluated through a feedback reporting system. If, during compliance inspections and monitoring, substantial deviation from the EMP is observed, then the EA will consult with the subborrower and propose appropriate changes to the EMP monitoring and mitigation plan.

Any major EMP adjustments will be subject to ADB review and approval and ADB may pursue additional EIA and, if necessary, further public consultation. The revised EIA with ADB confirmation is subject to reposting on the ADB's website as the ADB public communications policy requires.

10 Conclusions

10.1 Project benefit

The project will provide district steam supply to enterprises in JFIP to instead of small coal-fired boilers owned by the enterprises. To mitigate environmental impacts, the project will use Micro-fine Coal Atomization technology to increase combustion efficiency of boilers, then coal consumption of will be reduces compared to traditional coal fired boilers. The project's implementation will: (i) significantly reduce heat cost; (ii) reduce coal consumption and pollutants emission; and (iii) improve air quality in JFIP.

When compared to the equivalent production of heat through traditional coal-fired boilers, once operational the project will: (i) result in annual energy savings equivalent to 41,743 tons of standard coal, thereby providing a global public good by avoiding the annual emission of 104,065 tons of carbon dioxide (CO_2), a greenhouse gas; (ii) improve local air quality through the estimated annual reduction of emissions of sulfur dioxide (SO_2) by 178.42 tons, nitrogen oxides (NO_x) by 47.95 tons, and particulate matter (PM) by 24.69 tons; and (iii) eliminate the negative impacts of coal transportation through urban areas by truck.

10.2 Negative impacts and mitigation measures

Potential negative environmental impacts during operation phase include flue gas, waste water, noise and solid waste. The flue gas includes flue gas of boilers and dust-laden flue gas and is treated by dust removal, desulfurization and denitrogen measures before emission and can meet relevant standards. The report undertakes atmospheric dispersion modeling for SO_2, PM_{10}, TSP, ammonia and NOx using SCREEN3, a US EPA approved screening mode to estimate the effects to ambient air quality of the project. Based on the modeling result, the project will have very limited effects to the ambient air quality. The wastewater of the project includes boiler effluent, chemical water facilities drainage, wastewater from desulfurization process, sewage from equipment circulating cooling process, as well as domestic sewage will be

treated by different methods according to wastewater quality. Most of the treated wastewater will be recycled or reused and only few will be discharged to municipal sewer. Solid waste of the project is ash, slag and desulfurization gypsum which is 100% sold out.

Based on the information collected by the domestic EIA Institute and domestic EIA report and environmental due diligence, the project is comply with requirements of PRC laws and regulations and standard and the project's impacts during operation phase is acceptable.

10.3 Risk and guarantee

Micro-fine Coal Atomization technology used by the project is a proven technique with a lot of operation practices in many domestic cities. Thus the project will have no technical risk. Desulfurization, denitrogen and dust removal technology used by the project is also proven techniques which are wildly used in the domestic and overseas. But the project still has some risks associated with incorrect implementation of mitigation measures and environment monitoring during operation phase. Therefore, the following measures will be implemented to control the risks: (1) Budget for EMP implementation and environment monitoring will be sufficiently and timely allocated; (2) ADB will conduct regular review missions; and (3) Guarantee terms will be incorporated in loan agreement.

10.4 Overall conclusion

Based on the domestic EIA report and environmental due diligence, the project has identified potential negative environment impacts and appropriately established mitigation measures. If mitigation measures are well implemented and monitored, identified environmental impacts of the project can be reduced to an acceptable level. The project is environmentally feasible. The project will use advanced Micro-fine Coal

Overall, Micro-fine Coal Atomization technology is used in the project to achieve district steam to the JFIP. The project's implementation will improve air quality in JFIP and bring environmental and economic benefits to local development.

Appendix I Emergency response plan for environmental emergencies (cover pages)

预案编号：　　版本号：

亿利洁能科技（金乡）有限公司
突发环境事件应急预案

编制单位：亿利洁能科技（金乡）有限公司

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编制日期：2016 年 12 月 1 日

企业名称（盖章）：亿利洁能科技（金乡）有限公司

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各部门、岗位及人员：

为确保厂区财产和员工生命安全，降低环境事件产生的危害，提高厂区内各部门、各岗位、各人员对突发性环境事件的处理能力，在事故发生时，能够迅速有效组织实施抢险救援，防止事故扩大，最大限度地降低人员伤亡和财产损失，根据法律、法规及规范文件的要求，结合本单位实际编制了《亿利洁能科技（金乡）有限公司突发环境事件应急预案》。希望各部门要认真组织学习，并认真贯彻落实执行。

本预案已编制完成，通过专家评估后，自2016年　月　日开始实施。

批准人：

	亿利洁能科技（金乡）有限公司 程序文件	文件号： 版本号： 受控状态：		
标题：突发环境事件应急预案		共　页		
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