Initial Environmental Examination

Project Number: LN2960/7377
November 2013

PRC: Dynagreen Waste-to-Energy Project : IEE for the Zhangqiu Waste-to-Energy Plant

Prepared by

Shandong Academy of Environmental Science for
Dynagreen Environmental Protection Group Co., Ltd

Asian Development Bank

CURRENCY EQUIVALENTS

(as of 6 May 2013)

Currency unit – Yuan (CNY)

CNY1.00 = $0.16129

$1.00 = CNY6.2

In this report, "$" refers to US dollars.

ABBREVIATIONS

ADB	Asian Development Bank
AQG	Air Quality Guideline
As	Arsenic
BOD_5	5-day biochemical oxygen demand
C&D	Construction and demolition
$CaCO_3$	Calcium carbonate
Cd	Cadmium
CESMT	Community Environmental Supervision & Management Team
CH_3SH	Methyl mercaptan
Cl^-	Chloride
CN	Cyanide
CNY	Chinese Yuan
Co	Cobalt
CO	Carbon monoxide
COD	Chemical oxygen demand
Cr	Chromium
Cr^{6+}	Hexavalent chromium
CSS	Combined sewer system
Cu	Copper
DO	Dissolved oxygen
EA	Executing Agency
EIA	Environmental impact assessment
EIR	Environmental Impact Report
EIRF	Environmental Impact Registration Form
EIT	Environmental Impact Table
EMP	Environmental Management Plan
EPB	Environmental Protection Bureau
F^-	Fluoride
FSR	Feasibility Study Report
FYP	Five Year Plan
GDP	Gross domestic product
GHG	Greenhouse gas
GRM	Grievance redress mechanism
ZEMS	Zhangqiu Environmental Monitoring Station
ZEPB	Zhangqiu Environmental Protection Bureau
Hg	Mercury
ZPMO	Zhangqiu Project Management Office
I^-	Iodide
I_{Mn}	Permanganate index
IA	Implementing Agency
IUCN	International Union for Conservation of Nature
LAS	Linear alkylbenzene sulfonate (= anionic surfactant)
LPG	Liquefied petroleum gas
Mn	Manganese
MOE	Ministry of Environment
MSW	Municipal solid waste
NH_3-N	Ammonia nitrogen
N	Nitrogen
NO_2	Nitrogen dioxide
NO_2^-	Nitrite
NO_3^-	Nitrate
PAM	Project Administration Manual
Pb	Lead
pH	Measure of acidity (<7) and alkalinity (>7) based on hydrogen ion concentration
$PM_{2.5}$	Particulate matter with particle diameter ≤ 2.5 micron
TDS	Total dissolved solids
TN	Total nitrogen
TP	Total phosphorus
TPH	Total petroleum hydrocarbon
TSP	Total suspended particulate
USEPA	United States Environmental Protection Agency
WHO	World Health Organization
WWTP	Wastewater Treatment Plant
Zn	Zinc
HEPA	High Efficiency Particulate Air
UASB	Up flow Anaerobic Sludge Blanket

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MBR	Membrane Bio—Reactor
UF	Ultra-Filtration
DEH	Digital Electro Hydraulic Control
HRSG	Heat Recovery Steam Generator
PMO	Project Management Office
RP	Resettlement Plan
SO_2	Sulfur dioxide
SPS	Safeguard Policy Statement
SS	Suspended Solids
SNCR	Selective Non-Catalytic Reduction

WEIGHTS AND MEASURES

^{o}C	Celsius
μ	micron
μg/L	microgram per liter
Bq/L	Becquerel per liter
dB	decibel
km	kilometer
km^2	square kilometer
km^3	cubic kilometer
kW	kilowatt
L	liter
L/s	liter per second
m	meter
m^2	square meter
m^3/a	cubic meter per annum
m^3/d	cubic meter per day
m^3/s	cubic meter per second
mg/kg	milligram per kilogram
mg/L	milligram per liter
mg/m^3	milligram per cubic meter
no./L	number per liter
NTU	nephelometric turbidity
t	metric ton
t/a	ton per annum
t/d	ton per day
t/y	ton per year

CONVERSION

1 mu	=	666.7 m^2

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CHAPTER I EXECUTIVE SUMMARY

A. Introduction of the Project

1. Landfill requires large areas of land. Due to poor environment condition, the areas surrounding the landfill sites are not suitable for urban development and industrial park construction. With rapid urbanization, land prices increase rapidly. It is very hard to find a place for landfill. This issue is extremely serious in Zhangqiu City where the capacity of the existing landfill site can only last for 2 years. Moreover, the estimated domestic solid waste collected will increase from 735t/d in 2013 to about 1000t/d in 2020(Attachment 1: Zhangqiu City Development Master Plan 2011-2020). Therefore, constructing a modern waste incineration power plant is necessary to properly manage the municipal solid waste and achieve sustainable social-economic development for Zhangqiu City.

2. The municipal solid waste to energy project will construct an incineration power plant with two turbo-generator sets and solid waste treatment capacity of 1050t/d. The project will be constructed in two phases. Phase I will construct 12MW generator and waste treatment capacity of 700t/d. The phase I construction will start on April 2014 and the target commercial operation date is at the end of 2015. Phase II project will construct 6MW generator and solid waste treatment capacity of 350t/d. The Phase I estimated cost is 387.77million CNY and Phase II is 90.70million CNY. Phase II will be constructed after the operation of Phase I. And it will depend on the waste generation. Phase I and Phase II are both supported by ADB.

3. The facilities in the plant include production facilities such as comprehensive plant building, booster station, ignition oil pump room, sewage disposal station, leachate disposal station, industrial pump room and cooling tower and supporting production facilities as well as production office buildings and guard room within the incineration power plant area.

4. The EIA is prepared for both Phase I and Phase II.

Table I.1 Basic constituents of the proposed project

Item	Name	Phase I	Phase II
Major works	Incinerator	350t/d×2mechanical grate furnace	350t/dX1 mechanical grate furnace
	Steamer machine	12MW(N12-3.8) condensing steamer	6MW(N6-3.8) condensing steamer
	generator	12MW generator with power generation 81.59×10^6kW.h	6MW, Power generation 40.79×10^6kW.h
	the arrangement of the main garage	The main garage and the side rooms will be arranged as a whole, the main	Same as Phase I

Item	Name		Phase I	Phase II
			garage includes removal hall, reservation tank, furnace room, smoke purifying equipment and other rooms; the side room includes steamer room and general garage.	
the side public engineering	water supply system	the water supply and resource	The project water use, chemical water use and sanitary water use are all from the municipal water supply, the water pipe will be connected to the project location by the government;	Same as Phase I
		Chemical treatment	The filtration anti-seeping mix bed system is used to process the chemical water in the project. The technical route is: Water clean water pump → Multi-media filter live → activated carbon filter water tank → desalination reverse osmosis unit → addition to carbon dioxide the middle of the middle of the water tank → pump → mixed ion exchange water tank → demineralized water pump → boiler.	
		the recycle water system	Proposed project is the construction of 3 × 2300m^3 / h square mechanical ventilation industrial combination of counter flow cooling towers of a reinforced concrete frame structure combination arrangement.	
	power supply facilities		The substation in the Sangyuan village will provide a 35kV line as the special access to the power grid and a 35kV boost substation will be built up in the plant area.	
	dust removal system		The ash entering the reactor through the air chute. A small amount into the intermediate buffer position, dust in the intermediate buffer position after sump pumps. High-temperature slag discharged by the waste incineration boiler slag cooler. After magnetic separation to remove iron in the slag sent to the bucket elevator lose slag machine then sent by the bucket elevator to the slag room.	
pollution control technologies	flue gas treatment		The proposed incinerator flue gas using the semidry + bag house combination of technology; Flue gas reaction tower + hydrated lime injection + activated carbon injection + bag filter; The collection efficiency of 99.8 %, 85% desulfurization efficiency, dechlorination efficiency ≥ 95 %; Fluoride removal efficiency ≥ 90 %; Heavy metals Hg, Cd, Pb removal efficiency are ≥ 90 % . O_2, CO, NO_2, SO_2, HCl, HF. Set the flue gas line monitoring equipment: Monitoring the amount of flue gas, smoke, O_2, CO, NO_2, SO_2, HCl, HF.	Add one set of the equipment
	Nitrogen oxides control		The proposed project will use a mechanical grate waste incinerator, Strictly control the furnace temperature	

Item	Name	Phase I	Phase II
		between 850 ℃ to 950 ℃, And control the excess air coefficient in order to achieve the purpose of reducing the amount of NOx generated, Little quantity of NOx produced by combustion in the furnace, NOx from flue gas concentration of about 60 to 300mg/Nm^3.This project uses the Selective Non Catalytic Reduction (SNCR) system to remove NOx. After treatment, the concentration of NOx emission will be within 200 mg/Nm^3.The removal efficiency will be ≥ 33.33 %.	
	chimney	export inner diameter of 2.5m, Reinforced concrete chimney height of 80m	Shared a chimney with a phase I
	Odor treatment	The project waste storeroom and waste conveying system are sealed, and the combustion-supporting air is introduced from the upper part of waste storeroom through the first and secondary air fan, so as to make the whole garbage storehouse and refuse conveying system reach micro negative pressure to avoid the odor from escaping. Automatic door is installed in the waste storehouse; the door will automatically open when dumping the garbage from the garbage truck and close when completing dumping, and the door has the air curtain, so most of the odor can be blocked in the waste storeroom, thus avoiding its escape.	
	wastewater treatment	pH, CODcr, BOD5, SS, NH3-N, Hg, Cd. Rain and sewage are collected separately. Landfill leachate and ground cleaning water, vehicle washing wastewater discharged into municipal sewage pipe network after treatment at leachate treatment plant; The wastewater treatment system includes acid-base neutralization plus UASB anaerobic reactor plus MBR membrane bioreactor plus two FU ultrafiltration membrane system processing. Designed treatment scale 300t/d. Leachate treatment system and out of the outlet set line monitoring equipment, monitoring the pH, CODcr, BOD5, SS, NH3-N, mercury, cadmium, and lead . Effluents from the wastewater treatment plant goes to the municipal sewage pipe network of Zhangqiu sewage treatment plant, after further treatment, and ultimately discharged into the Luo River.	
	solid waste treatment	The proposed project waste incineration fly ash will be sent to Slag Sinotrans and to Zhangqiu brick building gold New Building Materials Co., Ltd. Depending on the leaching	Same as Phase I

Item	Name	Phase I	Phase II
		toxicity report. This will be shipped to a qualified hazardous waste disposal agency for final disposal.	
	Noise control	Damping foundation, plant sound insulation, acoustic enclosures, muffler and other measures.	Same as Phase I
deposit and delivery	waste warehouse	Garbage refuse storage pit is reinforced concrete structure, semi-underground waste storage pit length of 57.5m, width of 23m and a depth of approximately 13m, aerial parts of 7m. The underground part of 6m. The total effective volume is17193$m^{3.}$ If the garbage bulk concentration by 0.4t/m^3, garbage of about 7737tcan be stored to meet about 7 days incineration.	
	lime hydrate	Cylindrical vertical, the lower cone, the volume of 60m^3 Material: Steel.	
	activate carbon	Cylindrical vertical, the lower cone volume of 10m^3, Material : Steel	
	dust warehouse	The slag library is43m length, 5m width and 4m deep. The volume is 870m^3; And with storage capacity of 609 ton, it can meet about 4 days storage.	
	ash storage	The proposed project in the design diameter two φ6m transit ash storage with volume of 250m^3 and storage capacity of 188t.	
	Gas tank	Volume of 30 m^3	
office and living area		The front area set up is for office buildings, living quarters, cafeteria, and basketball court.	Same as Phase I

B. Baseline Environmental Conditions.

5. Baseline sampling was conducted by national environmental institute (Shandong Academy of Environmental Science) and compared with applicable PRC standards and the World Bank Group's environmental, health and safety (EHS) guidelines. For ambient air quality, TSP and PM_{10} currently exceed PRC and/or EHS standards due to the dust from surface and local weather conditions. For noise level, the project site is class III based on the Environmental Quality Standards for Noise GB 3096-2008, which is within acceptable limits. For surface water quality, COD_{cr}, BOD_5 and NH_3-N of the Luo River are worse than Category IV (the designated quality by Zhangqiu EPB), due to high levels of COD, Mn, BOD_5 and NH_3-N. For ground water quality, total hardness and total dissolved solids are affected by local hydrogeology, and the high concentration of nitrate-nitrogen indicates that ground water has been polluted. No physical cultural resources were recorded near the project areas during the surveys.

C. Environmental Assessment Findings

6. The Project's environmental assessment documents upon which this Initial Environmental Examination (IEE) is based have been prepared under the provisions of PRC Environmental Impact Assessment Law of 2003 and the PRC Management Guideline on EIA Categories of Construction Projects (2008). These have strengthened existing environmental impact assessment requirements and expanded their application to cover development plans. The release of the 2006 Interim Guideline on Public Participation in EIA has also been a significant development that provides for opportunities to involve the public in the EIA process.

7. The project will cause several environmental impacts during construction and operation phase which need mitigation measures, and is summarized below:

Item	Pre-construction and construction	Operation
Odor	Mainly coming from MSW, the MSW must be collected and transported for disposal every day.	Theodor pollutants (such as NH_3, H_2S, etc.) during operation of the project mainly come from waste pit and leachate treatment station. The whole waste pit has an enclosed configuration with negative pressure system, so as to prevent leakage of odorous gas. Meanwhile, the gas in the pond on the upper part of waste pit is extracted and then, after pre-heating, sent to the incinerator as primary air for combustion purpose, thus controlling emission of odor. Sealing is also provided for major buildings which produced or during treatment of leachate, so as to channel the odorous gas to negative pressure area of the waste pit. The transportation system adopts enclosed-type

		waste trucks. The odor is not emitted outside.
Noise	Noise control measures will be adopted, such as selection of low-noise type equipment; installation of silencer for air exhaust; damping for pipeline between valve and silencer; sealing for sound insulation, sound insulation for the plant; adjustment of equipment to keep dynamic balance (damping) etc. Upon the completion of construction of the project, the noise of the surrounding plant area will conform with the stipulated standard and there will have no environmental impact on the residents who reside within 300m outside the boundary of the plant. As such, the Project will not cause noise disturbance to the public upon completion of construction.	Make soundproof box for fan and install exhaust silencer; Strengthen management and maintenance of mechanical equipment. Sound insulation and damping measures in the plant are adopted so as to reduce the negative impact on surrounding environment, and prevent disrupting residents. Noise control measures will be adopted, such as selection of low-noise type equipment; installation of silencer for air exhaust; damping for pipeline between valve and silencer; sealing for sound insulation, sound insulation for the plant; adjustment of equipment to keep dynamic balance (damping) etc. Upon the completion of construction of the project, the noise of the surrounding plant area will conform with the stipulated standard and there will have no environmental impact on the residents who reside within 300m outside the boundary of the plant. As such, the Project will not cause noise disturbance to the public during operation.
Wastewater	Dispose at WWTP	Dispose at WWTP
Municipal Solid Waste	Collect and transport for disposal	Collect and transport for disposal

Flue gas	---	Proper treatment and online monitoring system; The optimal operation temperature of fume at the reactor outlet depends on the concentration of pollutants and humidity of fume; Negative pressure must be kept in fume passage, so fume does not come out even if it is leaking gas.
Dioxin	---	Make sure the proper treatment of flue gas; good combustion control, temperature of fume in the furnace or the flue before entering the exhaust-heat boiler is not less than , retention time of fume in the furnace and secondary combustion chamber is not less than 2s; All workers are equipped with personal protective device such as safety helmet, dust respirator, protective work cloth, protective gloves, safety shoes and safety glasses etc. Optimize the design of waste pit and strengthen operation to improve the heat value of waste entering the incinerator
Heavy metal	---	Injecting active carbon to absorb heavy metal
Fly ash	---	Solidification in plant and transport to landfill for final disposal
Slag	---	Transport for further disposal or reuse as construction material.

8. Construction impacts exist, but these are of temporary nature and are covered by stringent site management and procedural provisions in the Environmental Management Plan (EMP). Operational impacts require more attention and require a number of specific measures and management approaches spelt out in the EMP and included as loan assurances for success. Finally, the monitoring in the construction and operational phases will check that the environmental performance of the project remains high.

9. The project will support the approved Zhangqiu City Development Master Plan 2011-2020（Attachment 1）. The project is designed to remove infrastructure constraints, address environmental concerns, and promote sustainable economic growth. It contributes to ADB's Country Strategy for the PRC to make markets work more efficiently through infrastructure development and to promote environmental sustainability.

10. Project operational impacts will include flue gas emissions, odor, leachate and wastewater effluents, noise, fly ash and slag generation.

11. Mitigation measures include: i) “Physicochemical + UASB anaerobic reactor + MBR membrane bioreactor + two-step FU ultrafiltration membrane system for treatment of MSW leachate, ii) combined process of semi-dry process + active carbon spraying + bag house filter for treatment of flue gas; and iii) SNCR system for De-NOx. The flue gas purification system of the proposed project will have a dedusting efficiency of 99.8%, a desulphurization efficiency of 85%, a NOx removal efficiency of ≥33.33%, a dechlorination efficiency ≥95%，a defluorination efficiency of ≥90%, with heavy metal removal efficiency of Hg, Cd, Pb all being ≥90%. Wind curtains will be installed at entrance and exit of MSW discharging hall, the MSW storage will be designed as entirely closed, and maintain at negative pressure state. The top is to be installed with extraction openings of primary wind and secondary wind with filter devices, and it is to suction odorous gases into the incinerator as combustion air for the incinerator, so as to prevent escape of odors. Slag will be entirely sold as raw material for brick plants. According to the MSW incineration fly dust leaching toxicity identification report in the actual production of the proposed project, solidified fly dusts will be directly sent to Zhangqiu City MSW Landfill for landfilling or transported to eligible hazardous wastes disposal agency for final disposal.

12. **Information disclosure, consultation, and participation.** Details of the project were placed on the website of the Zhangqiu Municipal Government (ZMG) on 2 February 2012 and 1March 2012. Two rounds of public consultation and participation were conducted during preparations of the domestic and project EIA. The first round was by questionnaire surveys of stakeholders and affected people at the beginning of the domestic EIA process in April 2011. The main public concerns

recorded were of air, noise, and water quality, solid waste management, and impacts to ecology, during construction. The second round was on 1 March 2012, after completion of the draft domestic Environmental Impact Report (EIR). A key public concern raised was the need for a 'complaint center' to be established for the project. Explanations were given by the Zhangqiu Project Management Office (ZPMO) and the Shandong Academy of Environmental Science to all questions and concerns raised, and which subsequently guided the project design process.

13. **Environmental Management and Monitoring Plan.** The ZPMO will be responsible for the overall implementation of the project EMP, including inspection, monitoring, reporting, and initiating corrective actions or measures. The ZPMO will assign a qualified environment specialist from its staff to undertake the project environmental management activities. The EMP includes a Grievance Redress Mechanism (GRM) to document and resolve complaints from affected people. Multiple points of entry and modes of access for the public will be developed in the project pre-construction phase and details distributed to residents at project site, including face-to-face meetings, written complaints, telephone conversations, or electronic mail (e-mail).

Before the construction of the project, EMP will be finalized, which includes wastewater control, noise control, waste collection and treatment, dust control etc. After the operation of the project, monitoring plan will be finalized and carried out. The environmental monitoring report will be submitted every year.

14. **Risks and project assurances.** The key project environmental risk is low institutional capacity by the ZPMO to fully implement the EMP as well as overall environmental activities of the loan components. These risks will be mitigated by (i) providing training in environmental management under the project; (ii) appointing qualified project implementation consultants, (iii) following the project implementation monitoring and mitigation arrangements, and (iv) ADB conducting project reviews.

15. **Conclusion.** Based on the information assessed in this EIA, it is concluded that the net environmental impacts from project construction and operation, assuming full and effective implementation of the project EMP, are in compliance with PRC regulations and the requirements of the ADB Safeguard Policy Statement (2009).

CHAPTER II Policy, Legal, and Administrative Framework

A. Overview

16. The EIA report which the IEE is based has been prepared under the provisions of PRC Environmental Impact Assessment Law of 2003 and the PRC Management Guideline on EIA Categories of Construction Projects (2008). These have strengthened existing environmental impact assessment requirements and expanded their application to cover development plans. The release of the 2006 Interim Guideline on Public Participation in EIA has also been a significant development that provides for opportunities to involve the public in the EIA process.

17. This legislative framework lists the actions required to undertake effective Environmental Impact Assessment: (i) Collect and monitor environmental quality conditions of the project's location and its neighbouring regions; (ii) Analyze and evaluate the project to assess pollution sources and discharge of pollutants; (iii) Predict beneficial and adverse effects on surface water, ground water, atmosphere, acoustic environment, environmental hygiene of the affected areas during periods of construction, and operation of the project; (iv) Present pollution prevention measures that reduce the adverse effects, and estimate the costs of mitigation and environmental management of the project; (v) Analyze the existing environmental risk during the period of construction and operation of the project; (vi) Collect public views and comments on the construction of the project; and, (vii) Draw up a program for environment control, supervision and training.

18. The Environmental Impact Assessment under PRC law is also supported and guided by the following legislative provisions.

B. Laws, Regulations, Guidelines and Standards

1. PRC Laws

19. The following laws of the People's Republic of China govern the way in which the environmental management of the project must be implemented, in order to proceed. This suite of laws includes:

i. Environmental Protection Law of the People's Republic of China, adopted on December 26, 1989;
ii. Law of the People's Republic of China on Evaluation of Environmental Effects, adopted on October 28, 2002;
iii. Law of the People's Republic of China on Prevention and Control of Water Pollution, adopted on February 28, 2008;
iv. Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution, adopted on April 29 2000;

v. Law of the People's Republic of China on Noise Pollution of the Environment, adopted on October 29, 1996;
vi. Law of the People's Republic of China on Prevention of Environmental Pollution Caused by Solid Waste, adopted on December 29, 2004;
vii. Land Administration Law of the People's Republic of China, adopted on January 1, 1999;
viii. Law of the People's Republic of China on Promoting Clean Production, adopted on January 1, 2003.
ix. Law of the People's Republic of China on Power adopted on September 1995;
x. Law of the People's Republic of China on Energy Saving adopted on November 1997;
xi. Law of the People's Republic of China on Urban Planning adopted on December 1989;
xii. Law of the People's Republic of China on Renewable Energy adopted on February 2005;

2. PRC Regulations and Proclamations

20. The following regulations of the People's Republic of China support the environmental laws, particularly as they relate to, and are administered by the government of the Shandong Municipality and Shandong Environmental Protection Bureau.

i. Enforcement Regulations of Law on the Prevention and Control of Water Pollution of the People's Republic of China, promulgated by Decree No. 284 of the State Council of the People's Republic of China on March 20, 2003;
ii. Management of Environmental Protection in Construction Projects, promulgated by Decree No. 253 of the State Council of the People's Republic of China on November 29, 1998;
iii. PRC 11th Five-Years National Social and Economic Development Plan;
iv. PRC 11th Five-Years Environmental Protection Plan on November 22, 2007;
v. PRC 11th Five-Years Acid Rain and SO2 Control Plan on January 3, 2008;
vi. PRC 11th Five-Years Scientific Development Plan, June 2006;
vii. Acid Rain Control and SO_2 Control Zones of China on September 2002 by State Council;
viii. Notice on Strengthening and Regular Project Management for Newly Built Projects on November 2007 by General Office of State Council;
ix. Decision of Implementing Scientific Development View and Strengthening Environmental Protection by the State Council, issued on December 3, 2005;
x. Notice on Strengthening Urban Water Saving and Water Pollution Control on November 2000 by State Council;
xi. Regulation on Environmental Category for Construction Projects on September 2008 by Ministry of Environment Protection;
xii. Regulation on Strengthening Dioxin Control on October 2010 by Ministry of Environmental Protection;

xiii. Policy on Treatment of Urban Domestic Garbage and Technology of Pollution Prevention, Jiancheng [2000] No. 120, issued on May 29, 2000 by Ministry of Construction;
xiv. Compendium of China's Ecological Construction and Environmental Protection, issued on June 1, 2004;
xv. Circular of Strengthening Management of Environmental Impact Assessment against Risks, [2003] No. 152 issued by State Environmental Protection Administration of China;
xvi. Interim Measures on Public Participation in Environmental Impact Assessment, promulgate on March 18, 2006 by State Environmental Protection Administration of China.

3. Local Regulations and Documents

i. Zhangqiu City Master Plan (2005-2020) (Attachment 1);
ii. Zhangqiu 12th five-years Key Pollutants Total Emission Amount Control Plan(Attachment 2);
iii. Zhangqiu Environmental Function Zoning (Attachment 3);
iv. Zhangqiu Ecological City Construction Plan.

4. EIA Guidelines

21. The following guidelines and national standards of the People's Republic of China support the implementation of environmental laws and set the levels of environmental performance required for relevant activities:

i. Technical Guidelines for Environmental Impact Evaluation General Principles (HJ/T2.1-93);
ii. Technical Guidelines for Environmental Impact Evaluation - Air Environment (HJ2.2-2008);
iii. Technical Guidelines for Environmental Impact Evaluation - Surface Water Environment (HJ/T2.3-93);
iv. Technical Guidelines for Environmental Impact Evaluation – Ground Water (HJ610-2011);
v. Technical Guidelines for Environmental Impact Evaluation - Acoustic Environment (HJ/T2.4-2009);
vi. Technical Guidelines for Environmental Impact Evaluation - Non-polluting Ecological Impact (HJ/T19-1997);
vii. Specifications for Environmental Risk Evaluation of Construction Projects (HJ/T169-2004);
viii. Technical Specifications for Soil Erosion Prevention Plan (SL204-1998);
ix. Technical Guidelines for Environmental Evaluation of Power Plants (HJ/T13-1996);
x. Guidelines for Water Saving of Power Plants (DL/T783-2001).

5. Project Guidelines

i. [redacted]ttachment 5 : The power of attorney for EIA
ii. [redacted]ttachment 6 : The approval for the criteria application of EIA of Zhangqiu MSW incineration project (May 10th, 2012. Jinan Environmental Protection Bureau)
iii. [redacted]ttachment 7 : The approval for Municipal Solid Waste incineration plant construction (October 10th, 2011, Zhangqiu city people's government)
iv. [redacted]ttachment 8 : The Land pre-trial opinion of Municipal Solid Waste incineration plant (September 22th, 2011, Zhangqiu Municipal Bureau of Land and Resources)
v. [redacted]ttachment 9 : The letter of opinions on site selection for Zhangqiu MSW incineration project (September 21th,2011, Zhangqiu Urban Planning Bureau)
vi. [redacted]ttachment 10 : The water supplies agreement for production and living, and fire water of Zhangqiu MSW incineration project (April 2012, Zhangqiu Water Supply Company)
vii. [redacted]ttachment 11 : The certificate for MSW of Zhangqiu MSW incineration project (March 1th, 2013, Zhangqiu Urban Environmental Sanitation Center)
viii. [redacted]ttachment 12 : The statement of Ground cover with mineral resources for Zhangqiu MSW incineration project (May 9th, 2011, Zhangqiu Municipal Bureau of Land and Resources)
ix. [redacted]ttachment 13 : The reuse water supply agreement of Zhangqiu MSW incineration project (March 2013, Zhangqiu Wastewater Treatment Plant)
x. [redacted]ttachment 14 : The supply agreement for activated carbon (March 2013, Yantai activated carbon company)
xi. [redacted]ttachment 15 : The proof of sewage receive (March 2013, Zhangqiu Wastewater Treatment Plant)
xii. [redacted]ttachment 16 : The agreement for comprehensive utilization of slag (April 10th, 2012, Zhangqiu Liyuanxinxing building materials factory)
xiii. [redacted]ttachment 17 : The agreement of accepting fly ash (March 1th, 2013, Zhangqiu Urban Environmental Sanitation Center)
xiv. [redacted]ttachment 18 : The agreement for the disposal of hazardous waste (April 11th,2013, Qingdao Xintiandi Comprehensive Treatment of Solid Waste Company)
xv. [redacted]ttachment 19 :The consulting contract of Dioxin Testing (May 4th, 2013, Research Center for Environmental Analysis and Measurement of Zhejiang University)

6. Evaluation Standards

22. The scopes of the environmental impact assessment are (it is based on national regulations and the calculation done by Shandong Academy of Environmental Science):

i. Air: the surrounding area of the project site with radius of 2.7km;
ii. Surface water: upstream and downstream of the Zhangqiu Wastewater Treatment Plant (WWTP) effluent to Luo River;
iii. Ground water: the surrounding area of the project site with radius of 2km;
iv. Noise: Project site boundary and noise sensitive sites within 200m from the project boundary.
v. Risk assessment: the surrounding area with radius of 3km.

23. Relevant environmental quality standards include:

i. Class II of Ambient Air Quality Standards (GB 3095-2012) (Attachment 20 [to replace GB 3095-1996 on January 1, 2016];
ii. Hygienic Standard for the Design of Industries and Enterprises (TJ 36-79)(Attachment 21);
iii. Class III of Environmental Quality Standard for Noise (GB 3096-2008) (Attachment 22);
iv. Class III of Environmental Quality Standards for Surface Water (GB 3838-2002) (Attachment 23);
v. Class III of Quality Standard for Ground Water (GB/T 14848-93) (Attachment24);

24. Relevant pollutant emission standards for assessment include:

i. Emission Standard of Environmental Noise for Boundary of Construction Site (GB 12523-2011) (Attachment25);
ii. Class III Emission Standard for Industrial Enterprises Noise at Boundary (GB12348-2008) (Attachment26);
vi. Class II of Pollution Control Standards for Pollutants from Municipal Solid Waste Incineration (GB18485-2001) (Attachment27);
vii. Class II of Emission Standard for Odor Pollutants (GB14554-93) (Attachment28);
viii. Shandong Integrated Atmospheric Particular Matter Emission Control Standard (DB37/1996-2011) (Attachment29);
ix. Class 1A of Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB 18918-2002) (Attachment 30);
x. Waste Water Quality Standard for Discharge into Sewer Network (CJ343-2010) (Attachment 31);
xi. Standard for Pollution Control on the Landfill Site of Municipal Solid Waste (GB37 16889－2008) (Attachment 32);
xii. Shangdong Integrated Pollutants Discharge Standards for Xiaoqing River Catchment (DB37/656-2006) (Attachment 33);
xiii. Pollution Control Standard for Hazardous Waste Storage (GB18597-2001) (Attachment34).

7. Asian Development Bank (ADB) Environmental and Social Requirements

25. The Shangdong Zhangqiu Waste to Energy Project has been determined to be category B for environment, C for involuntary resettlement and C for Indigenous People based on Asian Development Bank's Safeguard Policy Statement 2009 (SPS). This category entails environmental impacts that can be mitigated. This IEE has been prepared under the provisions of the ADB's safeguard policy document[1] which requires a number of critical considerations, including: (i) project level grievance redress mechanism, including documentation in the environmental management plan (EMP); (ii) occupational and community health and safety requirements including emergency preparedness and response); (iii) economic displacement that is not part of land acquisition; (iv) meaningful consultation and participation; and (viii) an EMP which comprises implementation schedule. Since land acquisition has taken place in 2012 and prior to ADB financing, a separate Social Audit Report has been prepared to comply with ADB's SPS SR4 requirements.

26. The PRC domestic EIA has been prepared initially for PRC approval processes and therefore are required to use PRC standards throughout for water quality, air quality, noise and effluents. The ADB's SPS promotes the use of Country Safeguard Systems (CSS), however, the application of CSS requires an equivalence and acceptability assessment followed by ADB Board approval. Accordingly, in order to follow with this policy, this IEE will compare the critical PRC impact standards (effluents and emissions from subcomponents) with the International Finance Corporation's (IFC) Environmental Health and Safety Guidelines[2].

27. In accordance with ADB's Social Protection Strategy (2001), the project, including its contractors and subcontractors, will also comply with China Labor Law and relevant international core labor standards.

8. Environment, Health and Safety (EHS) Guidelines

28. The principles and standards of the IFC's Environmental, Health and Safety Guidelines (2007) have been endorsed by the ADB's Safeguard Policy. The general guidelines, in company with the Industry Sector Guidelines, will provide the context of international best practice and will contribute to establishing targets for environmental performance. The sector guideline referenced is the general EHS Guidelines (covering occupational health and safety and community health and safety) and the EHS Guidelines for Waste Management Facilities. The air, noise and water quality standards in the EHS guidelines will also provide justification for the use of PRC standards.

[1] ADB. 2009. *Safeguard Policy Statement.* Manila.

[2] IFC/World Bank Group 2007, *Environmental, Health, and Safety (EHS) Guidelines*, Washington April 30, 2007.

29. The design and technology of the proposed project will meet the national standards and the requirements laid out in the IFC's EHS sector guidelines.

30. Occupational and community health and safety, as laid out in the IFC's EHS guidelines, will be an assessment element for the project.

CHAPTER III DESCRIPTION OF THE PROJECT

A. General Introduction

31. Zhangqiu proposes to construct a waste-to-energy facility for the treatment of domestic solid wastes and the recovery of energy.

32. The proposed development will use robust and proven technology to recover energy as well as recyclable metals from residual waste that is currently landfilled. The facility will employ technology to process up to 1,050 tonnage per day of municipal solid waste and produce approximately 125.02 million kWh of electricity per year. The waste-to-energy facility will have three grate furnaces (two for phase I and one for phase II) and flue gas cleaning lines. At Phase I, the project will install two boilers with steam generating capacity of 2X32.3=64.6t/h and one steam turbine with 12MW power rating which will treat solid waste of 700t/d. At Phase II, the project will install one boiler with steam generating capacity of 32.36t/h and one steam turbine with 6MW power rating that will treat solid waste of 350t/d. The total steam generation capacity of the project will reach 96.9t/h. The Phase I construction will start on April 2014 and the target commercial operation date is at the end of 2015 The estimated cost is 326.9 million CNY. Phase II project will construct 6MW generator and solid waste treatment capacity of 350t/d. It will be constructed in 2016 and the estimated cost is 94.23 million CNY. It is anticipated that the waste-to-energy facility will operate 24 hours per day, seven days per week, for an average of 8000 hours per year. The site for the proposed development is located at the south-eastern of Houjia village, Mingshui Community of Zhangqiu City. The site area is approximately 113 mu (75,337.1 m^2).

33. The implementing agency is Dynagreen Regeneration Energy Ltd., which is responsible for both construction and operation of the project.

34. The total employment is 76 (66 during phase I and another 10 during phase II) when the project put into operation. During the project construction phase, the total number of workers is 30. The project will give local labor a priority. In employing staff and workers during the construction and operations phase, Dynagreen Regeneration Energy Ltd, including its contractor will comply with the national labor laws (mandated minimum wages, number of hours worked, safety, provision of medical/accident insurance, among others) and the relevant international core labor standards.

B. The Need for the Project

35. Zhangqiu city is located in the middle part of Shangdong province. It is located north of Taishan Mountain and south of Yellow River. It is a county level city under Jinan Municipality. The city covers an area of 1,855 km^2. There are 20 towns, 908 villages in the city with a total population of about 1 million.

36. At present, sanitary landfill is mainly used in Zhangqiu major city area for disposal of domestic solid waste. The current landfill was put into operation in September 2001. It has a total capacity of 750,000 cubic meters with designed capacity of 200t/day. The expected service life is 2 years, which barely meet the requirement of city development. Landfill leachate was pre-treated with physicochemical and biochemical method and then piped to Zhangqiu No.2 WWTP. Solid waste disposal method from western city is mainly simply buried causing certain impact on the surrounding environment.

37. Landfill requires large areas of land. Due to poor environment condition, the areas surrounding the landfill sites are not suitable for urban development and industrial park construction. With the rapid urbanization, land prices increase rapidly. It is very hard to find a place for landfill. This issue is extremely serious in Zhangqiu City where capacity of the existing landfill site can only last for 2 years. Moreover, the estimated domestic solid waste collected will be increased from 647t/d in 2012 to about 1000t/d in 2020. Therefore, constructing a modern waste incineration power plant is necessary to manage the municipal solid waste and achieve sustainable social-economic development for Zhangqiu City.

38. In order to improve the current waste treatment measures and requirements of the future waste increase in Zhangqiu city, establishing a modern waste incineration power plant in Zhangqiu city will help the city realize the city's urbanization needs and target of a sustainable economy.

39. For the past few years, with the constant development of the society and economy of Zhangqiu city, people have proposed higher requirements on the living environment. The current waste treatments in Zhangqiu city not only differs from the other cities and also differs from the sustainable development policy of the domestic waste treatment. To establish a standardized waste incineration power plant is urgent.

40. The project is not only able to use waste to generate power to realize the resource waste processing, and also improve the management of the landfill, reduce the odor, and process the waste for an more effective waste management in the Zhangqiu region.

41. With construction of the project, the secondary pollution can be controlled effectively and the environment condition will be improved from the processing of municipal waste. Waste incineration is accepted by many developed countries and it is becoming the trend of method to process the municipal waste of large and medium size cities. This project takes less land and processing cycle is short and almost harmless. Also, the heat generated from furnace will be utilized for power generation.

C. Strategic Framework

42. Conceptually, the Project is consistent with the Asian Development Bank's (ADB) *Strategy 2020*,[3] which supports urban sector investments as a dynamic engine of economic development and employment creation, innovation, and inclusive growth. It is designed to remove infrastructure constraints, address environmental concerns, and promote sustainable economic growth, and support policy and institutional reforms in Zhangqiu City.

43. The Project is consistent with the PRC's Twelfth Five-Year Plan (2011–2015), which promotes environment-friendly and resource-efficient urban development. The Zhangqiu City Environmental Sanitation Plan has exclaimed reduction, resource, harmless as the principals, to realize the unified planning and unified construction of the municipal waste treatment facilities, to establish a municipal waste processing system. The municipal wastes processing mostly depends on landfill in recent years, and in the long run, the incineration and recycling of waste will be mainly used and landfilling will be the alternative method. Therefore, to construct a waste incineration plant is in accordance with the general planning of the city.

44. The proposed project is in accordance with PRC Domestic Solid Waste Disposal and Pollution Control Technology Policy, Interim Provisions to Promote Industrial Restructuring, Industrial Restructuring Categories, Comprehensive Utilization of Resources Directory, Notice on Further Strengthening the Biomass Power Generation Project environmental impact assessment management.

45. Table III.1 summarizes the need for waste-to-energy as part of integrated waste management in the context of PRC policies.

[3] ADB. 2008. *Strategy 2020: The Long-Term Strategic Framework of the Asian Development Bank, 2008–2020*. Manila.

Table III.1 Consistence of the Project with Related Policies

Policies	Detail Requirements	The project
Technical Policy on Municipal Solid Waste Disposal and Pollution Control (Jiancheng No. 120, 2000)	In the areas that meet the following conditions, incineration plant is encouraged: i. lack of land resources ii. with financial support iii. solid waste heating value higher enough	Zhangqiu lack land resources Zhangqiu economic status has well developed The solid waste in Zhangqiu has higher heating value
Regulation on Promoting Industrial Restructuring (Guofa No.40, 2005)	Actively support and development of new energy and renewable energy industries and accelerate the development of wind, solar, and biomass energy	The project will accelerate the development of biomass energy (i.e. MSW).
Directory of Industrial Restructuring (2011)	Encouraged and supported industries: integrated MSW reuse, reduction and harmless projects.	The project will reduce solid waste amount, reuse to generate power and become harmless.
Policy on Comprehensive Utilization of Resources	Encourage using solid waste to produce electricity, heat and fertilizer	Garbage incineration power generation is using garbage to produce electricity
Notice on Promoting of Urban Sewage and Solid Waste Treatment	Promoting the construction of sewage recycling and garbage recycling facilities	Garbage incineration power belongs to the garbage recycling facilities
Notice on Further Strengthening the EIA Management for Biomass Power Generation Project	Incineration project is suitable for:(i) the areas that lack land for landfill and (ii) the domestic solid waste has heating value of greater than 5000 kJ/kg. The site must comply with the master plan of the city, land use plan, and environmental protection plan. It should be consistent with the city sanitation planning, waste incineration engineering and technical specifications.	The lower heating value in Zhangqiuis6700kJ/kg; Zhangqiu experiences lack of land for landfill. The proposed project is in accordance with the Zhangqiu Master Plan and Land Use Plan
	In addition to the regional law, rules and policies that prohibit the pollution project, the areas below are forbidden to establish the municipal waste incineration power plant; (1) urban built-up areas ; (2) the quality of the environment cannot meet the requirements and that no effective reduction measures; (3) may result in environmental quality at the sensitive area exceeding corresponding standards.	The land acquisition of the project is planning waste processing area, it is not in the city urban area and the local condition is qualified, and it will not cause disqualification of the sensitive protective objective.
	The other incinerator municipal solid waste incineration power generation projects shall not be blended with coal	The proposed project adopt grate incinerator, use of diesel fuel as the startup
Notice on Further Strengthening the EIA Management for Biomass Power Generation Project	Effective pollution control measures should be taken to ensure that emission of acidic flue gases such SO_2, NOx, HCl and other conventional flue gas pollutants do not exceed the Municipal Solid Waste Incineration Pollution Control Standard. Dioxin emission concentration should refer to the EU standards. Construction of municipal solid waste incineration projects in big cities or areas with special control requirements for nitrogen oxides, nitrate removal device should be installed. Flue gas automatic and continuous monitoring device should be installed. Dioxin, furnace temperature and oxygen capacity should be monitored and the monitoring should be connected with networking of the local EPB.	The proposed project incinerator meets the Technical Requirements of GB18485 – 2001. Adopt a semi-dry plus activated carbon injection and bag filter to purify the smoke, the acidic gases SO_2, NO_X, HCl can meet the standard of the GB18485-2001. Dioxin concentration is less than 0.1TEQ ng/m^3, which meet the EU standard. The proposed project using SNCR system to remove NOx. Dioxin, furnace temperature and oxygen capacity will be monitored and the

Policies	Detail Requirements	The project
	Activated carbon use should be measured and recorded.	monitoring will be connected with networking of the local EPB. Activated carbon use will be measured and recorded.
	Acidic/Alkali wastewater, cooling water, sewage and industrial wastewater treatment and disposal measures should be reasonable and feasible. Landfill leachate treatment be returned to the surface of landfill where possible. If not possible, the leachate treatment should ensure drainage up to the national and local emission standards. Should be provided with sufficient volume of landfill leachate collection tank; Sludge or concentrate should be incinerated inside is not allowed to carry out for processing.	Landfill leachate of the proposed project, The ground flush water and vehicle washing wastewater. By supporting landfill leachate treatment system, collected and deposit by the septic tank, enter the municipal sewer pipe network. Wastewater after neutralization of the acid-base and part of the boiler blow down is used as water; Circulating cooling water will be discharged to rain pipe networks
	Fly ash collected by the incineration slag and dust removal equipment should be collected, storage, transport and disposed properly. Incineration slag should be firstly treated with magnetic separation equipment to separate and recover metals, and then be comprehensively utilized or disposed according to the Standard of Non-hazardous Solid Waste Storage, Transportation and Disposal (GB18599-2001).Fly ash is hazardous waste and should be treated according to the Hazardous Waste Storage Pollution Control Standards (GB18597-2001) and Hazardous Waste Landfill Pollution Control Standard (GB18598-2001).It is encouraged to comprehensively utilize fly ash with precondition of technology can ensure the complete destruction of dioxins and effective stabilization of heavy metal and no secondary pollution during production and use process. After the implementation of Solid Waste Landfill Pollution Control Standard (GB16889-2007), incineration slag and fly ash disposal according to the new standards.	Fly ash and slag from the project will be separately collected, stored, transported and disposed. Slag will be pretreated with magnetic separation equipment to recover metals and then be comprehensively utilized. Fly ash toxicity will be tested. If the dioxin content in fly ash is less than 3 gTEQ/kg and moisture content less than 30%, according to the limit value of the toxicity of the HJ/T300,the ash can be delivered to landfill directly. Otherwise, the fly ash will be transferred to qualified hazardous waste treatment institute for disposal.
Notice on Further Strengthening the EIA Management for Biomass Power Generation Project	Odor prevention measures: sealed design is used in solid waste unloading, delivery and storage area. The solid waste storage pools and delivery system should use negative pressure operation mode. Landfill leachate treatment structures must be covered. At abnormal working conditions, effective deodorant shall be employed.	Odor prevention measures: sealed design is used in solid waste unloading, delivery and storage area. The solid waste storage pools and delivery system will use negative pressure operation mode, Landfill leachate treatment structures will be covered. At abnormal working conditions, effective deodorant shall be employed.
	Encourages separate solid waste collection at source. Solid waste transfer station generated leachate should not enter waste incineration plant to improve garbage calorific value. Garbage transportation routes should be reasonable, truck shall be sealed and prevent leak of landfill leachate. Compression garbage truck in line with the national encouraged equipment catalog should be used. Anti-leakage measure in the refuse pit and collection tank should be taken. To	Solid waste transfer station generated leachate should not enter the waste incineration plant, rely on the existing transport line to deliver, use anti-leakage measure in the refuse pit and collection tank. To take effective measures to prevent odor pollutants to escape, hazardous waste shall not enter the

Policies	Detail Requirements	The project
	take effective measures to prevent odor pollution. Hazardous waste shall not enter the municipal solid waste incineration power plant for processing.	municipal solid waste incineration power plant for processing.
	The environment impact assessment must have a special environmental risk impact assessment chapter, focusing on impact of dioxin and odor pollutant. The assessment standard is of 4pgTEQ/kg which is human body tolerable intake dose per day. The human body tolerable dose for direct breath is 10% of the above standard. Range of the impact should be calculated and environmental risk prevention measures should be taken and contingency response plan should be developed to prevent environmental pollution accident.	The EIA report includes an environment impact risk assessment chapter, focusing on the impact of the dioxin and odor. Impact scope is calculated. Environmental risk prevention measures are proposed and contingency response plan will be developed to prevent environmental pollution accident.
	Odor concentration at different distance should be calculated based on the source intensity of odor pollutants including ammonia, hydrogen sulfide, methyl mercaptan, odor, etc. Based on the calculated results and considering the risk assessment result, an environmental protections distance should be proposed as a control distance between the plant and residential areas, schools and hospitals, as well as reference for the newly planned new projects near the plant. For planned project, the distance should be not less than 300m.	The environmental safe distance is calculated and finally defined as 400m for this project.
	To achieve the objective of regional key pollutants total emission amount control, for newly increased pollutants emission from a project, same amount of reduction should be made from other project at the region.	The project will increase emission of key pollutants of SO_2 and NOx. Emission permission will be acquired from the EPB, and the EPB will balance the total emission in the region.
	Public consultation should be conducted in accordance with the former State Environmental Protection Administration issued requirement on Public Consultation During the Environmental Impact Assessment.	The public participation work has been carried out by the requirements of the Tentative Measures for Public Participation in Environmental Impact Statement (Attachment 35)
Notice on further strengthening the biomass power generation project environmental impact assessment management	The status monitoring: monitoring factors should be defined according to the emission standards. Before the operation of the project, monitoring stations should be set in downwind direction of annual dominant wind, at least one at the nearest sensitive site, and one at the place with maximum ground concentration, to monitor the dioxin concentration in the air. And to set a monitoring station at the upwind and downwind of the dominant wind, to monitor the dioxin in the soil. It is suggested to set the downwind monitoring station at the farmland near the area maximum ground concentration occurred. Impact assessment: PRC has no dioxin quality standard. The impact assessment can be conducted according to the Japan annual average dioxin concentration standards of (0.6pgTEQ/m^3). Daily monitoring: the dioxin monitoring and smoke monitoring are carried out at	Before the operation of the project, monitoring stations will be set in downwind direction of annual dominant wind, one at the nearest sensitive site, and one at the place with maximum ground concentration, to monitor the dioxin concentration in the air. And to set a monitoring station at the upwind and downwind of the dominant wind, to monitor the dioxin in the soil. During assessment, according to the guide principle, dioxin concentration at downwind is calculated during the poorest dispersion condition. During operation, dioxin concentration in both air and

Policies	Detail Requirements	The project
	least once at the area of places we determined above, to get the information of the dioxin situation of the project and the surroundings.	soil will be monitored at least once a year.
	Water use for WTE project should meet the national water use policy: encourage reuse of wastewater from WWTP. In the northern part of China where lack of water resource, surface water used for WTE should be limited and ground water use for WTE is forbidden.	The water use for the proposed project is provided by the government.
Policy on Strengthening Dioxin Pollution Prevention	To promote the construction of high quality waste incineration facilities and to strengthen the management facilities. Strictly implement the technical requirements of the Standard for Control of Pollution from Domestic Solid Waste Incineration and the Standard for Control of Pollutants from Hazardous Waste Incineration. Advanced practical technology should be selected. It should be very cautious to use incineration furnace that is not tested for practical use. Establish information disclosure system. WTE enterprises should publicize annual environmental report. Online monitoring of the SO_2, NOx, HCI and etc. and connected with local EPB network. Pollutant emission should be tested quarterly. Information screen that displays furnace temperature, duration of flue gas in furnace, flue gas temperature at exit, CO and etc. should be erected at apparent place of the plant to receive public supervision.	The proposed project will select mature mechanical grate garbage incinerator. The IA will publicize annual environmental report. Online monitoring of the SO_2, NOx, HCI and etc. and connected with Zhangqiu EPB network. Pollutant emission will be tested quarterly. Information screen that displays furnace temperature, duration of flue gas in furnace, flue gas temperature at exit, CO and etc. will be erected at apparent place of the plant to receive public supervision.
The implementation of views on building the province's environmental security prevention and control system	Environmental risk assessment should be conducted in accordance with requirements of the Construction Project Environmental Risk Assessment Technical Guidelines, Notice on Strengthening of Environmental Impact Assessment Management to Prevent Environmental Risks. The risk assessment should include identification of environmental risk source from newly built or extension project, prediction of the environment risk, site selection, location of sensitive areas, proposing prevent measures, provide the scientific and feasible monitoring measure and remedial actions.	The report has made the identification of the new and extended project risk, the prediction of the environment risk, the location sensitive selection and the preventive measures, provided the scientific and feasible monitoring measures and remedial actions
	The risk source unit should carry out a monitoring of the pollutant of the source features and a monitoring at the garage output point and main output place.	The report has set up a monitoring plan and the leachate treatment system. A monitoring is taken each shift at entrance, exit and general output place.

46. Jinan Environmental Department issued the Construction Project EIA Approval Principles in May 2012(Attachment 6). The principle defined the necessary conditions for approval of construction projects: project to meet relevant requirements of environmental laws and regulations, industrial policy, the relevant technical specifications issued by Ministry of Environmental Protection and the Shangdong EPB. Environmental quality of the city/county where the project located should conform to the ecological protection planning and environmental function zoning requirements. The project city/county must complete the task of reducing emissions. Construction projects must obtain permission for key pollutant emissions. EIA should be conducted for newly built project, expansion and renovation projects. Environmental protection facilities must be designed, constructed and operated simultaneously with the project main works (also named as Three Simultaneous System). Project emission/discharge must meet relevant pollutant discharge standards. The project should also meet the criteria of clean production.

Table III.1 Checklist for Project Approval in Shangdong Province

Whether the Project Meets the Principle for Project Approval	Options
Meet environmental protection laws and regulations	Yes√ No□
Meet city/county ecology protection plan and environment function requirements	Yes√ No□
Without pollutant emission or with pollutant emission but will not affect the local total pollutant emission control objective	Yes√ No□
Meet pollutant emission standards	Yes√ No□
Is the project site located at the area which is not forbidden to construct new project?	Yes√ No□
The construction unit has implemented the environment assessment and three simultaneous systems (environmental protection facilities should be designed, constructed and operated simultaneously with the major engineering works). Pollutants emission/discharge meet the relevant emission/discharge standards. Fulfilled emission reduction objectives on time	Yes√ No□ Yes√ No□ Yes√ No□
Whether the Project Has Limitation for Approval	
Emission reduction tasks has completed	Yes√ No□
Major pollutants emission exceed standards	Yes□ No√

Implementation EIA and three simultaneous system	Yes√ No□
Environmental protection facilities completion for approved projects before operation.	Yes√ No□
Whether the project located within the areas forbidden or limitation to approve new projects	
Within water source protection area, nature reserves, scenic area, ecology sensitive area	Yes□ No√
Danger chemical project near residential area	Yes□ No√
Located in urban planning area, or located out of economic develop area or high technology develop and industry area	Yes□ No√
Within the area of south to north water diversion project and 5km from Xiaogqing River embankment	Yes□ No√
Within the area that forbidden for new project approval due to against EIA requirements and three simultaneous system	Yes□ No√
At the area within 5 km from a national key river that didn't fulfill the environmental quality improvement objective	Yes□ No√
Whether the project city/county has Limitation for New Project	
The city/county failed to fulfill environmental emission control objective in successive 2 years	Yes□ No√
The city/county against the environment assessment and 3 simultaneity system	Yes□ No√
The city/county has not completed any WWTP construction by the first half 2008.	Yes□ No√
The city/county's waste water treatment rate lower than 60%	Yes□ No√
The city/county lack of capacity to control serious pollution	Yes□ No√

47. The proposed project meets the environmental protection principle of Shangdong EPB. It is not within any area that has approval limitation. All of the indicators meet the regulated requirements of under the regulation issued by Shangdong EPB No. 131, 2007.

48. In conclusion, the waste incineration project is in accordance of the requirements of *Municipal Solid Waste Disposal and Pollution Control Technology Policy*, *the Interim Provisions to Promote Industrial Restructuring*, *the Industrial Restructuring Catalog, Comprehensive Utilization of Resources Directory, Views on*

the Promotion of Urban Sewage and Garbage treatment Industrial Development, On the strengthening of the Dioxin Pollution Prevention Guidance, Further Implement the EIA and Three Simultaneous System. The project is not only a basic facility of urban construction but also a project with social and environmental benefits. It is indispensable from the angle of reduction, resource and harmless use of the waste and from the angle of saving resource, protecting the environment, recycling and establishing the economic environment. In general, the proposed project is feasible.

D. Main Features of the Project

1. Main Elements

49. The facilities in the plant include production facilities such as comprehensive plant building, booster station, ignition oil pump room, sewage disposal station, leachate disposal station, industrial pump room and cooling tower and supporting production facilities as well as production office buildings and guard room within the incineration power plant area. Main elements of the proposed project are shown in Table III.2.

Table III.2 Main Elements of the Proposed Project

Item	Name		Phase I	Phase II
Major works	Incinerator		350t/d×2mechanical grate furnace	350t/dX1 mechanical grate furnace
	Steamer machine		12MW(N12-3.8) condensing steamer	6MW(N6-3.8) condensing steamer
	generator		12MW generator with power generation 81.59×106kW.h	6MW, Power generation 40.79×106k W.h
	the arrangement of the main garage		The main garage and the side rooms will be arranged as a whole, the main garage includes removal hall, reservation tank, furnace room, smoke purify equipment and other rooms; the side room includes steamer room and general garage.	Same as Phase I
the side public engineering	water supply system	the water supply and resource	The project water use, chemical water use and sanitary water use are all from the municipal water supply, the water pipe will be connected to the project location by the government; a DN150 pipe is used to supply the project total water need of 1920m^3/d.	Same as Phase I
		Chemical treatment	The filtration anti-seeping mix bed system is used to process the chemical water in the project. the technical route is Water clean water pump → Multi-media filter live → activated carbon filter water tank → desalination reverse osmosis unit → addition to carbon dioxide the middle of the middle of the water tank → pump → mixed ion exchange water tank → demineralized water pump → boiler .	

Item	Name		Phase I	Phase II
		the recycle water system	Proposed project includes the construction of 2 × 2000m^3 / h square mechanical ventilation industrial combination of counter flow cooling towers of a reinforced concrete frame structure, combination arrangement. Largest circulating water 4000m^3 / h, The circulating water pump house is set to semi-underground building	
	power supply facilities		The substation in the Sangyuan village will provide a 35kV line as the special access to the power grid and a 35kV boost substation will be built up in the plant area.	
	dust removal system		The ash will enter the reactor through the air chute. A small amount into the intermediate buffer position, dust in the intermediate buffer position after sump pumps. High-temperature slag discharged from the waste incineration boiler slag cooler cooling, After the magnetic separator for the removal of iron, the slag is sent to the bucket elevator lose slag machine.	
environment protection	smoke treatment		The incinerator flue gas will be treated using the semidry + bag house combination of technology; Flue gas reaction tower + hydrated lime injection + activated carbon injection + bag filter; The collection efficiency of 99.8 %, 85% desulfurization efficiency, Dechlorination efficiency ≥ 95 %; Fluoride removal efficiency ≥ 90 %; Heavy metals Hg, Cd, Pb removal efficiency were ≥ 90 %;O_2, CO, NO_2, SO_2, HCl, HF. Set the flue gas line monitoring equipment: Monitoring the amount of flue gas, smoke, O_2, CO, NO_2, SO_2, HCl, HF .	
	Nitrogen oxides control		The proposed project used a mechanical grate waste incinerator. It strictly control the furnace temperature between 850 °C to 950 °C, and controls the excess air coefficient in order to achieve the purpose of reducing the amount of NOx generated, Little quantity of NO_X produced by combustion in the furnace, NOx from flue gas concentration of about 60 to 300mg/Nm_3. This project uses the SNCR system to remove NOx . After treatment, the concentration of NOx emission control within 200 mg/Nm_3.The removal efficiency of ≥ 33.33 % .	
	chimney		export inner diameter of 2.5m, Reinforced concrete chimney height of 80m	Shared a chimney with a phase I
	Odor treatment		The project waste storeroom and waste conveying system are sealed, and the combustion-supporting air is introduced from the upper part of waste storeroom through the first and secondary air fan, so as to make the whole garbage storehouse and refuse conveying system reach micro negative pressure to avoid the odor escaping., Automatic door is installed in the waste storehouse; the door will automatically open when dumping the garbage from the garbage truck and close when completing dumping, and the door has the air curtain, so most of the odor can be blocked in the waste storeroom, thus avoiding its escaping.	
	wastewater treatment		pH, CODcr, BOD_5, SS, NH3-N, Hg, Cd. The proposed project to take rain and sewage diversion, clean-up triage principles of wastewater treatment, sewage and sewage diversion, the leachate and ground washing wastewater and vehicle washing wastewater are discharged into municipal sewage pipe network after supporting leachate treatment system ; After neutralization of acidic and alkaline wastewater and boiler blow down water with slag to make water ; Vehicle washing with water and fly ash with water, Remaining as	

Item	Name	Phase I	Phase II
		clean water discharged into the storm sewer system. Project efflux of wastewater treatment of municipal sewage pipe network Zhangqiu sewage wastewater treatment plant for further treatment and ultimately discharged into the Luo River,. Landfill leachate treatment process materialized UASB anaerobic reactor plus MBR membrane bioreactor plus two FU ultrafiltration membrane system processing, Designed treatment scale 300t /d. Leachate treatment system and out of the outlet set line monitoring equipment, monitoring the pH, CODcr, BOD5, SS, NH_3- N, mercury, cadmium, lead .	
	Solid waste	The proposed project waste incineration fly ash will be utilized by sending to Slag Sinotrans and to Zhangqiu brick building gold New Building Materials Co., Ltd. Depending on the leaching toxicity report, this will be shipped to a qualified hazardous waste disposal agency for final disposal.	
	Noise control	Damping foundation, the plant sound insulation, acoustic enclosures, muffler and other measures.	Same as Phase I
deposit and delivery	Waste warehouse	Garbage library refuse storage pit reinforced concrete structure, semi-underground waste storage pit length 57.5mWidth of 23m and a depth of approximately 13m, aerial parts of 7m, the underground part of 6m. The total effective volume: 17193m^3, If the garbage bulk concentration by 0.4t/m3 of, You can store garbage about 7737tto meet about 7 days incineration.	
	lime hydrate	The cylindrical vertical, the lower cone, the volume of 60 m3 Material: Steel.	
	activate carbon	Cylindrical vertical, the lower cone volume of 10 m3, Material : Steel	
	dust warehouse	The proposed project located 43.5m × width 5m × deep 4m slag library a slag library volume of 870m3, about 609t of the slag can be stored.	
	ash storage	The proposed project in the design diameter two φ6m transit ash storage with volume of 250m3 and storage capacity of 188t.	
	Gas tank	Volume of 30m^3	
office and living area		The front area set up office buildings, living quarters, cafeteria, and basketball court.	Same as Phase I

The proposed project plant will include three major areas. The main production area consists of incineration plant, chimney and feeder ramp area; the auxiliary production area consists of integrated pump room, cooling room, oil pump room, underground oil can, water pools for fire prevention, leachate treatment station, weighbridge room and administrative area of office buildings, dining hall, residential area, guard room and living facilities office.

2. Main Equipment

Table.3 List of Main Equipment of the Project

PHASE I

NO.	ITEM	PARAMETER	Qty	UNIT	NOTE

Storage and feeding					
1	Truck scale	Maximum weighing: 50t	2		
2	Bridge grab	11t/ 6.3m^3	2	set	
Incineration					
3	Grate incinerator	350t/d	2		
4	Superheat boiler	MCR: 27.8t/h，4.0MPa（g），400℃	2		
5	Air condensing machine	Rated inlet pressure: 0.8MPa、20m^3/min	2	set	One with a prepared
6	Ignition and auxiliary burners		2	set	Set with the incinerator
7	Primary dry fan	9-19NO11.2D, 180° to left flow：19602m^3/h, pressure：6609Pa power： 45 kW	2		With inverter
10	Secondary fan	9-26NO10D 90° to right flow：19319m^3/h pressure：6056Pa power： 45 kW	2		With inverter
11	Slag machine		2		Set with the incinerator
12	Vibrating conveyor		2		
13	Separators		2		
14	A dry wind air preheater	F=100m^2	2		Set with the incinerator
15	Primary combustion air preheater wind	F=170m^2	2		Set with the incinerator
16	Secondary air air preheater	F=100m^2	2		Set with the incinerator
17	Leachate pump	Q=20m^3/h，H=22m，N=11kW	2		
18	Slag crane	5t， 1.5 m^3，N=35kW	2		

19	Periodic blow down	DP3.5	1		
Waste gas purification					
20	Reaction tower		2		
21	Bag filter		2		
22	Draft fan	flow：126553m^3/h pressure：6128Pa power：315kW	2		
23	chimney	Single tube, Diameter: 2.5m,Height: 80m	1		
24	online gas analyzer	NO_X、SO_X、CO_X、O_2、H_2O、(HCl)	2	set	
Turbine, power generation					
25	Turbine	model：N12-3.8/0.33	1		
26	generator	QF-12-2，12MW，10.5KV	1		
27	Condenser		1		Come with the turbine
28	Condensate pump		2		
29	Gland heater		1		Come with the turbine
30	Low pressure heater		1		Come with the turbine
31	Oil Cooler		2		Come with the turbine
32	hydrophobic expansion tank		1		Come with the turbine
33	Equalizing tank		1		Come with the turbine
34	Water vacuum pump		2		
35	Air Cooler		1		Come with the turbine
36	Auxiliary oil pump		1		Come with the turbine
37	AC pump		1		Come with the turbine
38	DC pump		1		Come with the turbine
39	Main tank		1		Come with

					the turbine
40	Feed pump		3		
41	Drain Pump		2		
42	Emergency pump		1		
43	Deaerator		1		
44	Deaerator tank		1		
45	Continuous blow down		1		
46	Drain tank		2		

PHASE II

NO.	ITEM	PARAMETER	QTY	UNIT	NOTE
Incineration					
1	Grate incinerator	350t/d	1		
2	Superheat boiler	MCR 27.8t/h ，4.0MPa（g），400℃	1		
3	Air condensing machine	0.8MPa、20m^3/min	1	set	
4	Ignition and auxiliary burners		1	set	Come with the incinerator
5	Primary dry fan	9-19NO11.2D ,left 180° flow：19602m^3/h pressure：6609Pa power：75kW	1		With inverter
6	Secondary fan	9-26NO10D right 90° flow：19319m^3/h pressure：6056Pa power：55kW	1		With inverter
7	Slag machine		1		Come with the incinerator
8	Vibrating conveyor		1		
9	Separators		1		
10	Primary wind heater	F=100m^2	1		Come with the incinerator

Waste gas purification					
15	Reaction tower		1		
16	Bag filter		1		
17	Draft fan	flow：126553m^3/h pressure：6128Pa power：315kW	1		
18	Online gas analyzer	NO_X、SO_X、CO_X、O_2、H_2O、(HCl)	1	set	
Turbine, generator					
19	turbine	model：N6-3.8/0.48	1		
20	generator	QF-6-2，6MW，10.5KV	1		
21	Condenser		1		Supply with turbine
22	Condensate pump		2		
23	Gland heater		1		Supply with turbine
24	Low pressure heater		1		Supply with turbine
25	Oil Cooler		2		Supply with turbine
27	Equalizing tank		1		Supply with turbine
28	Water vacuum pump		2		
29	Air Cooler		1		Supply with turbine
30	Auxiliary oil pump		1		Supply with turbine
31	AC pump		1		Supply with turbine
32	DC pump		1		Supply with

					turbine
33	Main tank		1		Supply with turbine
34	Feed pump		1		
35	Deaerator		1		
36	Deaerator tank		1		

3. General Plant Layout

50. The general layout focuses on the requirements of the technical process and rational land use. The design considered current natural conditions of the land, as well as transportation and piping requirements. It also includes coordinating with the existing buildings to meet the requirements of the production and security.

There are two separate gateways in the plant area, including one for passenger gateway and one for logistics. The gateway for passenger is in the north-west in the plant area and the logistics gateway is in the north-east of the plant area. All of the transportation vehicles will enter the plant through the logistics gateway. The empty trucks go back by the same route. The administration cars, livelihood resource and staff enter the plant by the gateway for passenger. The fire engine can go anyway to enter the plant area. By the circle passage, it can go to the different parts of the plant area. The administration park zone is set in the administration zone. The roads inside the plant are the City- concrete road. The circle passages are designed surrounding the main buildings, under the premise of satisfying the technical route, ensure the traffic is unblocked, and the distance is short and avoid unnecessary detour. The fire engine road and transport road work together, and the fire engine can run over the buildings in the plant area. The main road of the area of the factory has a width of 8m, the secondary road with width of 6m, and third road with width of 4m. The plant layout is shown in Attachment 36.

51. The project layout is divided into 4parts: the main production area, assistant production area, transportation area and the administration area.

- The main production area consists of incineration plant, chimney and material ramp.
- The assistant production area consists of integrated pump room, cooling room, oil pump room, underground oil can, industrial fire engine pool, livelihood water pool, leachate treatment station, and weighbridge room.
- Transportation area consists of scale room, scale and pier passage.
- Administrative area consists of office buildings, dining hall, living quarters, guard and dormitory.

52. The main plant area is located in the center of the project area. The incinerator is located in the middle of the main plant, flue gas treatment system, the chimney is located in the east of the main plant. Industrial fire water, leachate treatment station, the cooling tower is located in the eastern part of the plant. Office, dining room and living quarters are located in the western part of the plant. Project office and living quarters are perpendicular to the dominant wind direction to minimize the air and noise pollution impact in the area. The entire layout (Attachment 36) of the production process is convenient for transportation, flood prevention and drainage, lighting, ventilation, production safety and environmental protection.

4. Processes

53. The design of the proposed facility has been optimized to include the advanced emissions control and flue gas cleaning technology. The waste-to-energy process (or incineration with energy recovery) will consist of a number of main process elements as follows:

- waste acceptance
- waste intake and storage
- combustion process
- energy recovery process
- flue gas cleaning and dioxin and furan removal.

54. The production process of the proposed project is shown in Figure III.1

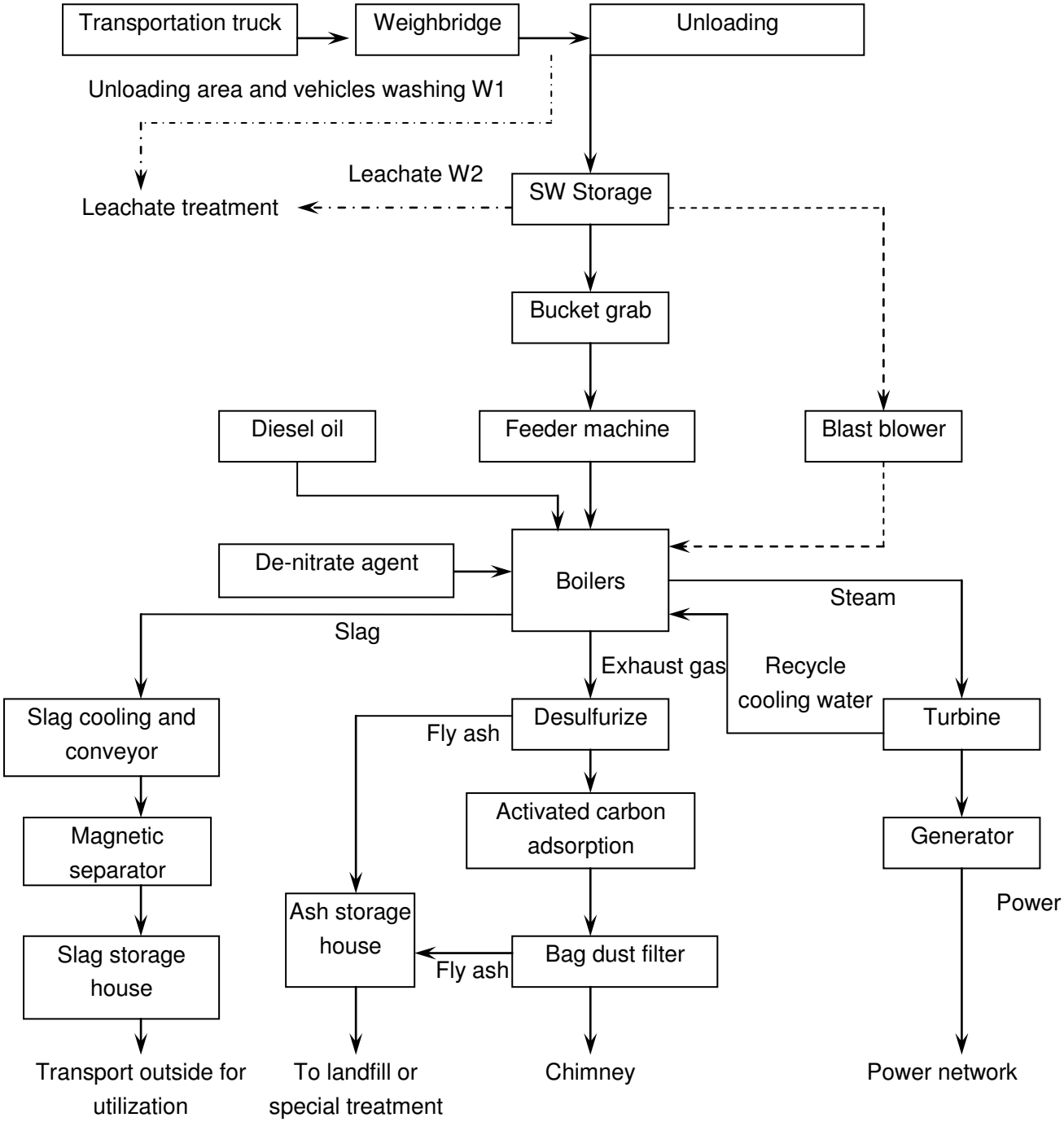


Figure III.1Production Process Diagram of the Proposed Project

a. Waste acceptance

55. **Waste Check at Entrance.** Solid waste will arrive at the site in compactor covered trucks. All waste trucks entering the waste-to-energy plant will be checked by the assigned personnel with necessary tools and equipment. Only municipal solid waste will be incinerated by the proposed project. Hazardous waste will not be

accepted. The municipal solid waste will be sent to the grate incinerator directly without any pre-treatment.

56. **Weighbridge.** Waste trucks will drive onto the weighbridge, located at the entrance and exit. All trucks used for the transport of waste, which enter and leave the plant, will be weighed. Drivers will present proper documentation, relating to the waste load, to the staff in the security office. Some trucks, on long-term contracts, carrying non-hazardous waste, will access the facility using a swipe card, which will record their details. The drivers of these trucks will not have to report to the security offices. The truck scale use the SCS model (Sequence Control System), which mainly consists of weighing body, weighing transducer, display and the computer system.

57. **Waste Handling and Storage.** The waste handling and storage facility for solid waste will consist of:

- waste reception hall
- waste bunker
- semi-automatic grab cranes
- three waste hoppers, two for the fluidized bed furnace and one for the moving grate furnace.

58. *Reception hall.* Covered trucks containing solid waste will enter the supervised reception hall and will be directed towards automatic discharge doors at higher discharge platform. High position unloading will be adopted to save effective room and make room for chemical water treatment station and compression machine repairing shop. The hall is 7m in height and 64m in length. The discharge platform is 24m in width. The size of automatic discharge door is 3.5m in width and 6.1m in height. Effluent treatment plant sludge will be feed into the waste-to-energy plant. This material will be handled in a similar manner as the solid waste.

59. To prevent the egress of odors, the waste reception hall will be maintained under negative pressure, i.e. air will be drawn in through any openings rather than escaping out. Air for combustion will be drawn from the reception hall through the waste bunker. As the waste reception hall will be an enclosed area, windborne litter will not be generated.

60. If for any reason, the facilities of the waste to energy plant are shut down, typically for 1or 2 days per year, the main fans for combustion air and flue gases will be kept in operation to maintain the reception hall under negative pressure. Any odours will then be discharged via the stack. Shut down of facilities might happen when there is an ongoing maintenance or a modification required on common plant parts such as a transformer, water supply systems, stack shell or air cooled condenser.

61. *Waste Bunker.* The bunker capacity has been chosen to allow the plant to accept waste during periods when the furnace or furnaces are shut down for maintenance and also to allow the plant to continue its operation even during long periods of no deliveries (i.e. long weekends, national holiday). The size of the bunker is 57.5m in length, 23m in width and 13m in depth (6m below the floor level and 7m above the floor level) with total volume of 17193m^3. Municipal solid waste typically has a density of 0.4t/m^3, and an approximate bunker capacity of 7737 ton. Or equivalent to about 10 days operation of the plant.

62. *Crane and Hopper*. The crane is in the upper position of the bunker for garbage feeding, handling, mixing, extracting and weighing. According to the general requirements of the project, two 11t waste crane are used (one operation and one spare). The volume of the hopper is 8m^3, the junk crane bridge, travelling mechanism, hoisting mechanism, trolley traveling mechanism, and electric equipment, grasping parts. Besides the electric equipment and bridge, the other 4 parts have their respective motor and work separately.

63. *Leachate Collection.* Since the waste contains high moisture, the water will leak during the deposit. At the bottom of the bunker there is a leachate collective tank and two leachate pump rooms to collect the leachate for temporary deposit. The leachate tank is 7m below ground level with total volume of 120m^3. It is enough to keep leachate of 11 to 15 hours. When the leachate reaching certain height, it will be transferred to the regulated pool which can keep the leachate for 7days.

b. Waste Incineration

64. Waste incineration system mainly consists of feeding, incineration, ash handling, combustion air, and start up.

65. **Solid Waste Feed**. Feed system includes hopper, chute, feeder and grate. The solid waste will be grabbed by crane and put into the ladder-shaped hopper with smooth wall. The solid waste will be fed from the top of the furnace to the bottom by the self-weight of the solid to ensure complete combustion. An excess quantity of air will be drawn in through the furnace to ensure sufficient cooling of grate bars.

66. The furnace chute connects the feeding hopper and the incinerator. The furnace chute includes upper part and lower part. There is a metal expansion joint between the two parts for the expansion of the heat absorption. There will be a certain amount of solid waste reserved in the chute forming a sealing layer to prevent air leakage into the furnace and flue gas to escape. The chute will be installed with separate gate to isolate the incinerator with outside.

67. There is a feeding machine at the bottom of the hopper to constantly feed the incinerator. The waste feeding can be adjusted by the real situation.

68. The grate surface is formed by several stove tiles. Upper and lower grates overlap. One row keeps stable while another row moving alternatively to have the solid wastes mixed and stirred completely and burnt thoroughly.

69. **Ignition.** When the incinerator is empty, the plant will use ignition burner at start up to bring the furnace to the temperature of 400℃, then combined with solid wastes to bring the temperature to the required operating temperature of above 850℃. With the inflame machine can prevent temperature from increasing rapidly and thus protect the furnace refractory. The ignition burner has a rated power of 4.5MW with oil consumption of 381kg/h. The total annual consumption of ignition is 100 thousand tons.

70. **Combustion Support.** The plant will use combustion supporting system with light diesel oil as fuel to bring and keep the furnaces to the required operating temperature of 850℃ for at least 2 seconds as appropriate. Light diesel oil may also be occasionally required as a supplementary fuel to maintain the temperature if waste of an exceptionally low calorific value is received. The combustion support machine will have a rated power of 7.5MW with oil consumption of 632kg/h. The total annual consumption of ignition is200 thousand tons.

71. **Combustion Air.** Primary combustion air will be drawn from the reception hall and bunker by the primary air fans. The wind flow rate is 40720Nm^3/h. Secondary combustion air will be drawn from the roof spaces above the furnaces and boilers, by the secondary air fans. The wind flow rate is 13573Nm^3/h. The air in the roof space will be heated by convection and radiation.

72. **Furnace.** A moving grate furnace is proposed for the line of the facility. It will operate in a similar fashion as an escalator, pushing waste from the top of the furnace to the bottom to ensure complete combustion. An excess quantity of air will be drawn in through the furnace to ensure sufficient cooling of grate bars.

73. The moving grate mechanism will transport the waste slowly from the feed point at the top of the furnace to the ash discharge at the bottom of the furnace. The rate at which the waste will travel through the furnace will be controlled to optimize the combustion.

74. As the waste enters the hot furnace the material will be heated due to contact with the hot flue gases and radiated heat from the walls of the incinerator. The initial heat will drive off the moisture from the waste. The next stage in the combustion process will be volatilization, where the combustible gases and vapors will be driven off. The volatilization stage will take place within the temperature range of 200℃ to 750℃.

75. The volatile components of the organic material of municipal solid waste typically account for 70 to 90% of the flue gases, and are produced in the form of hydrogen, carbon monoxide, methane and ethane. The combustion of these volatiles will take place immediately above the surface of the waste and in the combustion chamber above the grate.

76. The volatile gases and vapors released will immediately ignite in the furnace due to the temperature of the furnace gas, which will be within the range 850℃ and 950℃. Typical mean residence times of the gases and vapors in the combustion chamber will be 2 to 4 seconds. The final section of the grate will be the burnout section where the ash will be held for long enough to ensure sufficient burnout.

77. The grate will discharge the resultant bottom ash into a water bath, and then via a conveyor to an ash bunker.

78. Finer ash to that of the bottom ash will fall through the slits and gaps between the grate bars of the furnace into hoppers located under the grate. This finer ash, known as 'grate siftings', will be transferred by conveyor belt from the hoppers via a wet deslagger to the bunker.

c. Energy Recovery Process

79. **Waste Heat Boiler.** The thermal energy generated by burning the waste in the furnaces will be transformed into electricity using a conventional steam cycle. This will consist of a boiler to generate steam, a steam turbine across which the steam will be expanded to produce motive power and a condenser to condense the steam and dissipate the low-grade waste heat.

80. Waste heat boiler includes following parts: steam drum, water cooling wall, furnace wall, super heater, convection tubes and economizer.

81. The furnace gas will pass through three vertical empty passes and one tube bundles. The empty flue gas passes will be constructed from membrane walls without obstructions such as tube banks. The empty passes will allow heat transfer from the flue gas to the evaporating water in the membrane walls mainly by radiation. There will be no tube bundles in this section of the boiler as the fly ash will be sticky at temperatures above 650ºC, and would quickly deposit on, and foul the surfaces.

82. The large empty first pass will allow sufficient time at high temperature to complete combustion. The lower part of the first pass will be refractory lined to avoid corrosion and to provide thermal insulation close to the furnace. The refractory lined part of the first pass of the boiler will be designed to ensure that the specified

minimum residence time, temperature and oxygen content, after the last air/fuel injection, will be maintained.

83. At the fourth passes, the flue gases will then pass through three further stages containing heat exchangers: evaporator, super heater and economizer.

84. An evaporator tube buddle with less heating surface will be installed at the horizontal channel after the membrane walls. It will evaporate the boiler water to form wet steam and cool down the flue gas temperature to below 650℃, thus reduce the super heater corrosion by high temperature. The exhaust gas temperature from the evaporator is 190℃ to 230℃.

85. The super heater will heat the saturated steam from boiler barrel to form superheated steam which will increase efficiency of steam turbine. In normal power plant, the super heater is usually set at the radiation area to absorb radiation and convection heat. However, the super heater for waste incineration plant will be installed at the convection area to prevent corrosion by high temperature. The steam temperature will be controlled by the super heater water.

86. The economizer will be installed at the end part of the boiler to preheat the boiler feed water. It can reduce flue gas temperature and recovery heat thus increases boiler efficiency. In general, the gas temperature reduces 3℃ while the water temperature will raise 1℃. In order to keep the water bubbles outside the tube and to avoid the temperature inside too high damaging the tube materials, the water flow speed would be greater than 0.3m/s. The outlet of the economizer of the temperature will be lower than the saturated temperature (263℃) to avoid water stress and heat motion.

87. Ash removal device will be installed to clean ash on the super heater and economizer.

88. Some small amounts of boiler treatment chemicals including demineralized water and trisodium phosphate will be added to the boiler feed water to prevent corrosion and scale build up in the steam circuit. The chemicals amount will be controlled by pump. Each boiler set a dosing pump, a standby pump and two phosphate mixing boxes.

89. To ensure the quality of the steam, the boiler will be equipped with continuous blow down and regular outfall pipes. The blow down has a capacity of 278kg/h.

90. **Steam Turbine.** Superheat steam will drive the power generator set to convert heat energy into electricity. The system consists of steamer turbine, power generator, condenser, condensing pump, steam seal heater, low press heater and deaerator.

The steam turbine is single cylinder, condense and impulse type with three levels of non-regulated extraction of steam. The first level extraction of steam will be used for air preheater. The second level extraction of steam will used for deaerator and preheat water supply to 130℃. The third level extraction of steam will be used for preheat of condensation water. The air cooled generator with brushless excitation will be controlled by Digital Electro Hydraulic Control of Turbine (DEH) system.

91. The superheat steam generated by the 3 waste heat furnaces will be gathered into the main steam tube. Leads to two, respectively, in the main steam header pipe turbine main steam valve into two condensing steam turbine for power-driven generators. The exhaust into the condenser condensate as the condensate. By the condensate pump condensate pressure into pressure thermal deaerator. The 130℃ water supply in after oxygen from boiler feed pumps sent to the Heat Recovery Steam Generator (HRSG) run. The air preheater required heating steam extracted from the turbine extraction and drum. Heating and cooling the condensate is returned to the pressure deaerator.

92. The project has two steam turbines. There will be a steam bypass to the condenser, which will be used during start up and in the event of a failure of the steam turbine. The steam pipes will be provided with pressure relief valves, which will automatically activate in the unlikely event of the steam pressure exceeding a set level. The turbine will control the steam coming from the boiler by changing its rotation speed. The turbine hence 'follows' the steam production from the boiler.

d. Flue Gas Treatment

93. The semi dry and bag filter system would comprise reaction tower, lime injection, activated carbon injection, and bag filter. It will mainly use the dry lime to absorb the SO_2, HCl, SO_3, and use activated carbon to absorb the dioxin and heavy metals. NOx removal will adopt Selective Non Catalytic Reduction (SNCR) method which is to inject urea to the combustion chamber.

e. Evaporating Spray Tower/Reactor

94. Lime slurry with concentration of 15% will be nebulized to the size of 50micron drop at the top of the evaporating spray tower. The lime will be injected into the tower at the flue gases when they pass through the tower as a lime suspension. The tower will act as a reactor. Acid gas will react with lime that will generate $CaSO_4$ and$CaSO_3$.Flue gas leaving to the evaporating power will be diverted to bag house filter.

95. The flue gas leaving the boiler will still be relatively hot at approximately 210℃ and will be further cooled in the evaporating spray tower/reactor. The lower

temperature is required for the optimal operation of the activated carbon injection downstream, and to evaporate process water from the plant.

96. The salts contained in the water will be dried by evaporation in the spray tower/reactor and collected in the bag house filter as solid wastes for offsite disposal.

f. Activated Carbon/Clay Injection

97. Dioxins and furans are complex chlorinated hydrocarbon molecules, which are formed as a consequence of any combustion process. As described previously, the plant is designed to minimize the formation of dioxins by maintaining the flue gases at a high temperature (over 850℃) for over 2 seconds in the furnace and by rapidly cooling the gases from 450℃ to 250℃. These measures will reduce the dioxin concentration in the flue gases to a low level. The flue gas cleaning equipment will reduce dioxin concentrations in the flue gas to acceptable levels.

98. A fixed amount of activated carbon will be injected into the flue gas as it is leaving the evaporating spray reactor. Activated carbon consists of small, porous carbon particles, which due to their porosity have a very large surface area. The large surface area will adsorb heavy metals and trace levels of organics present in the flue gas, such as dioxins, furans, Polycyclic Aromatic Hydrocarbons (PAHs) and hydrocarbons. These carbon granules and other particulates, such as dust, will then be removed by filtration as the flue gases pass through the bag house filter.

g. Bag house Filter

99. The bag house filter will contain multiple filter bags in separate compartments. Maintenance and changing of filter bags will be done when the filter is on-line. The dust laden flue gases will be sucked from the outside (foul side) to the inside (clean side) of the filter bags leaving a dust cake on the outside of the bags. The pressure drop over the bags will increase as more dust accumulates. A reverse pulse of clean compressed air will be blown inside the bag as soon as a pre-set pressure drop set-point is reached. The airwave will inflate the bag and make the carbon and particulates on the outside crack and fall into collection hoppers below.

100. The particulates will consist primarily of fly ash carried over from the boiler and activated carbon. In addition, there would be un-reacted lime and salts from reaction of lime with acids from the flue gas in the reactor.

101. The project dust removal efficiency is about 99.8 %.

h. De-NOx

102. All combustion processes lead to the formation of nitrogen oxides (NOx). These substances are formed partly from combustion of the nitrogen fraction in the waste feed and partly from the oxidation of nitrogen in the combustion air. NOx formation will be controlled in two ways. Optimal combustion conditions in the furnace will minimize the oxidation of nitrogen in the combustion air. Mixing of the waste will also prevent localized high temperatures (and therefore higher NOx levels) in the furnace and cladding materials with suitable heat transfer properties will be used to give an optimal flue gas temperature. Secondly, in order to meet the strict NOx emission values, 'De-NOx' technology will be used. This technology uses the reaction of ammonia and nitrogen oxides at high temperature to convert the nitrogen oxides to nitrogen and water vapour. This reaction will be achieved by the injection of urea into the first section of the boiler. The urea will break down to form ammonia due to the temperature (approximately 900℃). The ammonia will then react with NOx to produce nitrogen and water. Throughout this process, the NOx levels will be monitored to optimize the quantity of ammonia solution/urea injected and ensure that emission values will be well within the PRC NOx emission limits and IFC's EHS emission guidelines. This technology of ammonia solution/urea injection is known as Selective Non Catalytic Reduction (SNCR). SNCR is a proven technology and experience has shown that it will attain the daily NOx emission limit of 200 mg/Nm^3.

$$CO(NH_2)_2+2NO+1/2O_2 \rightarrow 2N_2+CO_2+2H_2O$$

103. The urea solution tank is made of fiber reinforced plastics with vertical and flat bottom structure. The tank will be provided with liquid level and temperature indicators. It has a volume which can meet 7days usage. The urea will be lifted to the tank via the bucket elevator. After processing, 40% concentration urea solution will be made which will be stirred and heated to avoid the urea crystallization.

104. The urea solution will be sent to the dilution system via the transferring pump, the circulating transferring pump adopts one for use and another one for emergency. Due to the high viscidity, it is necessary to make sure the output volume and pressure of the circulating transferring pump stable. The resting urea will go back to the urea storage tank via the negative pressure control valve.

105. The measure device is adopted to control the volume and pressure of reactant and dilution water. The urea and water is sent to the injection gun after mixing by the static mixer.

106. The SNCR system will adjust the injection volume according to the signal from the Continuous Emissions Monitoring System (CEMS). Through the control of the SNCR system, it is designed that the NO_X emission concentration will be less than 200mg/Nm^3, the removal efficiency will be greater than 33.33%.

i. **Leachate treatment**

107. The project will generate about 120t of leachate per day. Leachate will be gathered and pre-treated through the process of Up flow Anaerobic Sludge Blanket (UASB) anaerobic reactor to membrane bioreactor (MBR)to ultra-filtration (UF) membrane. The design leachate treatment capacity is 300t/d. The pre-treated leachate will meet Shandong Provincial Wastewater Discharge Standard for Domestic Solid Waste Landfill (DB37/535-2005), and will be discharged to Binhai Wastewater Treatment Plant (WWTP) for further treatment to meet the Municipal WWTP Waste Discharge Standard (GB18918-2002). The treated water will be discharged to Luo River.

Table III.3 Leachate Pollutants Removal Efficiency

Process	Item	CODcr(mg/l)	BOD(mg/l)	NH_3-N(mg/l)	SS(mg/l)
Sediment tank	Influent	20000	5000	600	600
	Effluent	14000	3500	540	120
	Efficiency	30%	30%	10%	80%
UASB	Influent	14000	3500	540	120
	Effluent	4200	1225	378	84
	Efficiency	70%	65%	30%	30%
MBR	Influent	4200	1225	378	84
	Effluent	210	61.3	37.8	17
	Efficiency	95%	95%	90%	80%
Secondary ultra-filtration	Influent	210	61.3	37.8	17
	Effluent	84	18.4	11.3	8.5
	Efficiency	60%	70%	60%	50%
Standard CJ343-2010		≤300	≤ 150	≤35	≤ 400
Standard DB37/ 535－2005		100	20	15	70

j. Process Input

Municipal Solid Waste

108. Based from the forecast of the waste output from the Urban Planning of Zhangqiu city, the municipal waste output will be 735t/d in 2013 and the daily waste generated will be 1000t in 2016. With the development and planning of the industry zone, the waste output is expected to increase in several years. The complete details on the predicted waste generation in Zhangqiu city is shown in Table III.4

Table III.4 Predicted MSW Amount based from The Urban Planning of Zhangqiu City (2012)

Year	Population			Daily MSW Generated				Collection rate	Collected amount
	Total	Urban	Rural	Urban		Rural			
	$X10^4$	$X10^4$	$X10^4$	kg/person	t/d	kg/person	t/d		t/d
2010	101.51	48.00	53.51	0.80	384			0.65	250
2011	101.57	49.20	52.37	0.85	418	0.55	288	0.80	565
2012	101.64	50.45	51.19	0.90	454	0.60	307	0.85	647
2013	101.71	51.71	50.00	0.95	491	0.65	325	0.90	735
2014	101.77	52.96	48.81	1.00	530	0.70	342	0.95	828
2015	101.84	54.22	47.62	1.05	569	0.75	357	1.00	926
2016	101.90	55.47	46.43	1.10	610	0.80	371	1.00	982
2017	101.97	56.73	45.23	1.10	624	0.80	362	1.00	986
2018	102.03	57.99	44.04	1.10	638	0.80	352	1.00	990
2019	102.10	59.26	42.84	1.10	652	0.80	343	1.00	995
2020	102.16	60.00	42.16	1.10	660	0.80	337	1.00	997

109. According to the solid waste test report conducted by Environmental Hygiene Engineering Technology Centre (Attachment 37) on November 11, 2011, the composition and heat value of solid waste in Zhangqiu are listed in Table III.5.

Table III.5Composition and Heat Value of Solid Waste in Zhangqiu City

Item	Name		Weight in wet base%	Weight in dry base%
	Organic	Animal	1.59	2.44
		Vegetation	47.45	37.34
	Inorganic	Ash	0.14	0.21
		Brick/Ceramics	3.01	5.02
	Recycle	Paper	15.68	15.07
		Plastic Rubber	14.33	17.93
		Textile	5.07	5.35
		Glasses	0.96	2.21

Item	Name		Weight in wet base%	Weight in dry base%
		Metals	0.22	0.52
		Wood, bamboo	0.22	0.28
	Others		11.35	13.65

	Water content	Ash Content	C	H	N	O	S	CL
Dry base Composition (%)	—	30.82	37.36	5.38	1.23	21.06	0.39	0.15
Wet base composition (%)	58.59	15.42	15.42	2.22	0.50	8.73	0.16	0.06

High heating values (dry base)	14541.4kJ/kg	Low heating values (wet base)	4071.0kJ/kg
Standards	CJ/T313-2009		

110. After several days' storage in waste bunker, some of the water will leach out from the solid waste. The waste for combustion will have water content of about 50%. The waste composition is expected to be changed in the next ten years. With the increasing use of gas, coal and slag in the waste will be reduced, and the organic matter will increase. With rapid industrialization, the waste paper will increase, so the inflammable substance will also increase, which is good for incineration.

111. The project design lower caloric value is set as 6000kJ/kg. The tested fresh waste caloric value is 5106kJ/kg. The solid waste low heat value after processing is 5871kJ/kg.

Water Supply and Use

112. The major input to the process is waste for incineration. Other inputs include water, light fuel oil and reagents such as lime and activated carbon.

113. As the plant uses an air cooled condenser rather than cooling towers it will have a significantly lower water requirement than would otherwise be the case. The major water requirement will be for flue gas cleaning. Process water (for the steam cycle), domestic potable water and water for cleaning account for the rest of the demand. The expected water requirements are listed in the Table III.6.

Table III.6 Water Requirements

NO	Water use	Hourly (m^3/h)	Daily (m^3/d)	Annual ($x10^4m^3/a$)	note
1	Steam cycle evaporation	35.6	854.4	28.48	1.0% of cycle water
2	Steam cycle wind blow	3.56	85.44	2.85	0.1% of cycle water
3	Steam cycle waste discharge	14.24	341.76	11.39	0.4% of cycle water
4	Greening	0.88	21.18	0.70	

NO	Water use	Hourly (m^3/h)	Daily (m^3/d)	Annual ($x10^4m^3$/a)	note
5	Road and square cleaning	0.77	18.60	0.62	
6	Leachate treatment	1	24	0.72	
7	Chemical water	4.6	110.4	3.68	
8	Flue gas cleaning	2	48	1.6	
9	Water for equipment	58	1392	46.4	
10	Domestic supply	0.35	8.28	0.28	
11	Total	121	2904	96.72	——

Light Diesel Oil Consumption

114. The plant will use light diesel oil at start up to bring the furnaces to the required operating temperature of 850℃ as appropriate, the oil consumption is 381kg/h. The total annual consumption of ignition is 100 thousand tons. Light diesel oil will also be occasionally required as a supplementary fuel to maintain the temperature if waste of an exceptionally low calorific value is received. An automatic control system will bring light fuel oil on line should the temperature drop below 850℃ or 950℃ as appropriate. It will also be required for operation of the emergency power generator. The oil consumption will be 632kg/h. The total annual consumption of ignition is 200 thousand tons.

Other Input

115. Other inputs include sodium hydroxide (NaOH) solution, and hydrogen chloride (HCl) 30% solution in the demineralization, lime and activated carbon in the flue gas cleaning and urea in the de-NOx stage. The quantities of inputs will vary, depending on the calorific value of the waste and the flue gas cleaning equipment chosen. Estimated hourly consumption is indicated in Table III.7.

Table III.7 Estimate on Daily Consumption of Inputs

Name	Form	Storage	Storage capacity (t)	Consumption (t/a)
Lime (90%)	Solid	Tank	70	4350
Activate Carbon	Solid	Plastic Bag	1	100
Urea	Solid	Plastic bag	0.1	360
Scale inhibitor	Solid	Plastic Bag	0.3	20
NaOH	Liquid	Tank	0.18	12
Lubricating oil	Liquid	Oil barrel	0.05	6
HCl(30%)	Liquid	Tank	0.4	26

k. Process Outputs

Fly Ash

116. Boiler ash and flue gas cleaning residues will consist of compounds that will be carried over in vapor or particulate form from the combustion chamber. Fly ash generated from the project contains heavy metals of Pb, Hg, Cr, Cu, Ni, Cd. It must be separately collected and treated. Residues will be removed from the boiler and spray tower by an enclosed conveyor system and transferred to silos. The silos will be fitted with high efficiency particulate air (HEPA) filters to prevent dust emissions. The fly ash will be transferred to a collection truck and all trucks leaving the facility will be securely covered to prevent any ash escaping from the truck. Two fly ash silos will be sized at approximately 75m^3 each and will have the capacity to store 120t of residue which is equivalent to 5-7 days of residue (38.64t/d). This meets the PRC guideline which requires that ash silos should be designed with the capacity for storage of at least 3 days residue.

117. The project's fly ash will be solidified by the technology of blending with cement and chelating agent, and finally molded to form blocks. The ratio of fly ash, cement and chelating agent is 20:2:3. The solidification will be done in the plant area.

118. After the operation of the project, toxicity test for fly ash will be conducted. If the moisture content is less than 30%, the dioxin content is less than 3gTEQ/kg, due to the toxicity is lower than the regular limit, the fly ash will be sent to the landfill, or sent to the hazardous substance processing agency. The toxicity testing will also be done during the operation of the project. The percentage of fly ash to landfill or hazardous substance agency will be defined after toxicity test.

Bottom Ash

119. The bottom ash from the furnaces will be at a high temperature when it exits the furnaces. The bottom ash from the grate will be discharged into a water bath, and then via a conveyor to the ash bunker.

120. The bottom ash will consist of silicates, minerals, metal pieces and glass compounds. A metal separator (over-band rotating magnet), located on the last conveyor before the bottom ash bunker, will remove metals and transfer it to a separate compartment of the ash bunker. The recovery of metals from the bottom ash produced from the incineration process is a more efficient and cleaner process than removing metals from the incoming municipal waste stream and is common practice in incineration plants. The recovered metal from bottom ash is free of contaminants such as organics and plastics and is therefore more acceptable at recycling facilities than those metals that would be removed directly from the municipal waste stream.

Emissions from the incinerator will not be affected by the small quantity of metal in the waste stream.

121. The ash bunker is sized at 700m^3 (29.4m in length, 5.95m in width and 4m in depth) and will have the capacity of 490t. The bottom ash generation is 145.2t/d. The design capacity of the bunker can meet the PRC requirements that specifies that designed ash bunker should have a capacity for 3 days ash generation. Ash will be transferred from the bunker to collection trucks using a crane and hydraulic grab. The grab will be in an enclosed structure/loading bay and transfer will take place in an enclosed loading bay. All trucks leaving the facility will be securely covered to prevent any ash escaping from the trucks.

122. The bottom ash will be used to make bricks by the Zhangqiu Zhujin New Type Construction Material Company. Since slag is considered a good building material for it has higher fire resistance, heat preservation and heat insulation property. It does not only solve the problem of disposal but it also allows making some economic profit.

Electricity

123. The waste-to-energy plant will produce thermal energy produced by the combustion of the waste to produce electricity. The annual electricity generation is estimated as 125.01X10^6kWh, of which 26.25 X10^6kWh (c.a. 21%) will be used by the plant itself with the remainder, approximately 98.77 X10^6kWh (c.a. 79%) being exported to the national grid.

I. Description of Secondary Process/Activities

Emergency Generator

124. The proposed facility will have a sophisticated control system and back-up system for protection against events which could have the potential to damage plants, affect human health or the environment. In the event of a power cut, the facility will automatically shut down. During automatic shutdown, waste will be prevented from entering the furnace and most electrical/electronic equipment, motors and fans will cease operating except those which are required to cool the plant and provide emergency lighting. In the event of a power cut, however, these critical motors and fans will require an emergency power supply. This will be provided with a backup or emergency electrical generator powered by a diesel motor.

Uninterruptible Power Supply

125. In the unlikely event of a failure of the supply from the electrical distribution system, the plant's uninterruptible power supply (UPS) will supply electricity to the critical systems, such as the gas cleaning and computer systems. The UPS will be

designed to maintain a power supply to the control systems for 15 to 30 minutes until the emergency generator comes on line to supply electricity to motors, pumps and fans until the plant is safely shut down.

Storm water

126. The waste-to-energy facility when constructed will form a rainwater catchment area of approximately 3000m^2 consisting of roofed areas, roads, hardstands and those landscaped areas immediately adjacent to the facility. The storm water runoff will be discharged to the local drain. In order to prevent flooding of the local drains, the rate of discharge from the site will be controlled, the site will require the provision of attenuation to store and control the storm water discharges. The storm water attenuation tank with a capacity of 80m^3 has been designed. The storage volumes have been based on the storage required for peak rain water collection at rate of 5.10m^3/min over a 15-minute period.

Fire Water Retention

127. In accordance with Fire Prevention Law of the People's Republic of China, the facility is required to have a fire water management system for the retention and control of contaminated water generated when fighting a fire. This system applies to the process building, tank farm bund and the tanker unloading bays. High pressure water supply for fire hydrant system will be provided. The water capacity is 60L/s, the capacity and pressure are ensured by the firefighting tank and the hydrant water supply system. The main plant use the fire water cannons system (PSKD30 Model for water cannons), the water capacity is 60L/s, 2 PSKD30are provided for waste pit firefighting, the rate capacity is 30L/s with protective radius of 60m.

128. The fire alarm system consists of smart automatic warning system, smart temperature and smoke detective with location monitoring module, control module, alarm button and alarm ring. The operation room is set in the reception room, the smart alarm control and firefighting cabinets are provided. The alarm button are in all the inside hydrants in the plant area. Once the button is broken, the firefighting pump is started, and the monitor will show the location of the fire. The manual/auto control are set in the firefighting cabinets.

m. Site Management

129. When completed and fully operational, the plant will employ approximately 76 permanent personnel, some of whom will work in shifts as the plant will be operational 24 hours per day. Employed personnel will be grouped for the following functions:

- management and administration,
- operations,

- maintenance,
- quality control and assessment,
- shift operators for the waste-to-energy plant.

130. Initially, senior managerial staff will be sourced from experienced personnel. All other staff will be recruited locally prior to start-up. Among the 76 jobs which will be generated during Zhangqiu WTE plan to peration period, it is estimated that at least 20% can be provided to female staff, which are mainly laboratory, financial, and administration positions.

131. Key staff will be recruited prior to commissioning and will be trained by experienced personnel at a similar waste-to-energy plant. Training will also be carried out in cooperation with the waste-to-energy plant manufacturer and equipment designers and suppliers. As part of the contractual agreement, the incinerator manufacturer will be required to remain on-site for the first twelve months of operation, or until the facility has been fully commissioned. By doing this, the operators will become familiar with the equipment and learn first-hand from the equipment's design engineers. The plant's staff will be responsible for routine maintenance and inspections of the plant, maintenance budget planning, procurement of services and materials, managing and supervising repairs and overhauls, the upkeep of the management information system (MIS) and updating and renewing environmental and operating permits. Major machinery repairs and plant overhauls which cannot be done by the facility's staff will be subcontracted out to either local contractors or to the plant's equipment suppliers. On such occasions the hiring of special expertise or specialized equipment will be required. Through careful preparation and training, the plant staff will be prepared for every stage of construction, commissioning and operation of the proposed facility.

Security

132. Site security will be provided by a combination of suitable infrastructure and security personnel. It is proposed that the site entrance will have a security entrance gate. There will be a security fence consisting of brick fencing around the plant. There will be closed circuit television (CCTV) cameras located at suitable points around the site. Some of these will be mounted on camera towers. The exact number and location of the cameras will be reviewed on an ongoing basis. A record will be kept of all visitors to the site. Visitors will be monitored and supervised at all times.

133. Site Tidiness Litter patrols will be conducted by the staff within the facility, around the site and on the public road adjacent to the facility to ensure that litter will not cause a problem.

n. Health & Safety

Design and Construction Health and Safety

134. The proposed facility will be designed in accordance with the PRC and international safety and health guidelines. The following principles will be incorporated into the design of the proposed facility.

- The plant will be designed by skilled personnel according to internationally recognized standards, design codes, legislation, good practice and experience.
- The design will be reviewed to check for safety hazards in steady and non-steady state conditions and for ease of operability. Backup systems for pumps, control systems, power supply and instruments etc. are provided for critical situations.
- Fire detection and firefighting systems are provided;
- The design will comply with PRC Guidelines.

135. The installation will be validated as part of commissioning procedures and the installation will be well maintained and cleaned. The plant will apply strict rules on safety such as a working permit system, training of operators and staff, and provision and use of personal protection equipment. The plant will strive to minimize human interaction in safety critical operations in order to eliminate the potential for 'human factors' to initiate or exacerbate major accidents at the site. It is the policy of Dynagreen to attach the greatest importance to the health and safety of all persons employed on the project and indirectly affected by the works. All construction projects will be carried out, in such a way that the risks to the health and safety of all persons engaged in, or affected by, its construction and maintenance are eliminated or reduced to an acceptable level under current health and safety legislation, namely the Safety, Health and Welfare at Work Act 2005 and international good practice. The Dynagreen employs consultants to act as health and safety coordinators on larger projects. Dynagreen also employs a full time, fully qualified Health and Safety Officer who is responsible for ensuring that relevant legislation is adhered to and that best practice in health and safety is employed and enforced during construction.

General Operational Safety

136. The operation of the waste-to-energy plant will involve hazards associated with the handling of combustible materials, chemicals and high-pressure steam. During the detailed design phase of the plant, hazard and operability studies will be carried out. These studies are a systematic method of identifying hazards and assessing mitigation measures.

137. Dynagreen operates a combined Quality, Environmental, Safety and Health (QESH) Management System. The proposed facility will operate to ISO 9001:2000

and ISO 14001, the internationally recognized quality and environmental management system standards.

138. The QESH policies are the top-level documents of each element of the system. They define Dynagreen's overall aims and objectives with respect to the provision of a quality service to customers, the provision of a quality workplace to employees and the control over the environmental and health and safety impacts of its activities respectively.

139. Dynagreen maintains a Register of Environmental Aspects, which identifies the aspects of Dynagreen's activities that can interact with the environment and determines where controls are required. Dynagreen also carries out Health and Safety Risk Assessments in order to identify the health and safety hazards associated with Dynagreen's activities and to determine where controls are required. Both the Register of Environmental Aspects and the Health and Safety Risk Assessments will be updated to incorporate the activities at the proposed facility. Prior to start-up of the incineration plant, a comprehensive set of operating procedures covering all aspects of the different activities will be drawn up.

140. Dynagreen will draw up a safety statement covering the operation of the plant and appoint safety representatives from the plant workforce. Employees represent Dynagreen's greatest asset. By providing opportunities, facilities and financial resources, Dynagreen aims to ensure that all members of staff are in possession of the knowledge, skills and experience necessary to perform their jobs to a satisfactory standard.

141. The incineration process will be controlled manually and automatically by employees and a computerized control system in the control room. Through recruitment, training, performance management, employee development and succession planning, Dynagreen provides employees with sufficient training, experience and knowledge for their roles and ensures that they are competent to perform them.

o. Emergency Response Planning

142. A Site Emergency Plan will be prepared prior to operational start-up, which will set out the response measures to be taken by personnel in the event of an emergency. These measures will be designed to ensure maximum protection for the site employees, site visitors and people in other premises near the site, to limit property damage and to minimize the impact on site operations and on the environment. The Site Emergency Plan will have four basic components, as listed below.

Prevention

143. Prevention involves identifying potential hazards and then taking measures to remove the hazard, or reduce the potential for the hazard and its adverse effects.

Preparedness

144. Emergency planning, training programmes, emergency drill and exercise programmes are integral components of an effective preparedness programme. The site will have a dedicated 'emergency response team', which will be given specific training. Evacuation routes will be defined and all personnel will be aware of them.

Response

145. The site will be manned on a continuous basis except during shut-down periods when there will be a maintenance and security presence. Response activities address the immediate and short-term effects of an emergency.

Recovery

146. Recovery activities and programmes involve restoration of site services and systems to normal status.

Chapter IV DESCRIPTION OF THE ENVIRONMENT

147. The description of the baseline environment (biophysical and socio-economic) establishes (i) the environmental setting within which the project will be implemented, and (ii) the environmental values which will be changed (either negatively or positively) by the project.

148. The baseline environmental survey undertaken for the project was determined by the environmental parameters which were relevant to impact assessment.

A. Regional Environmental Setting

1. Location

149. Zhangqiu City (E117° 10′ ～E117° 25′ , N36° 25′ ～N37° 09′) is located in the middle of Shandong Province and is under the administration of Jinan Municipality. It connects Zibo City in the east, Zouping County in the northeast, Licheng District in the west, and Laiwu City in the south. Jiyang is to the opposite of the Yellow River. The total area of Zhangqiu City is 1699km^2, with 70km long from north to south and 37km wide from east to the west. The map showing the location of the project is Attachment 36.

150. The proposed BOT project of Zhangqiu domestic waste incineration power plant lies to the northeast of the existing waste treatment plant, located in the southeast of Houjia Village in Mingshui Street of Zhangqiu City. The topography of the project site is flat, with a few farmland and forest. There are also several temporary buildings around the proposed site.

151. Provincial road S102 is 500km far from the proposed site. A 500m long incoming road for the plant will be built and connected to the existing incoming road of Zhangqiu domestic waste treatment plant. The distance of the plant to the center of the city is 5km, with convenient transport condition.

2. Landform

152. Zhangqiu City inclines from the southeast to the northwest. Tai mountainous region, piedmont alluvial plain and northern piedmont alluvial plain range from south to north in sequence. Its south and southeast are mainly mountainous areas, with sea level elevation of 200-800m, accounting for 31% of the whole city area. Hills dominate the area between Changcheng Ridge and Changbai Mountain, whose sea level elevation is 50-200m, accounting for 26% of the total city area. Plain lies in the north

with a gradient of 1/300 and sea level elevation of 15-50m, accounting for 43% of the total city area. The highest sea level among the city is 924m, while the lowest is 15m.

153. In terms of regional tectonics, the northern Zhangqiu city belongs to Jiyang Depression, and the south belongs to Luxi Upwelling Area. Monocline rock stratum consists the main geological structure, majority of which are fault blocks and with little folds.

154. The project area is located in the piedmont alluvial incline plain. The terrain is flat, higher in the south and lower in the north. The natural grade is less than 1.0%. The earthquake resistance intensity is 6（Richter scale）. The quaternary coverage is thin and mainly consists of clayey soil, which will not cause collapse, landslide, mud-rock flow, karst collapse and surface subsidence.

3. Geology

155. According to the comprehensive drilling analysis conducted by Shandong Academy of Environmental Science, the rock and soil are divided into three strata within the drilling depth as follows:

- Plain fill (Q_4^{ml}): the layer disperses among the site. It is 0.50－3.80m thick, and the bottom elevation is 260.13－318.38m. It is yellowish-brown, loose and a little humid, and mainly consists of clayey soil, with some lime-ash, brick filling and roots.

- Strongly weathered basalt (J1): The layer is stable within the site area without exposure. The largest disclosure thickness is 9.50m. The core recovery is around 65%. The rock quality index is extremely poor (RQD＜25), and the rock basic quality level is V. It is grey-green, intense weathered and the core is crushed. It mainly consists of mafic feldspar and pyroxene forming porphyritic structure, with pores and joints, and is fragile.

- Moderately weathered basalt (J1): The layer is stable within the site area without exposure. The largest disclosure thickness is 2.00 m. The core recovery is around 75%. The rock quality index is poor (RQD=65), and the rock basic quality level is V. It is grey-green, moderately weathered and the core is completed. It mainly consists of mafic feldspar and pyroxene forming porphyritic structure, with fragility.

156. According to the Geotechnical Engineering Investigation Report of Zhangqiu Domestic Waste Sanitary Landfill Project, there is no unfavorable geological condition in and around the project site. The site is stable and suitable for construction.

157. According to the Geological Hazard Assessment Report of Zhangqiu Domestic Waste Treatment Project prepared by Shandong Zhengyuan Construction Company Ltd, mesozoic crustal movement (Yanshan Movement) brought about incline and fault for the horizontal stratum deposit deposited in the Paleozoic Era and Mesozoic Era. The regional stability is closely related to the revivification of the fault structure.

- Wenzu Fault: 9km far away from the assessment area. It ranges from the Mount Tai group metamorphic zone in the upstream of Laiwu City to Ludi Village-Xitianguang-Wnzu-Shanzhouzhuang, incising the whole Paleozoic stratum. It lies under the quaternary layer from the north of Xilanggou. The total length is 36km, 22km of which is exposed. The general grade of the fault is about 330°, inclining from southwest with an angle of 72°, which is normal fault. The southwest stratum of the fault descends and shifts to the south, and the occurrence varies in accordance with the inclination of the fault. The occurrence of the east stratum is stable. The shift range of the southern section is larger than the north section of the two parts. Ordovician connects to Permian System with a level difference of 650m in south section. The north section is in the Permian System, and the stratigraphic difference is 220m. The west of the fault inclines to Sanyuan Village, and the east inclines to Donglanggou.

- Yuwang Mountain Fault: locates 22km to the east of the assessment area. It lies in the southern Zhou Village of Zibo City, ranging from eastern Houtaishi to eastern Jinshan Mountain. The east of Jishan Mountain is covered by quaternary system, and the fracture surface inclines to the east with an angle of 58° (normal fault). Its east plate descends while west plate ascends. The two layers belong to Jurassic system, with a level difference of 340-1000m and the fault zone is 100-200m long. The rocks are broken and filled by calcite vein. The east plate is dragging fiercely and is somehow moving to the south.

4. Earthquake

158. Huge earthquakes always happen in deep and large fault zones. The Yanlu Fault and Liaokao Fault within Shandong Province control the occurrence of huge earthquakes. The assessment area, located in the blank space of seismic center grid, is 115km away from Yishu Fault to the east and 130km away from Liaokao Fault to the west. Thus, earthquakes in the past are in small scale and low magnitude.

159. According to China Seismic Motion Parameter Zoning Map (GB18306—2001), the seismic peak acceleration within the area is 0.05g and the corresponding basic intensity is VI, which belongs to regional crust stable zone.

160. According to regional geological materials and the Geotechnical Engineering Investigation Report of Zhangqiu Domestic Waste Sanitary Landfill Project, there is no tectonic activity within the assessment area, hence there is no condition for ground

fracture, collapse, landslide, mud-rock flow, karst collapse and mined-out area breakdown. The geological hazard risk is assessed as small.

161. Generally, there is no unfavorable geological process within the proposed site and its periphery. It is stable and suitable for the construction of the project.

5. Hydrogeology

- **Regional Hydrogeology**

162. Hydrogeological features vary due to the geological, landform and lithological differences. Therefore, the regional ground water can be divided into three types according to the groundwater storage conditions, water-physical property and hydraulic characteristics: loose rock pore fissure water, clasolite pore fissure water and bedrock fissure water.

163. Loose rock pore fissure water mainly distributes in the southern mountain valley and inclined plain in front of mountains. In the mountainous valley there is mainly alluvial layer voids phreatic water, which has single and unstable aquifer. The water-containing lithology is mainly calcareous concretion loess-like clayey sand with grit, gravel and gravel layer. All of them are lenticular, narrow and thin (less than 5m). Confined by topography and landform, it has good runoff condition, water permeability and storage while weak water abundance; the single well water inflow is less than 500m^3/d. The ground water is supplemented by rainfall, varying with changes of seasons, and the buried depth is 5-12m. The water quality of the ground water (heavy carbonate type water) is good, the mineralization degree of which is less than 1g/L. In the inclined plain in front of mountains, the ground water mainly includes alluvial layer voids phreatic water and pressure water. The area is the alluvial-pluvial fan of Balou River, and medium sands, coarse sands as well as sand gravel consist of the aquifer. Horizontally, the aquifer is lenticular; vertically, it is zonal distributed. The aquifer of the alluvial-pluvial fan varies from single layer to multiple layers from its head to the front, and its axis to both sides. The layer gets thinner, and the thickness is 10-15m. The particle gets smaller, and the water-containing property gets weaker. The water buried depth is 8-17m, and the single well water inflow is 1000-3000m^3/d. The annual variation amplitude of water level in front of mountains is 3-4m, and 1-2m in the place where is far away from the mountains. The mineralization degree is less than 0.5g/L and belongs to calcium bicarbonate type water.

164. Clasolite pore fissure water is mainly exposed within the area. Its aquifer includes clay rock, shale, sandstone and glutenite in Permian System. The rock structure is intense, and water buried level is higher than 5m and top to more than 10m in high land. The pressure water head is high in those deeply buried section. With medium water yield property, the single well water inflow is less than 100m^3/d,

and some part are 100-500m^3/d. The water quality is good, and mineralization degree is less than 0.5g/L, dominated by heavily calcium bicarbonate type water.

165. Bedrock fissure water: the majority of the water spreads in the middle of the area. Its aquifer includes andesite in cretaceous system, Anshan basalt, tuff, volcanic agglomerate and olivine basalt in neogene system. Rocks contain undeveloped fissure and vesicular structure, and the thickness of weathered zone is 3-7m. The water-containing is poor, and the single well water inflow is less than 100m^3/d. However, due to its structure, the water yield property will be strengthened in sections where rocks are broken and converging conditions are good, and the single well water inflow will be more than 100m^3/d. There is no unified groundwater level, while most of them are deeper than 30-40m. The water quality is good, and its mineralization degree is less than 0.5g/L (bicarbonate water).

166. According to the geological investigation, the regional ground water is mainly quaternary pore phreatic water and bedrock fissure water. The aquifer of the former one mainly includes sand gravel layer in riverbed, and the aquifer of the latter one is mainly basalt of Yanshan Period in Mesozoic. The water-containing and transmissibility vary according to different lithology and developing degree of fissure, which brings about inhomogeneity of its water yield property.

167. Drilling and water injection test conducted by Shandong Academy of Environmental Science shows that the permeability coefficient of the filling and the bedrock is 7.42×10^{-3}cm/s and 7.44×10^{-5}m/s respectively. According to the test data, the filling is mid-permeable stratum while basalt is slight-permeable stratum. Details are shown in Table IV.1.

Table IV.1 Outputs of drilling and water injection test

Bore No.	Length of the tested segment （m）	Height of the water head h(m)	Stable water injection Q （m3/d）	Formation lithology	Permeability Coefficient K	
					m/d	Cm/s
3	3.0	2.5	0.141	Filling	0.641	7.42×10-3
12	2.5	2.0	0.023	Bedrock	0.0643	7.44×10-5
Note: Equation adopted $K=\frac{0.366Q}{Lh}\lg\frac{2h}{r}$						

According to the above parameters, the permeable stratum of the area is 3.8-5.9m thick.

168. No groundwater is discovered during the investigation. Testing on water from wells of nearby village and combining the water quality analysis materials, the groundwater is identified as sulfuric acid heavy calcium carbonate magnesium water, whose pH is 7.74 and mineralization degree is 659.88mg/L. The amount of sulfate is 268.13mg/L.

- **Project Area Hydrogeology**

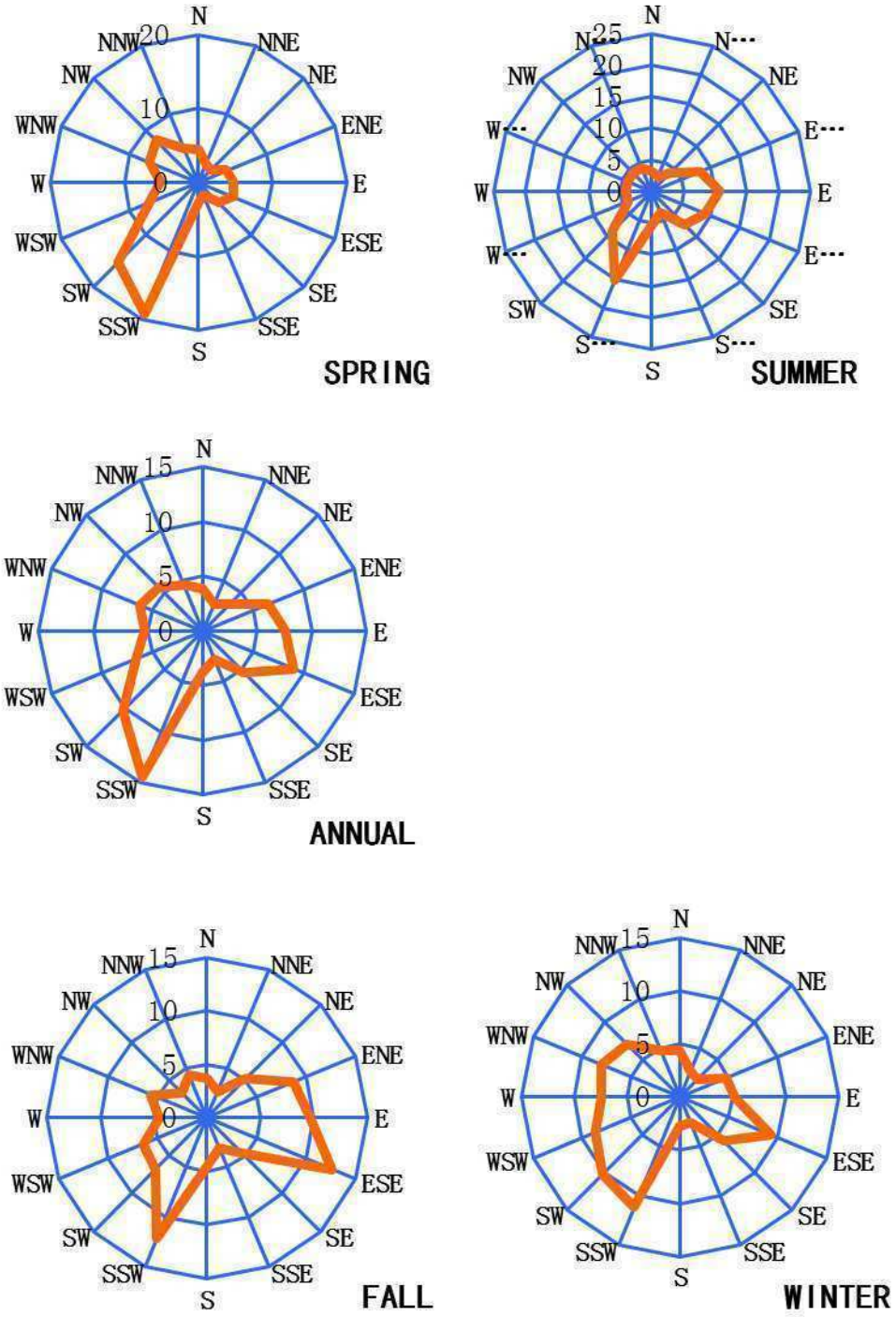
169. According to the Water Source Protection Plan of Zhangqiu City, the first level of surface drinking water protection area refers to Mingshui Lake, Baiyun Lake, Haishan Lake and the surrounding protection area within the urban area.

170. The spring groundwater supply area of Zhangqiu City includes four towns in southeast Zhangqiu (Duozhuang, Wenzu, Caofan, Guanzhuang) and hilly areas of Shuangshan and Fucun subdistrict offices. The water sources of Zhangqiu are Hetao Water Plant in southeast urban area, Shengjin Water Plant in in west urban area and Duozhuang Water Plant in southern urban area, which is the reserved water resource.

171. The proposed project is located in the northeast of Zhangqiu City, and is 15km to the downstream of its water source. The groundwater of the project area flows from the northeast to the southwest. The plant site is within the downstream far away from the water source, and is not in associated protection zone; besides, it is not hydraulically connected to the surface water around and shallow groundwater, hence the proposed project will not largely impact the groundwater source.

6. **Climate**

172. Zhangqiu City is a mid-latitude city with continental climate in warm temperate monsoon zone which has four distinctive seasons. Summer is from May to July, spring is from February to April. Autumn is from August to October and winter is from November to January. The area is a mid-humid climate region with an annual average temperature of 12.9℃, annual average precipitation of 603.9mm, annual maximum precipitation of 1121.6mm, annual minimum precipitation of 280.1mm and daily maximum precipitation of 166.7mm. Its seasonal precipitation unevenly distributes due to monsoon—precipitation in spring accounts for 13% of its annual total, and precipitation in summer accounts for 65% concentrating in July and August, while the precipitation in winter is less than 10mm. The rainfall distribution decreases from south to north. The time of sunshine is long in the area and the air is dry, thus its evaporation is larger than precipitation. The annual average evaporation is 2038.8mm, monthly maximum evaporation is 464.3mm and its monthly minimum evaporation is 28.8mm. The predominant wind direction is south-south-west (SSW), with a frequency of 17.81%, annual average speed of 3.2M/S, and annual maximum of 33.3M/S. It also has a tundra maximum thickness of 0.5m, snow depth of 0.40m, hottest month underground of 0.8m, and soil temperature of 27.7ºC. The wind rose diagram is shown below



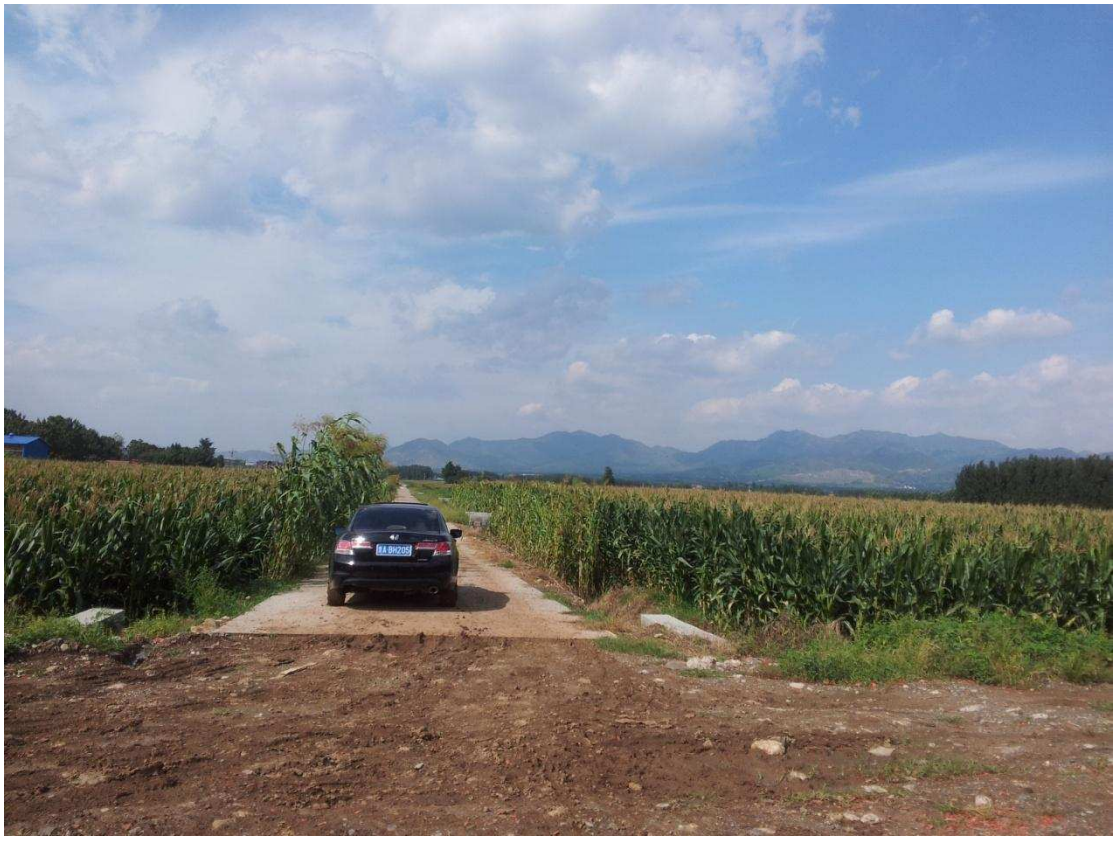
The wind rose diagrams of project（2012）

7. Ecological environment

173. The regional ecology of the project area is agricultural ecology. Due to historical influence and human activities, there is no original natural vegetation in the area, and most soil is covered by cultivated plants. The current vegetation is

secondary vegetation, dominated by artificial vegetation including cultivated and manual forest vegetation. Agricultural crops consist of the main vegetation with natural herbaceous vegetation inset in, forming a group of arbor, shrub and herbal vegetation. Arbor mainly refers to fast-growing deciduous and hardwood species; shrub includes mulberry, amorphafruticosa, Chinese rose, euonymus and buxus; herbal vegetation includes cultivated plants and natural herbal plants (cultivated plants are mainly wheat, corn, peanut and sweet potato, and natural herbal plants are mainly annual and perennial plants including sheep fescue etc.).

174. Vegetation in the assessment area is mainly cultivated plants and natural herbal plants including wheat, corn, peanut and sweet potato. There is no state protected and precious endangered animal and plant. The pictures below show the vegetation in the project area.



8. Cultural heritage

175. There is no natural protected area, resort or cultural heritage within the project area.

B. Social environment

176. The proposed project is located in Puji Town of Zhangqiu City. Zhangqiu City is in the central area of Shandong Province and is 45km away from Jinan. Mount Tai lies to the south and the Yellow River is in the north. The total area of the City is 1855km^2, administrating 20 towns/townships, 2 sub-districts, 908 administrative villages; and the total population is 989,000. Zhangqiu is the birthplace of “Longshan Culture” whose history could be traced back to 8000 years ago. It is culturally famous for Li Qingzhao (a female poet in Song Dynasty) and Li Kaixian (a dramatist in Ming Dynasty). Natural sites and historical relics in the City include Baimai Spring, Baiyun Lake, Qixing Platform, Chengzi Cliff, Dongping Tomb and Great Wall of Qi. Zhangqiu City also has a solid industrial foundation, forming the industrial structure led by high-tech industries of electronic information, biological pharmacy and fine chemistry, supported by energy and power, machinery, light industry and construction material, medical chemistry and textile and garment.

177. The Gross Domestic Product (GDP) of the city in 2010 is RMB 50.06 billion Yuan based on the study conducted by Zhangqiu Municipal People’s Government. The three industries portion of which is 10.8:57.2:32. Its fiscal revenue reached RMB

2.89 billion Yuan, increasing by 25.3%. The fixed assets investment amount to RMB 27.34 billion Yuan, increasing by 20%. The comprehensive strength maintains top 50 among national county regions. Its total food production amounts to 679,000 tons, increasing by 2.9% and achieving an 8-year production increase. The amount of industrial enterprises above the designated scale in 2010 is 501 (54 more than that of last year), the total sales revenue of which increased by 20% to RMB 90.14 billion Yuan. The industrial added value increased by 17.2% to RMB 23.83 billion Yuan. Regarding service industry, its added value reached RMB 16.01 billion Yuan (increased by 14%) in 2010, and the portion in GDP increased by 2.1% than last year. In 2010, the urban per capita disposable income is RMB 16,906 Yuan, increasing by 12.6%; and the rural per capita net income is RMB 10,138 Yuan, increasing by 10.3%. There are 5266 new urban employees and 11770 transferred rural labor force. The city ranked 38 among the 100 national scientifically developing mid and small sized cities in 2010.

C. Environmental quality

1. Ambient Air

a. Routine Monitoring Results

178. The EIA collected the project area SO_2, NO_2 and PM_{10} monitoring results from 2011 to 2012 which was conducted by Zhangqiu Monitoring Station. The distance of sampling sites to the project site is around 1-10 km. The daily concentration of SO_2, NO_2 and PM_{10} are shown in Table IV.2.

Table IV.2 Air Quality from January 2011 to February 2012 (unit: mg/m^3)

Monitoring time	Location: Guangnan Reservoir		
	SO_2	NO_2	PM_{10}
January 2011	0.056	0.041	0.089
February 2011	0.065	0.047	0.09
March 2011	0.06	0.041	0.087
April 2011	0.046	0.027	0.075
May 2011	0.042	0.019	0.064
June 2011	0.025	0.017	0.069
July 2011	0.027	0.024	0.045
August 2011	0.024	0.027	0.043
September 2011	0.039	0.028	0.072
October 2011	0.045	0.036	0.075
November 2011	0.054	0.035	0.082
December 2011	0.054	0.043	0.071
January 2012	0.067	0.04	0.09
February 2012	0.067	0.043	0.082

179. From Table IV.2 and Figures IV.1 to IV.3, it can be seen that concentration during heating season is higher than that of non-heating seasons. Winter is heating season because of the heating system for local citizen while non-heating season is spring, summer and autumn.

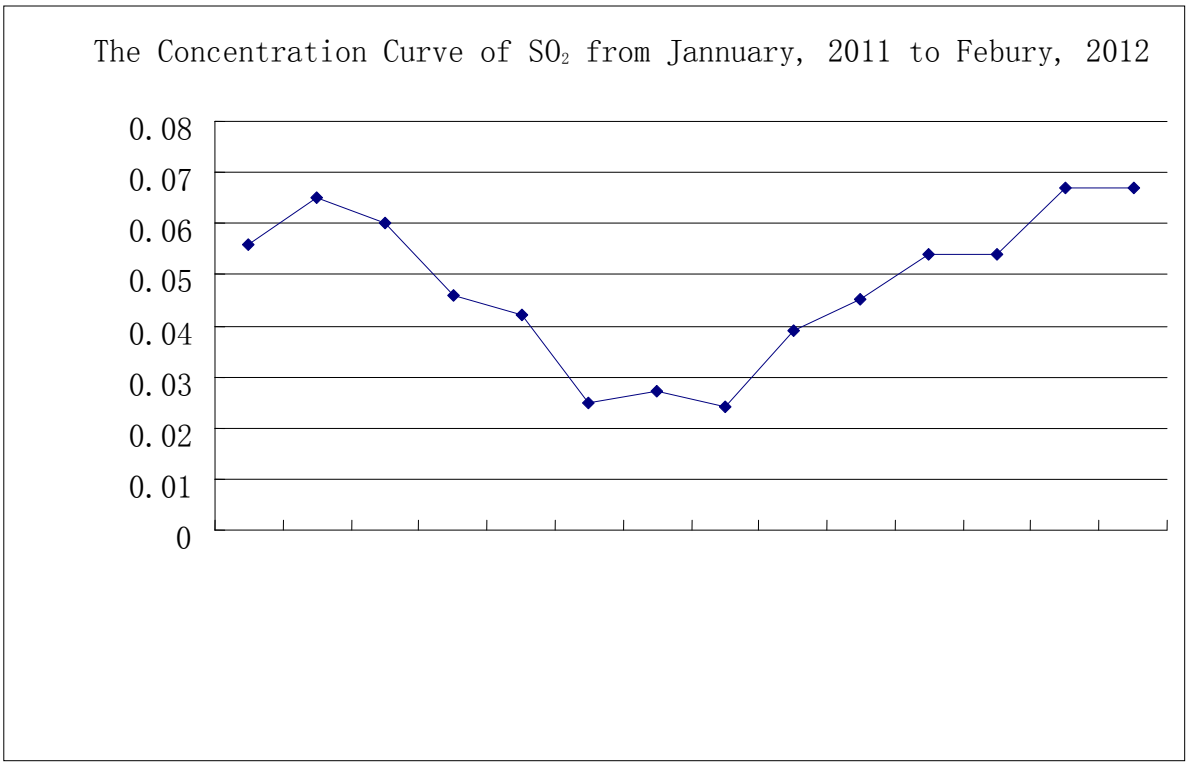


Figure IV.1SO_2 Concentration curve from January 2011 to February 2012

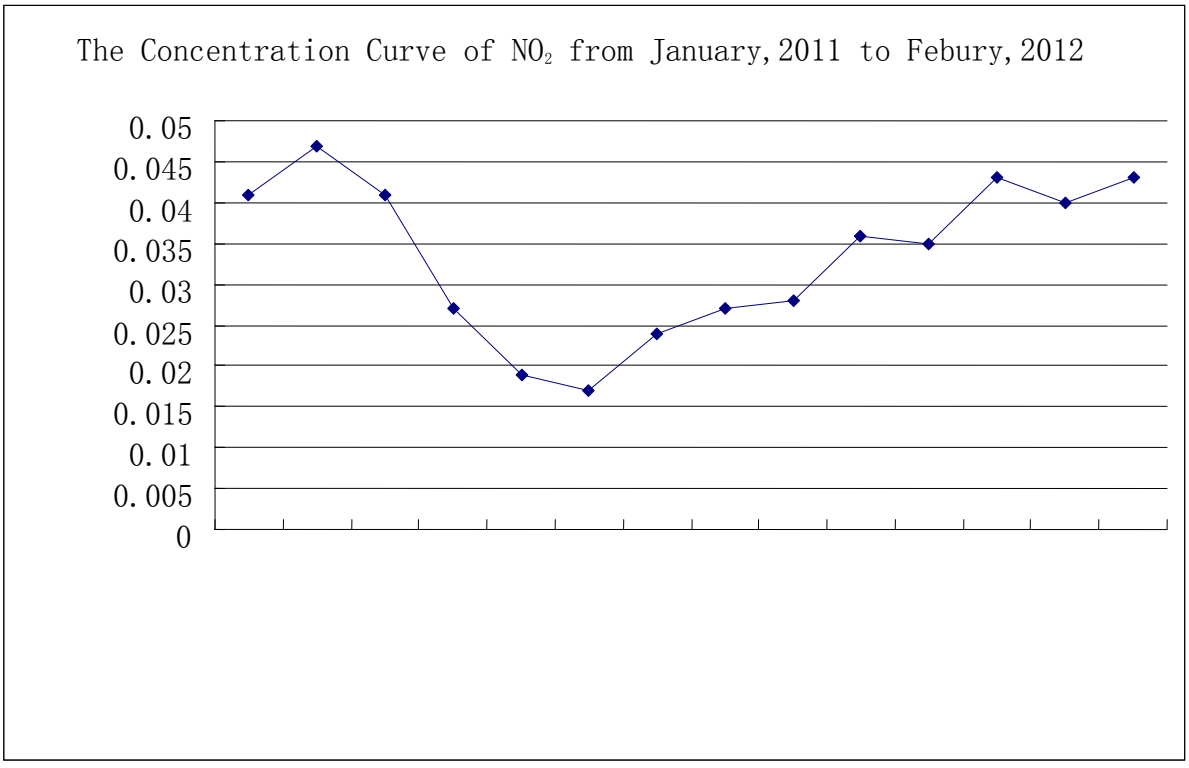


Figure IV.2 NO_2 concentration curve from January 2011 to February 2012

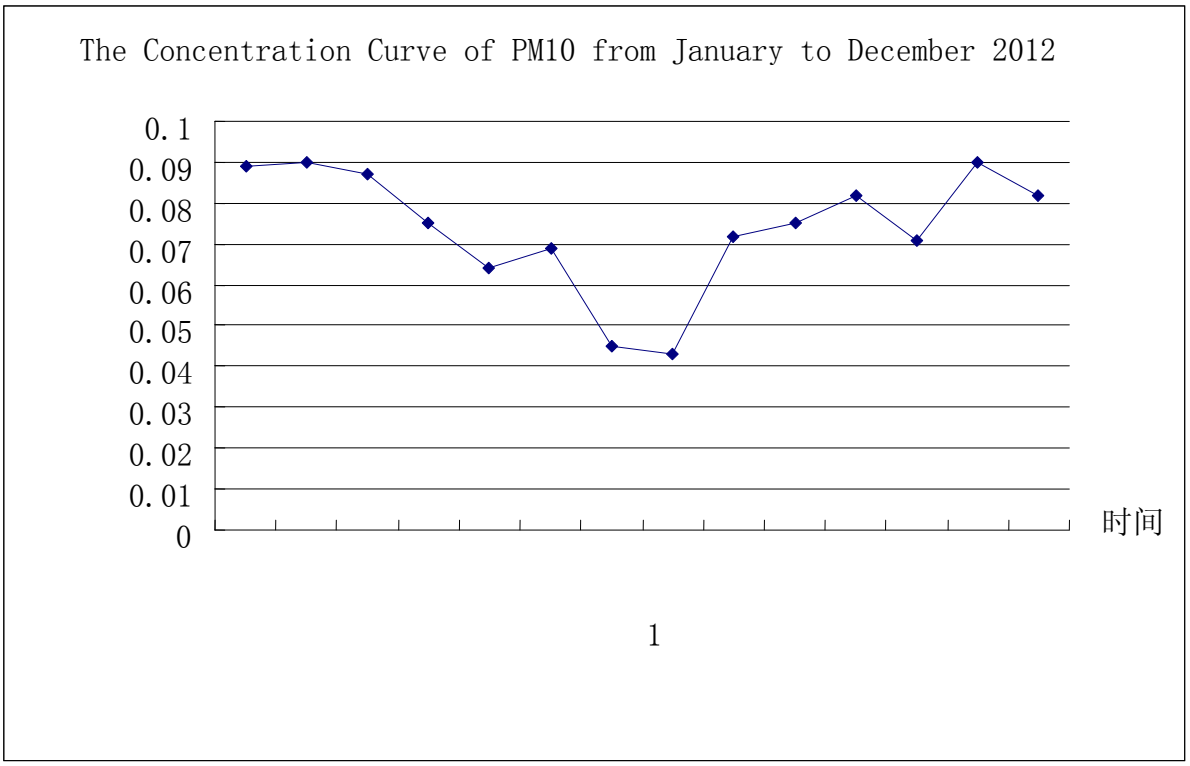


Figure IV.3 PM10 concentration curve from January 2011 to December2012

b. Air Quality Monitoring for the EIA

180. According to the requirement of guideline HJ2.2-2008, environmental monitoring results should indicate the real air quality situation. During selection of environmental monitoring sites, various factors should be taken into account including project scale, topography of project site, location of air sensitive sites, dominant wind direction and frequency, environmental function zoning and location of possible high concentration area. By using polar coordinate method, 6 monitoring sites were selected. The location for air quality monitoring location and parameters is shown in Attachment 36.

Table IV.3 Air Quality Monitoring Location and Parameters

No.	Name	Direction	Distance from plant boundary(m)	Parameters
1#	Wangzhong village	S	510	SO_2, NO_2, TSP, PM10, HCl, Hg, Cd, Pb, Fluoride, NH_3, H2S,CH_3SH and odor
2#	Xiushui village	SW	1900	SO_2,NO_2,TSP,PM10,HCl,Hg,Cd, Pb, Fluoride
3#	Houjia village	N	560	SO_2,NO_2,TSP,PM10,HCl,Hg,Cd, Pb, Fluoride, NH_3, H2S, CH_3SH and odor
4#	Taiping village	NE	600	SO_2,NO_2,TSP,PM10
5#	Jujia village	NE	1850	SO_2,NO_2,TSP,PM10,HCl,Hg,Cd, Pb, Fluoride

No.	Name	Direction	Distance from plant boundary(m)	Parameters
6#	Chizitou village	SE	1600	SO_2,NO_2,TSP,PM10

181. **Monitoring Unit:** the air quality monitoring was conducted by Shandong Provincial Test Center during the period of February 29, 2012 to March 6, 2012.

182. **Monitoring period:** SO2, NO2, TSP, PM10, NH3, H2S and CH3SH were monitored for 7 days, HCl, Hg, Cd, Pb and Fluoride was monitored for 3 days, and odor was monitored for 2 days.

183. **Monitoring frequency:** Continuous monitoring equipment was used to conduct the ambient air quality monitoring. In cases where continuous monitoring cannot be conducted, at least 4 times of SO_2, NO_2 and fluoride monitoring should be conducted at hours of 02:00, 08:00, 14:00 and 20:00. For SO_2, NO_2 and fluoride hourly concentration, the monitoring should include at least 45min sampling data. For SO_2 and NO_2 daily concentration, the monitoring should include at least 18 hours sampling data. For fluoride daily concentration, the monitoring should include at least 12 hours sampling data. For HCl, Hg, Cd, Pb daily concentration monitoring, 18 hours sampling is required; for HCl, Cd, NH_3, H_2S and CH_3SHhourly concentration, at least 4 times sampling is required at 02:00, 08:00, 14:00 and 20:00. O_3 monitoring should be conducted at least twice.

184. During air quality monitoring, meteorology parameters including wind direction, wind speed, total cloud, lower cloud, temperature, humidity, and atmospheric pressure are also recorded.

Table IV.4 Monitoring Methodology

Parameters	Standard	Methodology	Detection limit
SO2	HJ/T 482-2009	Formaldehyde absorption - Pararosaniline Spectrophotometry	Hourly:0.007 mg/m3; daily:0.004 mg/m3
NO2	HJ/T 479-2009	Naphthyl ethylenediamine dihydrochloride spectrophotometric method	Hourly:0.010 mg/m3 Daily:0.006
TSP	GB/T 15432-1995	Gravimetric method	0.001mg/m3
PM10	HJ 618-2011	Determination of the concentration of airborne particulate	0.001 mg/m3
HCl	HJ/T 27-1999	Mercury thiocyanate spectrophotometry	Hourly:0.02 mg/m3 Daily:0.004 mg/m3

Parameters	Standard	Methodology	Detection limit
Pb	Ambient air and waste gas monitoring and analysis method(4th edition)	Atomic absorption spectroscopy	0.0005 mg/m^3
Cd	Ambient air and waste gas monitoring and analysis method(4th edition)	Atomic absorption spectroscopy	0.00005 mg/m^3
Hg	Ambient air and waste gas monitoring and analysis method(4th edition)	atomic fluorescence spectrometric method	0.003μg/m^3
Fluoride	GB/T 15434-1995	Fluoride ion selective electrode assay	0.9 μg/m^3
CH3SH	GB18056-2000	p-amino-N, N-dimethylaniline colorimetric method	0.0002 mg/m^3
NH3	HJ 533-2009	Nessler's reagent colorimetry	0.05 mg/m^3
H2S	GB/T11742-1989	Methylene blue spectrophotometric method	0.002 mg/m^3
Industry noise	GB 12348-2008	The factory boundary noise emission standards	--
Ambient noise	GB 3096-2008	Acoustic Environmental Standard	--
Odor	GB/T14675-1993	Triangle Odor Bag	10

185. **Monitoring Results:** Ambient air quality baseline monitoring data indicates that particulate matter (represented by TSP and PM10) was the main air quality problem at the 6 locations monitored from 29thFebruary to 6th March 2012. Of the monitoring results, 57.14% exceeded GB 3095-1996Class II standards for TSP, and 69.05% exceeded GB 3095-1996 Class II standards for PM10, as well as World Bank Group EHS Interim Guidelines. Of the 6 sites monitored, three (Xiushui village, Houjia village and Wangzhong village) showed higher levels of TSP and PM10 than the others because of traffic, industrial development and local weather condition. Details are shown in Table IV.5.

TableIV.5 : Ambient Air Quality Monitoring Data (unit: mg/m^{3}except ug/m^3 for Hg and no unit for Odor)

No.	Location	Date (2012)	TSP	PM_{10}	SO_2		NO_2		NH_3	H_2S	CH_3SH	HCl		Fluoride		Cd		Hg	Pb	Odor
			Daily Average	Daily Average	Hourly Average	Daily Average	Hourly Average	Daily Average	Hourly Average	Hourly Average	Hourly Average	Hourly Average	Daily Average	Hourly Average	Daily Average	Daily Average	Hourly Average	Daily Average	Daily Average	
1	Wangzhong village	Feb 29	0.388	0.191	0.146	0.118	0.072	0.057	0.10	0.003	ND	0.03	0.005	0.0032	0.0016	ND	ND	0.003	ND	16
		March 1	0.403	0.205	0.147	0.120	0.069	0.053	0.07	0.002	ND	0.03	0.005	0.0035	0.0021	ND	ND	ND	ND	14
		March 2	0.363	0.173	0.111	0.095	0.057	0.048	0.05	ND	ND	0.03	0.004	0.0034	0.0020	ND	ND	ND	0.0005	---
		March 3	0.241	0.126	0.128	0.112	0.067	0.054	0.09	0.003	ND	---	---	---	---	---	---	---	---	---
		March 4	0.417	0.211	0.180	0.132	0.097	0.071	0.09	ND	ND	---	---	---	---	---	---	---	---	---
		March 5	0.320	0.167	0.130	0.114	0.075	0.060	0.14	0.005	0.0002	---	---	---	---	---	---	---	---	---
		March 6	0.267	0.141	0.126	0.094	0.061	0.047	0.07	0.002	ND	---	---	---	---	---	---	---	---	---
2	Xiushui	Feb 29	0.420	0.212	0.174	0.106	0.097	0.050	---	---	---	0.04	0.007	0.0026	0.0018	ND	ND	ND	0.0005	---
		March 1	0.481	0.253	0.138	0.129	0.083	0.068	---	---	---	0.04	0.006	0.0041	0.0025	ND	ND	0.004	0.0006	---
		March 2	0.286	0.160	0.124	0.097	0.060	0.049	---	---	---	0.03	0.006	0.0025	0.0021	ND	ND	ND	ND	---
		March 3	0.298	0.162	0.141	0.119	0.079	0.061	---	---	---	---	---	---	---	---	---	---	---	---
		March 4	0.372	0.191	0.205	0.137	0.104	0.080	---	---	---	---	---	---	---	---	---	---	---	---
		March 5	0.237	0.136	0.144	0.126	0.079	0.063	---	---	---	---	---	---	---	---	---	---	---	---
		March 6	0.322	0.172	0.138	0.092	0.097	0.053	---	---	---	---	---	---	---	---	---	---	---	---
3	Houjia village	Feb 29	0.439	0.215	0.159	0.124	0.096	0.058	0.09	0.003	ND	0.03	0.004	0.0038	0.0020	ND	ND	ND	ND	14
		March 1	0.328	0.176	0.159	0.113	0.079	0.063	0.05	ND	ND	0.03	0.005	0.0042	0.0027	ND	ND	ND	ND	12
		March 2	0.314	0.168	0.116	0.098	0.063	0.045	0.05	ND	ND	0.04	0.005	0.0041	0.0023	ND	ND	ND	ND	---
		March 3	0.335	0.171	0.103	0.082	0.064	0.053	0.09	0.002	ND	---	---	---	---	---	---	---	---	---
		March 4	0.408	0.208	0.120	0.104	0.088	0.062	0.08	0.003	ND	---	---	---	---	---	---	---	---	---
		March 5	0.246	0.127	0.147	0.112	0.064	0.055	0.10	0.004	ND	---	---	---	---	---	---	---	---	---
		March 6	0.280	0.148	0.157	0.114	0.087	0.061	0.06	ND	ND	---	---	---	---	---	---	---	---	---
4	Taiping	Feb 29	0.281	0.155	0.144	0.108	0.083	0.060	---	---	---	0.03	0.004	0.0046	0.0021	ND	ND	ND	ND	---
		March 1	0.305	0.167	0.150	0.112	0.075	0.054	---	---	---	0.02	0.005	0.0051	0.0029	ND	ND	ND	ND	---

No.	Location	Date (2012)	TSP	PM_{10}	SO_2		NO_2		NH_3	H_2S	CH_3SH	HCl		Fluoride		Cd		Hg	Pb	Odor
			Daily Average	Daily Average	Hourly Average	Daily Average	Hourly Average	Daily Average	Hourly Average	Hourly Average	Hourly Average	Hourly Average	Daily Average	Hourly Average	Daily Average	Daily Average	Hourly Average	Daily Average	Daily Average	
	village	March 2	0.261	0.143	0.132	0.101	0.053	0.044	---	---	---	0.03	0.007	0.0049	0.0030	ND	ND	ND	ND	---
		March 3	0.291	0.150	0.170	0.110	0.067	0.059	---	---	---	---	---	---	---	---	---	---	---	---
		March 4	0.364	0.176	0.180	0.107	0.085	0.050	---	---	---	---	---	---	---	---	---	---	---	---
		March 5	0.270	0.142	0.145	0.102	0.077	0.058	---	---	---	---	---	---	---	---	---	---	---	---
		March 6	0.326	0.165	0.125	0.103	0.076	0.056	---	---	---	---	---	---	---	---	---	---	---	---
5	Jujia village	Feb 29	0.387	0.197	0.150	0.105	0.094	0.071				0.03	0.004	0.0031	0.0015	ND	ND	ND	ND	---
		March 1	0.285	0.149	0.136	0.093	0.072	0.052	---	---	---	0.04	0.008	0.0044	0.0020	ND	ND	ND	ND	---
		March 2	0.225	0.124	0.133	0.102	0.062	0.051	---	---	---	0.04	0.004	0.0026	0.0018	ND	ND	ND	ND	---
		March 3	0.270	0.138	0.114	0.095	0.072	0.055	---	---	---	---	---	---	---	---	---	---	---	---
		March 4	0.369	0.186	0.179	0.118	0.081	0.060	---	---	---	---	---	---	---	---	---	---	---	---
		March 5	0.264	0.140	0.142	0.104	0.082	0.056	---	---	---	---	---	---	---	---	---	---	---	---
		March 6	0.347	0.178	0.140	0.097	0.070	0.054	---	---	---	---	---	---	---	---	---	---	---	---
6	Chizitou village	Feb 29	0.381	0.186	0.114	0.101	0.072	0.056	---	---	---	0.03	0.005	0.0041	0.0019	ND	ND	ND	ND	---
		March 1	0.415	0.206	0.168	0.097	0.087	0.059	---	---	---	0.04	0.004	0.0047	0.0026	ND	ND	ND	ND	---
		March 2	0.301	0.158	0.125	0.096	0.060	0.053	---	---	---	0.03	0.005	0.0037	0.0021	ND	ND	ND	ND	---
		March 3	0.215	0.116	0.156	0.116	0.082	0.057	---	---	---	---	---	---	---	---	---	---	---	---
		March 4	0.407	0.201	0.147	0.102	0.079	0.049	---	---	---	---	---	---	---	---	---	---	---	---
		March 5	0.313	0.161	0.132	0.098	0.067	0.054	---	---	---	---	---	---	---	---	---	---	---	---
		March 6	0.290	0.149	0.178	0.108	0.086	0.065	---	---	---	---	---	---	---	---	---	---	---	---
GB 3095-1996 Class II			0.30	0.15	0.50	0.15	0.12	0.24	---	---	---	---	---	---	---	---	---	---	---	---
TJ36-79 Residential area			---	---	---	---	---	---	0.20	0.01		0.05	0.015	0.02	0.007			0.0003	0.0007	
GB 14554-93 Class II			---	---	---	---	---	---	1.5	0.06	---	---	---	---	---	---	---	---	---	20
GB18056-2000			---	---	---	---	---	---			0.0007	---	---	---	---	---	---	---	---	
Former Yugoslavia Standard			---	---	---	---	---	---	---	---	---	---	---	---		0.01	0.003			

No.	Location	Date (2012)	TSP	PM_{10}	SO_2		NO_2		NH_3	H_2S	CH_3SH	HCl		Fluoride		Cd		Hg	Pb	Odor
			Daily Average	Daily Average	Hourly Average	Daily Average	Hourly Average	Daily Average	Hourly Average	Hourly Average	Hourly Average	Hourly Average	Daily Average	Hourly Average	Daily Average	Daily Average	Hourly Average	Daily Average	Daily Average	
World Bank Group EHS Interim			---	0.150	---	0.125	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Note: Hourly averages were taken in 4 one-hour intervals.Only the highest hourly average was presented in this table. = exceed the standard requirements. ND = not detected

2. Surface water

186. **Monitoring Location:** According to the direction where the wastewater of the project goes and the environmental function requirements of the wastewater recipient water body, it is to totally arrange three monitoring sections at ZWWTP, in the upstream and downstream of outlet of Luo River for environmental quality status monitoring of waste water. The sections for monitoring environmental quality of surface water are listed in TableIV.6.

Table IV.6List of Surface Water Monitoring Locations

No.	Section Location	Objective
1#	200m upstream of interface between outlet of wastewater treatment plant and Luo River	It is to look into status of quality of incoming water from upstream of Luo River
2#	500m downstream of interface between wastewater discharge outlet of ZWWTP and Luo River	It is to look into the status of water volume and quality of totally mixed section downstream of wastewater discharge outlet of the wastewater treatment plant
3#	3000m downstream of interface of outlet of ZWWTP and Luo River	It is to look into the status of water volume and quality at attenuation cross section downstream of wastewater discharge outlets of the wastewater treatment plant

187. **Monitoring parameters and frequency:** pH value, CODcr, BOD_5, ammonia nitrogen, petroleum, cyanide, volatile phenol, total salts, fluoride, Hg, As, Zn, Cr, Pb, Cd and fecal coliform, totally 16 items. Simultaneously, it is to measure such hydrological parameters as river width, depth, flow velocity and flow. It was to monitor for 2 days, and it was to take samples once every day. The monitoring was conducted by Analysis and Test Center of Shandong Province on March 4 and 5, 2012, for two days, and samples were taken once in the morning of the first day and once in the afternoon of the second day.

188. **Monitoring and Analysis Method:** It is to implement the relevant regulations in Environmental Quality Standards for Surface Water (GB3838-2002), Water and Wastewater Monitoring and Analysis Methods and Environmental Monitoring Code. The monitoring and analysis methods may be referred to in Table IV.7

Table IV.7: List of Monitoring and Analysis Methods for Surface Water

Item Name	Standard Codes	Standard Name	Detection Limit
pH	GB/T 6920-1986	Glass Electrode Method	/
Ammonia nitrogen	GB/T 7479-1987	Nessler's Reagent Colorimetric Method	0.02 mg/L
COD_{Cr}	GB/T 11914-1989	Dichromate Titration Method	10mg/L
BOD_5	GB/T 7488-1987	Dilution and inoculation method	2 mg/L
Hg	SL 327.2-2005	Atomic Fluorescence Spectrometry	0.00005 mg/L
As	SL 327.1-2005	Atomic Fluorescence Spectrometry	0.0002 mg/L
Pb.	Water and Wastewater Monitoring and Analysis Methods (4th Edition)	ICP-MS	0.0002 mg/L
Cd	Water and Wastewater Monitoring and Analysis	ICP-MS	0.00005 mg/L
Zn	Water and Wastewater Monitoring and Analysis Methods (4th Edition)	ICP-MS	0.001 mg/L
Cr	Water and Wastewater Monitoring and Analysis Methods (4th Edition)	ICP-MS	0.0005mg/L
Fluoride	HJ/T 84-2001	Chromatography of ions	0.02 mg/L
Total salts	HJ/T51-1999	Gravimetric method	10 mg/L
Volatile phenol	HJ 503-2009	After distillation 4- amino antipyrine Spectrophotometry	0.001mg/L
Cyanide	GB/T 7487-1987	Isonicotinic acid-pyrazolone colorimetric method	0.002 mg/L
Petroleum	GB/T16488-1996	Infrared spectrophotometry	0.02 mg/L
Fecal coliform	Water and Wastewater Monitoring and Analysis Methods (4th Edition)	Multiple tube fermentation method	3.0 number/L

189. **Surface water standards:** The determining standard is PRC's Environmental Quality Standards for Surface Water (GB 3838-2002). This defines five categories reflecting different environmental functions: I – highest water quality, for headwaters and National Nature Reserves; II – drinking water sources in Class I protection areas, habitats for rare aquatic organisms, breeding grounds for fish and crustaceans, and feeding grounds for fish fry; III – drinking water sources in Class II protection areas, wintering grounds for fish and crustaceans, migration routes, water bodies for aquaculture and capture fishery, and swimming; IV – general industrial use and non-contact recreational activities; V – lowest quality, suitable only for agricultural and scenic water uses (Table IV.8). The World Bank Group has guidelines on effluent quality standards but not ambient water quality, and recognizes the use of local criteria for EHS purpose. According to the environmental function zoning for the Luo River, Class IV is applicable.

TableIV.8 Environmental Quality Standards for Surface Water (GB 3838-2002)

Parameter	Category				
	I	II	III	IV	V
pH	6 ~ 9	6 ~ 9	6 ~ 9	6 ~ 9	6 ~ 9
Dissolved oxygen (DO) [mg/L]	90% saturation or ≥7.5	≥6	≥5	≥3	≥2
Permanganate index (I_{Mn}) [mg/L]	≤2	≤4	≤6	≤10	≤15
Chemical oxygen demand (COD) [mg/L]	≤15	≤15	≤20	≤30	≤40
5-day Biochemical oxygen demand (BOD_5)	≤3	≤3	≤4	≤6	≤10
Ammonia nitrogen (NH_3-N) [mg/L]	≤0.15	≤0.5	≤1.0	≤1.5	≤2.0
Total phosphorus (as P) [mg/L]	≤0.02	≤0.1	≤0.2	≤0.3	≤0.4
Lakes & reservoirs	≤0.01	≤0.025	≤0.05	≤0.1	≤0.2
Total nitrogen (lakes, reservoirs, as N) [mg/L]	≤0.2	≤0.5	≤1.0	≤1.5	≤2.0
Copper (Cu) [mg/L]	≤0.01	≤1.0	≤1.0	≤1.0	≤1.0
Zinc (Zn) [mg/L]	≤0.05	≤1.0	≤1.0	≤2.0	≤2.0
Fluoride (as F^-) [mg/L]	≤1.0	≤1.0	≤1.0	≤1.5	≤1.5
Selenium (Se) [mg/L]	≤0.01	≤0.01	≤0.01	≤0.02	≤0.02
Arsenic (As) [mg/L]	≤0.05	≤0.05	≤0.05	≤0.1	≤0.1
Mercury (Hg) [mg/L]	≤0.0005	≤0.0005	≤0.0001	≤0.001	≤0.001
Cadmium (Cd) [mg/L]	≤0.001	≤0.005	≤0.005	≤0.005	≤0.01
Chromium (Cr, hexavalent) [mg/L]	≤0.01	≤0.05	≤0.05	≤0.05	≤0.1
Lead (Pb) [mg/L]	≤0.01	≤0.01	≤0.05	≤0.05	≤0.1
Cyanide (CN) [mg/L]	≤0.005	≤0.05	≤0.2	≤0.2	≤0.2
Volatile phenol [mg/L]	≤0.002	≤0.002	≤0.005	≤0.01	≤0.1
Total petroleum hydrocarbon (TPH) [mg/l]	≤0.05	≤0.05	≤0.05	≤0.5	≤1.0
Anionic surfactant [mg/L]	≤0.2	≤0.2	≤0.2	≤0.3	≤0.3
Sulfide [mg/L]	≤0.05	≤0.1	≤0.2	≤0.5	≤1.0
Fecal coliform bacteria [number/L]	≤200	≤2000	≤10000	≤20000	≤40000

190. **Monitoring Results:** The monitoring results are listed in Table IV.9.The BOD_5 in the upstream of junction of wastewater plant draining exit and Luo River exceeds Class IV standard in the Surface Water Environment Quality Standard (GB3838-2002) as shown in Attachment 23. The COD_{Mn}, BOD_5 and NH_3-Nconcentration in both 500m and 3000m downstream of junction of Zhangqiu wastewater plant draining exit and LuoRiver exceeds the standard. Therefore, Luo River has been polluted due to the local small scale industrial facility, agricultural development by applying pesticide and chemical on farm lands. Local government such as Zhangqiu government, Zhangqiu environmental protection bureau has carry out several solutions, such as environmental monitoring, industrial facility monitoring and water purification as presented in Attachment 38.

Table IV.9: Surface Water Quality Monitoring Data

Monitoring Spots	Monitoring Date	pH	Cyanide	CODMn	BOD5	NH3-N	Total Salts	Volatile Phenol	Petroleum	Fluoride	Fecal Coliform	Cd	Cr	Hg	As	Pb	Zn
1#	03.04	8.07	ND	24	8.0	0.26	1048	ND	0.04	0.05	1700	ND	ND	0.00008	0.0003	ND	0.002
	03.05	7.94	ND	26	8.6	0.23	961	ND	0.04	0.02	2300	ND	ND	0.00009	0.0003	ND	0.002
2#	03.04	7.69	0.006	60	12.1	6.53	957	0.002	0.07	0.10	9400	ND	ND	0.00012	0.0004	ND	0.008
	03.05	7.63	0.003	51	10.6	4.61	949	0.002	0.05	0.12	9900	ND	ND	0.00011	0.0003	ND	0.006
3#	03.04	7.88	0.004	56	11.2	5.04	916	0.002	0.07	0.20	9200	ND	ND	0.00010	0.0003	ND	0.006
	03.05	7.79	0.002	49	9.1	4.07	908	0.001	0.05	0.19	9500	ND	ND	0.00013	0.0003	ND	0.007
GB 3838-2002 Class IV standard		6-9		30	6	1.5	0.2	0.01	0.5	1.5	20,000	0.005		0.001	0.1	0.05	2.0

Source: Shangdong Analysis and Test Center, March 2012; ND = not detected,

3. Groundwater

191. **Monitoring Locations:**

According to the direction of the underground water and the characteristics of the project, four locations were identified for groundwater quality monitoring as shown in Table IV.10.

Table IV.10 List of Underground Water Monitoring Locations

No.	Name	Relative Position	Relative Distance (m)	Significance of Establishment
1#	Monitoring well of landfill	S	200	Monitoring spot of underground water near the factory site
2#	Chizitou Village	SE	1600	Monitoring spot upstream of underground water
3#	Hou's Village	N	560	Monitoring spot of underground water downstream of factory site
4#	Nie's Village	NW	750	Monitoring spot of underground water downstream of factory site

192. **Monitoring Parameters:** pH value, total hardness, soluble total solids, permanganate index, ammonia nitrogen, nitrate nitrogen, Nitrite nitrogen, volatile phenol, cyanide, fluoride, As, Hg, Six valence chromium, Pb, Cd, Zn and total fecal coliform, totally 17 items. It is to simultaneously monitor water temperature, well depth and burying depth of underground water.

193. **Monitoring Frequency:** The environmental quality status quo monitoring of underground water this time was conducted by Analysis and Test Center of Shandong Province on March 5, 2012, for one day, and samples were taken once.

194. **Monitoring and analysis methods:** It is to implement such regulations as *Standard Examination Methods for Drinking Water* (GB5750-85), *Water and Wastewater Monitoring and Analysis Method* (4th Edition) and *Environmental Water Quality Monitoring Quality Assurance* Manual and other relevant regulations.

Table. IV.11 List of Underground Water Quality Analysis Methods

Item Name	Standard Codes	Standard Name	Detection Limit
pH	GB/T 5750.4-2006	Glass Electrode Method	/
Total Hardness	GB/T 5750.4-2006	EDTA Titration Method	1.0 mg/L
Soluble Total Solids	GB/T 5750.4-2006	Weight Method	10 mg/L
Permanganate index	GB/T 5750.7-2006	*Standard Examination Methods for Drinking Water,* Comprehensive Indicators of Organics	0.05 mg/L
Fluoride	HJ/T 84-2001	Chromatography of ions	0.02 mg/L

Item Name	Standard Codes	Standard Name	Detection Limit
Nitrate nitrogen	HJ/T 84-2001	Chromatography of ions	0.02 mg/L
Nitrite nitrogen	GB/T 5750.5-2006	Diazo coupling Spectrophotometry	0.001 mg/L
Ammonia nitrogen	GB/T 5750.5-2006	Nessler's Reagent Colorimetric Method	0.025 mg/L
Cyanide	GB/T 5750.5-2006	Inorganic non-metallic index	0.002 mg/L
As	GB/T 5750.6-2006	Atomic Fluorescence Spectrometry	0.0002 mg/L
Hg	GB/T 5750.6-2006	Atomic Fluorescence Spectrometry	0.00005mg/L
Cd	GB/T 5750.6-2006	ICP-MS	0.00005 mg/l
Pb	GB/T 5750.6-2006	ICP-MS	0.0002mg/L
Zn	GB/T 5750.6-2006	ICP-MS	0.001mg/L
Six valence chromium	GB/T 5750.6-2006	DPCI Spectrometry	0.004mg/L
Volatile phenol	HJ 503-2009	4- amino antipyrine Spectrophotometry	0.001mg/L
Total fecal coliform	GB/T 5750.12-2006	*Standard Examination Methods for Drinking Water,* Microbe indicators	2 MPN/100ml

195. **Ground water quality standards:** In the PRC this is divided into five categories according to the Quality Standard for Ground Water (GB/T 14848-93). Category III or above is suitable as drinking water. Category IV can only be used for drinking water after treatment.

Table IV.12: Ground Water Quality Standards according to GB/T 14848-93

Parameter	Unit	I	II	III	IV	V
Color	HU	≤5	≤5	≤5l	≤5l	>25
Odor and taste	---	No	No	No	No	Yes
Turbidity	NTU	≤3	≤3	≤3	≤3U	>10
Visible object	---	No	No	No	No	Yes
pH	---	6.5~8.5			5.5~6.5, 8.5~9	〈5.5,>9
Total hardness (as $CaCO_3$)	mg/L	≤150	≤150	≤150	≤150	>550
Total dissolved solid (TDS)	mg/L	≤300	≤300	≤300l	≤300l	>2000

Sulfate (SO_4^{2-})	mg/L	≤50	≤50L	≤50L	≤50L	>350
Chloride (Cl^-)	mg/L	≤50	≤50L	≤50L	≤50L	>350
Iron (Fe)	mg/L	≤0.1	≤0.1	≤0.1	≤0.1	>1.5
Manganese (Mn)	mg/L	≤0.05	≤0.05	≤0.0	≤0.0	>1.0
Copper (Cu)	mg/L	≤0.01	≤0.01	≤0.0	≤0.0	>1.5
Zinc (Zn)	mg/L	≤0.05	≤0.0	≤0.0	≤0.0	>5.0
Molybdenum (Mo)	mg/L	≤0.001	≤0.00	≤0.0	≤0.0	>0.5
Cobalt (Co)	mg/L	≤0.005	≤0.00	≤0.00	≤0.0	>1.0
Volatile phenol	mg/L	0.001	0.001	0.002	≤.002	0.01
Anionic surfactant	mg/L	No	≤o/L	≤o/L	≤o/L	>0.3
Permanganate index (I_{Mn})	mg/L	≤1.0	≤1.0	≤1.0	≤1.	>10
Nitrate (NO_3^-, as N)	mg/L	≤2.0	≤2.0	≤2.	≤2.	>30
Nitrite (NO_2^-, as N)	mg/L	≤0.001	≤0.00	≤0.00	≤0.0	0.1
Ammonia nitrogen (NH_3-N)	mg/L	≤0.02	≤0.02	≤0.0	≤0.0	>0.5
Fluoride (F^-)	mg/L	≤1.0	≤1.0	≤1.0	≤1.0	>2.0
Iodide (I^-)	mg/L	≤0.1	≤0.1	≤0.1	≤0.1	>1.0
Cyanide (CN)	mg/L	≤0.001	≤0.00	≤0.00	≤0.0	>0.1
Mercury (Hg)	mg/L	≤ 0.00005	≤ 0.0000	≤0.000	≤0.000	>0.001
Arsenic (As)	mg/L	≤0.005	≤0.00	≤0.00	≤0.00	>0.05

Selenium (Se)	mg/L	≤0.01	≤0.01	≤0.01	≤0.0	>0.1
Cadmium (Cd)	mg/L	≤0.0001	≤0.000	≤0.00	≤0.00	>0.01
Hexavalent chromium (Cr^{6+})	mg/L	≤0.005	≤0.00	≤0.00	≤0.0	>0.1
Lead (Pb)	mg/L	≤0.005	≤0.00	≤0.00	≤0.0	>0.1
Beryllium (Be)	mg/L	≤ 0.00002	≤ 0.0000	≤0.0000	≤0.000	>0.001
Barium (Ba)	mg/L	≤g/Lu	≤g/L	≤g/L	≤g/L	>4.0
Nickel (Ni)	mg/L	≤g/Lel	≤g/Le	≤g/Le	≤g/L	>0.1
DDT*	μg/L	No	≤o/Lhl	≤o/L	≤o/L	>1.0
Lindane (666)	μg/L	≤g/Lan	≤g/La	≤g/L	≤g/L	>5.0
Total coliform bacteria	no./L	≤o./	≤o./	≤o./	≤o./	>100
Total bacteria	no./L	≤o./	≤o./	≤o./	≤o./L	>1000
Total alpha (α) radioactivity	Bq/L	≤q/L	≤q/L	≤q/L	>0.1	>0.1
Total beta (β) radioactivity	Bq/L	≤q/L	≤q/L	≤q/L	>1.0	>1.0

* Dichlorodiphenyltrichloroethane

196. **Monitoring Results:** The total hardness and total dissolved solids of the 4 groundwater monitoring spots are all under the Class III standard of Groundwater Quality Standard (GB/T14848-93). The nitrate nitrogen index of 1# monitoring spot cannot meet the Class III standard of Groundwater Quality Standard (GB/T14848-93).Other index all reach the Class III standard of Groundwater Quality Standard (GB/T14848-93). The total hardness and total dissolved solids are affected by local hydrogeology, and the high concentration nitrate nitrogen indicates that 1# monitoring well has been polluted. Therefore, the groundwater of the proposed project area is generally in good quality except for some individual index exceeding the standard such as Total Hardness, Total dissolved solids and NO_3-N.The reason of pollution are list below:

- **Industrial development**
- **Lack of Wastewater treatment project**

- **Wastewater discharge without treatment;**
- **Agricultural pollution**

Table IV.13 Ground Water Monitoring Results

No.	Parameters	Unit	1# Landfill Monitoring Well	2# Chitou Village	3# Hou's Village	4# Nie's Village	GB/T14848-93 Category III
1	pH Value	--	7.39	7.57	7.24	7.18	6.5-8.5
2	Total Hardness	mg/L	1014	1000	805	649	≤450
3	Total dissolved solids	mg/L	2170	1699	1332	1170	≤1000
4	Permanganate index	mg/L	1.24	0.91	1.08	0.62	≤3.0
5	Ammoniac Nitrogen	mg/L	0.06	0.04	0.05	0.04	≤0.2
6	NO_3-N	mg/L	27.96	15.20	15.60	3.51	≤20
7	NO_2-N	mg/L	0.002	0.002	0.011	ND	≤0.02
8	Volatile Phenol	mg/L	ND	ND	ND	ND	≤0.00
9	Cyanide	mg/L	ND	ND	ND	ND	≤0.05
10	Fluoride	mg/L	0.29	0.24	0.32	0.41	≤1.0
11	As	mg/L	ND	ND	ND	ND	≤0.05
12	Hg	mg/L	ND	ND	ND	ND	≤0.001
13	Six valence chromium	mg/L	ND	ND	ND	ND	≤0.05
14	Pb	mg/L	ND	ND	ND	ND	≤0.05
15	Cd	mg/L	ND	ND	ND	ND	≤0.01
16	Zn	mg/L	ND	ND	0.055	ND	≤1.0
17	Total fecal coliform	no./L	ND	ND	ND	ND	≤3.0
18	Well depth	m	10	42	10	13	
19	Ground water depth	m	4	8	4	4	
20	Water Temperature	(℃)	14.0	13.3	13.5	14.1	

Source: Analysis and Test Center of Shandong Province on March 5, 2012, ND = not detected

4. Acoustic environment

197. Monitoring Locations: In the monitoring of environmental quality for noise, four monitoring spots were identified, 1m outside the four factory boundaries. Arrangement of monitoring spots of environment quality for noise may be referred to in Table IV.14.

Table IV.14 List of Noise Monitoring Locations

No.	Name	Monitoring Location	Significance of Establishment
1#	North factory boundary	1m outside factory boundary	Status of environmental noise
2#	West factory boundary	1m outside factory boundary	Status of noise in factory boundaries and environment
3#	South factory boundary	1m outside factory boundary	Status of noise in factory boundaries and environment
4#	East factory boundary	1m outside factory boundary	Status of noise in factory boundaries and environment

198. **Monitoring Frequency:** The environmental monitoring for noise was conducted by Analysis and Test Center of Shandong Province on February 29, 2012, for one day, and samples were taken once in the day and once in the night.

199. **Monitoring and analysis methods:** It is to implement such regulations as *Emission Standard for Industrial Enterprises Noise at Boundary* (GB12348-2008) (Attachment 26) and *Environmental Quality Standards for Noises* (GB3096-2008-Attachment 22). Monitoring conditions: During the period of measurement, it was without rain or snow or lightning, the wind velocity was below, 5m/s, and the microphone was covered with windshield. "A" weighting network was adopted, with fast dynamic properties, and it is to monitor equivalent A sound level as the representative value.

Monitoring Results: The day and night noise of the 4 monitoring spots can all meet the Class III standard requirement in Acoustic Environment Quality Standard (GB3096-2008-Attachment 22), which indicates that the acoustic environment within the project area is fine.

TableIV.15 Noise Monitoring Results

No.	Name of Spot	Daytime dB(A)	Nighttime dB(A)
		Leq	Leq
1#	North factory boundary	44.4	43.6
2#	West factory boundary	44.9	47.2
3#	South factory boundary	48.1	47.0
4#	East factory boundary	43.7	42.2
GB12348-2008		65	45

5. Soil

200. **Monitoring Locations:** according to the flow direction of underground water near the factory site, local perennial dominant wind direction, wind frequency distribution characteristics and pollutants discharging characteristics of the proposed project, and it is to totally arrange three spots for monitoring soil quality.

Table IV.16 List of Soil Monitoring Sites

No.	Name	Relative Direction	Relative Distance (m)	Significance of Establishment
1#	Wangzhong Village	S	510	Monitoring spots at upwind and upstream of underground water at the factory site
2#	Monitoring Spot of Factory Site	——	——	Monitoring spot at the factory site
3#	Houjia Village	N	560	Monitoring spots at downwind and downstream of underground water at the factory site

201. **Monitoring parameters:** pH value, Cd, Hg, As, Cu, Pb, Cr, Zn, Ni and cation exchange quantity, totally 10 items. It is to take sample once at each monitoring spot, and the soil sample taken was planting soil, and the sampling method is to implement the regulations in *The Technical Specification for Soil Environmental Monitoring* (HJ/T166-2004).

202. **Monitoring frequency:** the environmental quality monitoring of soil was conducted by Analysis and Test Center of Shandong Province on March 5, 2012, for one day, and samples were taken once at each monitoring spot.

203. **Monitoring method:** the analysis method is to implement the relevant regulations in *Environmental Quality Standard for Soils* (GB15618-1995). The monitoring and analysis methods may be referred to in Table IV.17.

Table IV.17 List of Soil Monitoring and Analysis Methods

Item Name	Standard Name	Standard Name	Detection Limit
pH	NY/T 1377-2007	Determination of pH values in Soil	--
Cd	GB/T 17141-1997	Graphite furnace atomic absorption spectrophotometry	0.05 mg/kg
Hg	GB/T 22105.1-2008	Soil quality-Analysis of total mercury-Atomic fluorescence spectrometry	0.002 mg/kg
As	GB/T 22105.2-2008	Soil quality-Analysis of total arsenic-Atomic fluorescence spectrometry	0.02mg/kg
Cu	HJ 350-2007	Inductively Coupled Plasma Atomic Emission Spectrometry, ICP-AES	1 mg/kg
Pb	GB/T 17141-1997	Graphite furnace atomic absorption spectrophotometry	0.5 mg/kg
Cr	HJ 491-2009	Inductively Coupled Plasma Atomic Emission Spectrometry, ICP-AES	5mg/kg
Zn	HJ 350-2007	Inductively Coupled Plasma Atomic Emission Spectrometry, ICP-AES	1 mg/kg
Ni	HJ 350-2007	Inductively Coupled Plasma Atomic Emission Spectrometry, ICP-AES	1 mg/kg

204. **Assessment Standards:** In this EIA of soil, it is to implement category II of Environmental Quality Standard for Soils (GB15618-1995). According to the monitoring results, it is to implement the criterion of pH value greater than 7.5.

205. **Monitoring Results:** It can be seen from Table IV.18that all the monitoring items includes As, Hg, Cd, Pb, Cr, Cu, Ni and Zn at the three soil monitoring spots in this EIA may satisfy with the requirements in Level 2 criteria (pH>7.5) in *Environmental Quality Standard for Soils* (GB15618-1995).

Table IV.18 Soil Monitoring Results:

Monitoring Date	Monitoring Spots	pH	As	Hg	Cd	Pb	Cr	Cu	Ni	Zn
5 March 2012	Wangzhong Village	8.24	6.12	0.056	0.08	18.3	86	29	38	83
	Monitoring Spot at Factory Site	8.12	6.75	0.050	0.06	17.6	87	28	37	66
	Houjia Village	8.29	7.28	0.036	0.06	21.1	84	26	34	68
Category II of GB1561801995			25	1.0	0.60	350	250	100	60	300

Chapter V ALTERNATIVE ANALYSIS

206. Three types of alternatives were assessed: (i) 'no project' scenario, (ii) different sites, and (iii) use of different dredging methods and devises.

A. No Project Scenario

207. Under the 'no project' scenario, the 650 tons to 1000 tons per year municipal solid waste generated and collected in recent years will be disposed in the existing Zhangqiu Landfill with remaining capacity of 649,700 tons which can service for two more years. A new landfill has to be constructed and more land will be needed. This is not consistent with the Zhangqiu Municipal Environmental Sanitation Plan (2003-2020). The plan has exclaimed *"reduction, resource, harmless" as the principles, to realize the unified planning and unified construction of the municipal waste treatment facilities, to establish the blameless municipal waste processing system. The municipal wastes processing mostly depends on landfill in recent years, and in the long run the incineration and recycle will be mainly used and the landfill will be complementary.* Therefore, to establish a waste incineration plant is in accordance with the general planning of the city.

208. Landfilling of waste represents the lowest level of the waste hierarchy. Many countries have banned recyclable and combustible waste to landfill – only pre-treated material (e.g. residues from composting or waste-to-energy facility can be disposed to landfill. Landfilling is the least favored option because it generates methane, and recovers the least energy or material value from the waste deposited. Methane, which is a potent greenhouse gas, is produced with odorous by-products through the decomposition of biodegradable matter in a landfill. While landfill gas collection systems can capture between 20 and 70% of this gas for energy generation, significant quantities of gas are dissipated to the environment. Additional problems arise from degradation by-products from the landfill (leachate), which presents a pollution threat to ground water and surface water, while litter and vermin will have an impact unless well managed.

209. Landfills are cheaper to run but they occupy a large surface. The value of the land is an "immobilized capital" which will only be recovered after many decades (possibly after further expenses for remediation). Incinerators are much more practical, especially in Zhangqiu City where land values are higher.

Table V.1: List of Comparison about Disposal Means of MSW

Content	Sanitary Landfill	Incineration	Compost Treatment
Operation Safety	Relatively good, be careful about fire prevention	Good	Good
Technical Reliability	Reliable	Reliable	Relatively Reliable
Floor Area	Large	Small	Moderate
Site Selection Conditions	It is relatively difficult, needs to consider topographic, engineering geological and hydro geologic conditions, prevent pollution of surface water and underground water, generally being far away from the downtown area, with relatively short transportation distance.	Easy May be constructed close to downtown Relatively short transportation	Uneasy Need to avoid densely populated area and prevent odorous impacts, with moderate transportation distance.
Final Disposal	No need for final treatment otherwise, but quantity is large.	Only cinder need to be conducted landfill treatment, which will be about 10% - 20% of initial quantity	Non-compost products need to conduct landfill treatment, which will be about 20-25% of initial quantity
Recovery of Resources	There is no successful cases of separate in site, but it is potentially possible	Pretreatment Process Part of raw materials may be recovered	Pretreatment Process Part of raw materials may be recovered
Surface Water Pollution	Possible However, measures may be taken to lower the possibilities	While conducting cinder landfill, the possibility of its pollution to surface water is similar to that of landfill.	Nil
Underground Water Pollution	Possible, although anti-seepage measure may be taken, leakage is still possible	It is related to disposal means of cinder, and it may happen if it is improperly disposed	It is related to disposal means of cinder, and it may happen if it is improperly disposed
Atmospheric Pollution	Yes, It may be controlled by adopting such measures as covering and compaction.	It may be controlled to be up to the standard	There are some odorous impacts, but the possibility of over proof pollution indices is not high.
Soil Pollution	Limited to landfill site	Nil.	Need to control heavy metal contents in compost products
Construction Investments	Relatively low, but the land requisition costs in economically developed areas are very high	Imported equipment: 0.5-0.6 million RMB/t; Domestic equipment: 0.2-0.5 RMB /.	0.1-0.15 million RMB/t

210. It can be seen from Table V.1 that after comparison, MSW incineration treatment has the following advantages: i.e., the project will take less land, which is good for saving land resources; It has high level of volume and weight reduction of MSW, as it may reduce volume by 90% and weight by 80%. The MSW treatment will be complete, with limited hazards of secondary pollution. Equipment operation is all-weather and entirely enclosed, with high level of automatic control. The excess heat of MSW incineration may be used to produce steam for power generation and heat supply, and save energies. However, it simultaneously has certain disadvantages: Acidic gases generated in the course of incineration, such as HCl, HF and SOx, heavy metals like Hg, Pb and Cr, and waste gas pollutants like dioxins, need to undergo purification treatment. The incinerated cinder and fly dust still need to be safely disposed or comprehensively utilized. Incinerated fly dust is a dangerous waste difficult for treatment and disposal, when it is necessary to conduct safe landfill,

it is necessary to establish a special dangerous wastes landfill. In order to dispose of MSW when the incinerator is in maintenance and repair, it is necessary to prepare a small sanitary landfill as standby.

211. Therefore, MSW incineration generation may duly realize environmentally friendly MSW treatment, reducing quantity and turning it into resources. Although it will also generate corresponding wastes, such as waste gases, fly dusts and cinder, etc., corresponding environmental measures may be adopted to minimize the negative impacts, which can save land resources, recover thermal energy for generation, which is suitable for economically developed, densely populated areas with scarce land resources.

212. The proposed development will minimize the need for landfill by providing an alternative solution which is higher up the waste hierarchy. The disposal technology of incineration generation process selected by the proposed project is technically advanced and reasonable.

B. Alternative Sites

213. For project site selection, the site selection meets the Zhangqiu Municipal Master Plan and Land Use Plan. The selected site is near the existing landfill with no environmental sensitive areas nearby. The nearest village is more than 500m away from the site. Slag generated from the project can be easily disposed at the landfill. MSW transportation system has been well developed and no structures restrict MSW transportation vehicle weight and height. There is no other environmental constraint that might restrict the development of the project such as wetlands, historic sites, and access to sewers, critical habits or potential mineral developments. Two more sites were considered during the site selection. The one in Guanzhuang town was dropped because it is located within the drinking water source conservation area and the one in Puji town was given up because the area has high population density and with nice scenery for people’s recreation.

214. Selecting a site for a MSW incineration power plant is a complicated comprehensive subject, which involves national economic policies, local urban master planning, development planning, land use natures, communication and transportation, meteorological conditions, water source, water head site protection, geologic conditions, telecommunication, electricity, water supply and drainage, project waste discharge natures, environmental impacts and other political, economic and technical aspects.

215. According to the urban master plan, regional topographic and geologic data, it preliminarily determined seven candidate plant sites for this project. After field reconnaissance to the candidate sites, comparative analysis were conducted to the topographic, terrain, water source, electricity, municipal, meteorological,

communication and transportation, land use conditions, plans for neighboring areas, estimated investments for resettlement and population distribution, etc. Whereas four candidates had such disadvantages as difficult land acquisition, inconformity with land use planning and long transportation distance, etc., three candidate plant sites were left as options. In light of *Circular on Further Reinforcing Management of Environmental Impacts Assessment of Biomass Power Generation Plants* (September 2008, H.F.[2008] No. 82), *Code for Planning of Urban Environmental Sanitation Facilities* (GB50337-2003), *Technical Code for Municipal Waste Incineration* (CJJ90-2009) and other documents and specifications, it is to conduct comparative analysis about the optional sites for the proposed MSW incineration plants, The comparative analysis may be referred to in Table V.2

Table V.2 Comparison and Selection of MSW Incineration Power Plant Site

No.	Elevation Factor	Candidate Plant Site 1	Candidate Plant Site 2	Candidate Plant Site 3
1	Land use conditions	The existing site of Zhangqiu City MSW Treatment Plant has been adjusted as construction use land, which conform to the master plan for land use.	The land to be used is state-owned, currently being unused land and pond, which conform to land use plan. The ponds need to be applied with the provincial government for examination and approval for converting the use of state-owned agricultural use land, and the paid use fee of the newly increased construction land is 34RMB/ m^2, and the remaining land use will be handled land supply procedures according to relevant regulations.	The present land use is collectively owned agricultural land use, which conforms to master plan for land use. There are certain difficulties to acquire the land, and under the condition of conforming to relevant planning and annual land use quota planning, after Zhangqiu City Government issues a document and submit to Shandong Provincial Government for examination and approval of converting the land use, have it acquired, and handle the land supply procedures.
2	Meteorological conditions	It is in the upwind direction of the downtown, relatively close to the East Town.	It is in the downwind of the downtown area, with limited environmental impacts on the downtown area.	It is in the upwind of the downtown area, relatively far away from the downtown area.
3	Transportation conditions	Existing roads may be used, and it is only necessary to build access road	Existing roads may be used, and it is only necessary to build access road	Existing roads may be used
4	Water supply conditions	It is to connect into the already built municipal pipeline network	It is to connect into the already built municipal pipeline network	Water intake distance is long, with great elevation difference
5	Power supply conditions	It is 10km away from the 220kV Substation.	It is 2km away from the Substation.	It is 25km away from the 220kV Substation.
6	Drainage conditions	Percolate and production waste water will be drained into the municipal drainage pipeline network, and conveyed to the wastewater treatment	Percolate and production waste water will be drained into the municipal drainage pipeline network, and conveyed to the wastewater treatment	It is to have it treated up to Level 3 and drain into the wastewater pipeline network, and the external pipeline length is about 5km.

No.	Elevation Factor	Candidate Plant Site 1	Candidate Plant Site 2	Candidate Plant Site 3
		plant.	plant.	
7	Planning of neighboring areas	Nil	Nil	The neighboring areas are planned as Kenli County Development Zone
8	Estimated costs of resettlement	Nil	Nil	The land acquisition and resettlement costs will be high
9	MSW transportation conditions	The selected site is 8km away from the East Town of Zhangqiu City, which is a relatively reasonable transportation distance, and transportation costs will be relatively low.	The selected site is 18km away from the East Town of Zhangqiu City, which is a relatively long transportation distance, and transportation costs will be slightly high.	The selected site is 15km away from the East Town of Zhangqiu City, which is a moderate transportation distance, and transportation costs will be relatively low.
10	Seismic conditions	There is no earthquake fault zone running across the region.	There is no earthquake fault zone running across the region.	There is no earthquake fault zone running across the region.
11	Geological conditions	Geologic conditions are relatively good	Geologic conditions are relatively good	Geologic conditions are relatively good
12	Environmental protection conditions	It is in the upwind of the main town, and in general, the environmental air has great impacts on the East Town.	It is in the downwind of the main town, and in general, the environmental air has limited impacts on the Central Town.	It is in the downwind of the main town, and in general, the environmental air has limited impacts on the Central Town. However, it has great impacts on Kenli County Seat and Development Zone.

216. From the comparative selection results, we may see that Plant Site 1 is the existing site of Zhangqiu City MSW Treatment Plant, which is 8km away from the East Town, with relatively short transportation distance and low transportation costs. However, it conflicts with the planning of the Ecological Industry Park, and the site is located at the extension line of the airfield runaway, with aviation height limit, which need approval from the aviation administration department. According to the predominant wind direction of Zhangqiu City, MSW incineration flue gas and dusts will have relatively great impacts on the East Town.

217. Plant Site 3 is located at the Development Zone, and its current land use is collectively owned farmland, which is construction land of the development zone, conforming to the master land use plan. There are certain difficulties to acquire the land, and under the condition of conforming to relevant planning and annual land use quota planning, it is necessary for Zhangqiu City Government issues a document and submit to Shandong Provincial Government for examination and approval of converting the land use, have it acquired, and handle the land supply procedures, with high land acquisition and resettlement costs. In general, the environmental air has limited impacts on the Central Town. However, it has great impacts on Kenli County Seat and Development Zone.

218. Comprehensive comparison and selection indicates that Plant Site 2 is superior to Plant Site 1 and Plant Site 3. Therefore, it is to select Plant Site 2 as the plant site for the proposed construction project. It is to conduct comprehensive demonstration according to site selection reasonableness analysis, in combination with engineering analysis, and prediction results of various special themes of environmental impacts.

C. Alternative Technologies

1. Alternative Incineration System

219. Presently, there are many combustion modes of MSW incinerator already put into operation in the countries all over the world: multistage chain grate, inclined reciprocating grate and reverse feeding open-hearth furnace grate, fluidized bed incinerator, rotary combustion – rotary furnace.

220. Grate incinerator is a relatively mature technology in the developed countries, with high reliability, which is mature incineration equipment for treating large volume of MSW. Grate incinerator mainly may be classified as two great types, i.e., reciprocating grate incinerator and rolling grate incinerator. Grate incinerator is a relatively mature technology in the developed countries, with such advantages as low pretreatment requirements, extensive applicable range of calorific value of MSW, easy and convenient operation and maintenance, etc. It is the most commonly used MSW incinerator with the largest treatment volume. The maximum throughput of a single incinerator may be as high as 1,200t/d, and the technology is mature and reliable. Grate may be classified as the preheating and drying section, incineration section and burnout section. MSW is dried and ignited by radiation from the top and heat convection of flue gas, the ignited MSW at the upper part of the grate will rotate and agitate the MSW layers by grate movement, causing internal combustion of MSW. Continuous rotation and agitation will reinforce looseness and breathability of the MSW layer, which is good for combustion and burnout of MSW, and the clinker ignition loss is ≤3%. With high furnace temperature and supplemented with secondary air, it may ensure the retention time of MSW at areas with flue gas temperature above 850℃ in the incinerator to be no less than 2 seconds in the incinerator, so as to ensure that dioxins may be adequately decomposed.

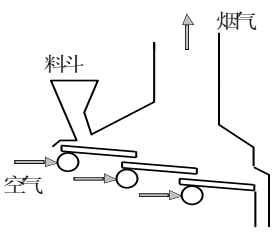
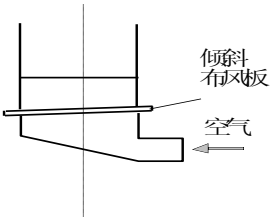
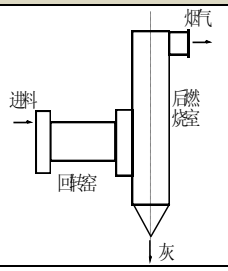
221. Rotary kiln incineration system is derived from rotary calcinations kiln with lining of fire-bricks, which has been extensively used in the cement industry. MSW is fed in from the front end of the top of the inclined and slowly rotating rotary kiln, control MSW forward moving speed by rotation speed, enable the MSW to finish the drying and incinerating MSW and cooling ash in the course of forward conveyance in the kiln, and cooled slag will be discharged from the lower end of furnace. The characteristics of rotary kiln is extensive applicability of fuels, as it can incinerate wastes with different properties, and such furnaces have fewer machine parts, with fewer failures, which may continuously operate for a long time. However, the thermal

efficiency of rotary kiln is low, it needs to consume a lot of auxiliary fuels, the temperature of the gas emitted is low, with odors, and needs deodorizing devices or guide into high-temperature rear combustion chamber for incineration. Since the kiln is long and takes a large space, and the grate structure of the rear combustion chamber is demanding, its costs are high, and its price is expensive.

222. Circulating fluidized bed combustion technology is a new clean combustion technology quickly developed in early 1960s. The basic characteristics of incinerator adopting this technology is that it is arranged with air distribution plate resistant to high temperature at the bottom of the hearth, which is loaded with heat-carrying inert particles, distribute air under the bed, so that inert particles will boil and form a fluidized bed section, the upper of which it is to be designed with a high enough burnout section (i.e., suspension section). The characteristics of fluidized bed are high rates of heat transfer and mass transfer between the particles and gases. After the materials were put into the fluidized bed, fluidized bed technology had been developed 70 years ago. It was used to incinerate industrial sludge in 1960s, incinerate MSW in 1970s, and it was extensively popularized in Japan in 1980s, and the market share was over 10%. However, in late 1990s, due to improvement of flue gas emission standard and its own shortcomings, incineration treatment of MSW by adopting fluidized bed technology was restricted. Although fluidized bed incinerator was somehow applied domestically a few years ago, it was mostly used in projects with daily throughput below 500t/d MSW, and there were some arguments, and it needs further improvement. Moreover, the input MSW of fluidized bed incinerator needs to be separated and crushed, which easily fail. Simultaneously, it needs to add fuel coal.

223. Comparisons about MSW incineration method and technologies may be referred to in Table V.3.

Table V.3: List of Comparisons about MSW Incineration Method and Technologies

Items	Stoker fired grate MSW incinerator	Fluidized bed incinerator	Rotary kiln incinerator
Furnace profile			
Characteristics of Furnace Hearth and Body	Mechanically moved fire grate, with relatively large fire grate area, and relatively large hearth volume	Fixed fire grate, with relatively smaller fire grate area and hearth volume	Without fire grate, dragging MSW to move by rotation of furnace body
Whether MSW is to be Pretreated	Not necessary	Necessary	Not necessary
Equipment floor area	Large	Large	Moderate

Items	Stoker fired grate MSW incinerator	Fluidized bed incinerator	Rotary kiln incinerator
Clinker ignition loss	Easy to be up to the standard	Raw refuse must be separated and crushed, and added with fuel coal for continuous combustion supporting to be up to the standard	Raw refuse uneasy to be up to the standard
Retention time in MSW incinerator	Relatively long	Relatively short	Long
Excess Air Factor	High	Moderate	High
Maximum throughput of single incinerator	1,200t/d	500t/d	500t/d
Air supply for MSW combustion	Easy to adjust according to working conditions	Relatively easy to adjust	Uneasy to adjust
Adaptability to MSW moisture content	It may be adaptive to MSW of different moisture contents by adjusting the wind volumes and temperatures at the drying section	Incinerator temperatures will easily fluctuate with the change of MSW moisture contents	It may be adaptive to MSW humidity by adjusting the rotating speed of the rotary drum
Adaptability to unevenness of MSW	It may homogenize the MSW by reversely rotating the MSW with the fire grate	Heavier MSW will quickly get to the bottom, making it difficult for complete combustion	Air supply can hardly be adjusted by sections, so large pieces of MSW are difficult to be burnt out.
Dust content in flue gas	Relatively low	High	High
Combustion media	No need for media	Media needed	No need for media
Control of combustion working conditions	Easy	Uneasy	Uneasy
Operation Costs	Low	Low	Relatively High
Flue Gas Treatment	Relatively Easy	Relatively Difficult	Relatively Easy
Maintenance Workload	Relatively Low	Relatively High	Relatively Low
Operation References	The most	Fewer	Very few in MSW
Comprehensive Evaluation	It is highly adaptive to MSW, with fewer failures, good treatment properties and environmental protection properties, and lower costs.	Pretreatment required, with higher failure rate, need to continuously add fuel coal for combustion, uneasy to be up to environmental standards.	It requires high calorific value of MSW (above 2,500kcal/kg), and operation costs are higher.
Applicability to the project	Applicable	Not applicable	Not applicable

224. In summary, in comparison with fluidized bed incinerator and rotary kiln incinerator, stoker fired grate incinerator has the following characteristics:

(1) It is technically mature, and it is particularly noteworthy that almost all the large incinerator plants adopt stoker fired grate incinerators.
(2) It is more adaptive to the properties of high moisture and low calorific value of domestic MSW, and it can ensure complete combustion of MSW.
(3) It is reliable and easy for operation, highly adaptive to MSW, and it is uneasy to cause secondary pollution.
(4) It is highly economic, and MSW may directly enter the incinerator without pretreatment, with lower operation costs.
(5) The equipment has long service life, and it is stable, reliable and convenient for

operation and maintenance.

225. In summary, MSW incineration treatment is a relatively feasible for environmentally friendly treatment of MSW and turning MSW into resources, and stoker fired grate incinerator is the first choice of technology for treatment of the Chinese MSW with high moisture, low calorific value and collected in mixtures. Analyzing from technology maturity, investment costs, integration of incineration technology and operation workability of the incinerator power plant, it is to adopt stoker fired grate incinerator in this project.

2. Alternative DeNOx Technology

226. DeNOx can be achieved by either Selective Catalytic Reduction (SCR) or Selective Non Catalytic Reduction (SNCR). Both technologies are considered Best Available Technologies (BAT).

227. SCR is more complicated to operate than SNCR. Ammonia is used as a reagent in the process. As it requires fossil fuel (gas) it has a negative effect on the overall energy balance of the plant. It also has an extensive fire safety prerequisite. As a result, a SCR system is more prone to technical difficulties and frequent, unscheduled, shutdown time. Advantages include an option to combine DeNOx with dioxin removal, efficient NOx removal and less effluent and residues.

228. SNCR is a less complicated system and is therefore more reliable and not as prone to technical difficulties and frequent, unscheduled, shutdown time. However, it does require a higher consumption of ammonia. Modern SNCR systems can achieve low NOx emission limits. SNCR does not require any additional energy input.

229. Two reagents can be used in such a DeNOx system: ammonia or urea. Urea is a chemical that decomposes to ammonia and carbon monoxide at temperatures greater than 200℃. It is safer to handle than ammonia. In an SNCR system, the carbon monoxide will be further oxidised to carbon dioxide because it is applied at temperatures of approximately 900℃. Urea allows a larger temperature range in which to react with NOx. It is proposed to use SNCR with urea or ammonia injection as it is safer, more flexible and consumes less energy and therefore does not have a negative effect on the overall energy balance of the plant.

230. The project will use SNCR system that is considered BAT that can achieve low NOx emission limits.

3. Alternative Acidic Gas Removal

231. The acidic gases generated in the course of incinerating garbage mainly include HCl, HF, NOx and SOx. Options foracidic gases purification processes include wet process, dry process and semi-dry process:

a. Wet Process

232. The application rate of the wet process was quite high in the early periods, which used alkali substances as absorbents to effectively purify the acidic gaseous pollutants. Wet-process purification may be completed by one step or two steps, and purifying equipment includes venturi scrubber of absorbing tower (filled tower and orifice column), etc. Presently, wet-process desulphurization technology by lime process is the most commonly used wet-process flue gas desulphurization technology in the world. The wet-process flue gas desulphurization technologies have such advantages as high plant performance, low construction costs, simple equipment structures, easy maintenance and repair, and saving energy, etc. The disadvantage is that it needs to conduct further treatment of products of liquid reaction, with complicated process flow, the complete plant will occupy large area of land, and the investments and operation costs will be quite high.

b. Dry Process

233. The efficiency of pollutants removal from the flue gas by dry-process purification is relatively low. In order to effectively control emission of acidic gaseous pollutants, it is necessary to increase the retention time of solid absorbents in the flue gas, and main good turbulence, so that the specific surface of the absorbents will be big enough. The absorbents used in dry-process purification are mostly $Ca(OH)_2$ powder. The portfolio of dry-process purification processes is generally to spray absorbents through the pipes, and supplement with subsequent efficient dust wipers. On the flue where the flue gas enters the bag filter, it is to install jet entrance of slaked lime and active carbon for injecting $Ca(OH)_2$ powder and active carbon powder. The purpose of injecting $Ca(OH)_2$ powder is to remove the acidic gas from the flue gas, so that the emission densities of HCl, HF and SO_X may meet the national standards. The purpose of injecting active carbon powder is to remove the heavy metals and dioxins from the flue gas. The significant advantage of dry-process purification is that the products of reaction are in solid form, which may be directly conducted final treatment, without having to conduct secondary treatment to the purification products like the wet-process purification process. The disadvantage is that the pollutants removal efficiencies are lower than that of the wet-process flue gas treatment system, and the consumption of absorbents will be higher than that of the wet-process.

c. Semi-dry Process

234. Semi-dry-process flue gas purification system is a process between the wet process and the dry process. Its advantage is high purification efficiency, without having to conduct secondary treatment to the products of reaction. The process is quite demanding for operation skills, and it takes long time of practices to achieve good effects. Flue gas must have enough long retention time to have complete chemical absorption reaction, so as to meet the objective of efficient removal of pollutants. Simultaneously, it enables the moisture content of reaction products to be fully vaporized, and eventually be discharged in solid form. Therefore, retention time is a very important parameter in the design of semi-process purifying reaction tower. Temperature difference at inlet and outlet of purifying reaction tower directly affects the form of reaction products and removal efficiency of acidic gases. Except retention time and temperature difference, particle size and spraying effects of absorbent also have great impacts on the entire purifying process. In the course of practical operation, there are strict requirements for all the above mentioned elements, or it may result in failure of the entire process. Semi-process reaction tower is connected with the subsequent bag filter, constituting semi-dry process purifying process system. The desulphurization rate of semi-dry process is 80 - 90%, the removal efficiencies of such acidic gases as HCl and HF are above 90%, and the dust removing efficiency is higher than 99%. It has such advantages as low equipment costs, low operation costs, high purification efficiency, simple maintenance, and there is no need to conduct secondary treatment to the products of reaction, etc. It may be applicable to different types of stoves, such as MSW incinerator, and coal-burning boiler, etc. The disadvantage of such purification plant is that it is demanding for automatic control level. Moreover, it is also demanding for spray nozzles: It should not only have good atomizing effects, but also be resistant to corrosion and abrasion, and not easy to be plugged.

235. In summary, if semi-dry process flue gas treatment system is compared with wet-process and dry-process flue gas treatment systems, its greatest advantage is that it fully uses the excess heat in the flue gas to vaporize the moisture in the hot liquid, the reaction products are discharged in dry solid form, which avoided the wastewater treatment problem in the purifying course of wet scrubber. Therefore, it is extensively used in purifying gaseous pollutants in MSW incineration flue gases.

4. Alternative De-Dust Technology

236. Presently, electrostatic dust collector and bag filter are generally used to treat the smoke dust in incineration flue gas. Presently, since the dedusting efficiencies of small-unit electrostatic collectors are unstable, and the dedusting efficiencies of bag filters are higher than that of the electrostatic collectors, bag filters are used in most cases.

237. Bag house filter is also referred to as filter-type dust collector, and it is a dry-style high-efficiency dust collector. It filters the solid particles in dusty gases with

bag house filtering components made with organic fibers or inorganic fibers, and it is used to collect non-agglutinating and non-fibrous industrial dusts. Bag house filters are extensively used in some thermal power plants and MSW incineration plants in the United States, Canada, Australia and Europe, etc. Bag house filter for incineration flue gas is already a mature technology, and there are also more than 10 Chinese companies using bag house filters in different areas.

238. Bag house filters can be used at temperatures up to 200℃ with high efficiency. Such filters achieve typical dust emissions of 2 mg/Nm3 which compares favorably with the waste incineration directive which sets the limit at 10 mg/Nm3. Due to the creation of a cake on the filter cloth it is possible to consider a bag house filter as a reactor also for the removal of acid gases and further removal of dioxins and heavy metals. The outlet temperature from the evaporating spray reactor is between 140 and 180℃, therefore this is an optimal location for a bag house filter in the process. For the reasons outlined above it is therefore proposed to use a bag house filter for the removal of dust after the evaporating spray reactor as the outlet temperature is optimal.

239. Electrostatic dust collector is a kind of dust-collecting equipment to charge the particles of dusty gas when it runs across high-voltage electric field for ionization, and separate the particles from the dusty gas with the effects of electric field force. Electrostatic dust collector is used quite early in China, and after many years of development and application, the technology has been relatively mature, with relatively high dust collecting efficiency. An efficiency of 95 % is common. However, achieving dust emissions below 3 mg/Nm^3 has proven difficult.

240. Comparison of Bag house filter and Electrostatic Dust Collector may be referred to Table V.4.

Table V.4: Comparisons of Bag house filter and Electrostatic Collector

	Bag house filter			Electrostatic Collector		
Technical and Economic Indicators	Equipment land occupation (m^2)		100	Equipment land occupation (m^2)		300
	Equipment investment (in 10^4 RMB)		450	Equipment investment (in 10^4 RMB)		640
	Operation and maintenance cost (10^4 RMB /a)		36	Operation and maintenance cost (10^4 RMB /a)		60
	Dust removal effects (mg/Nm^3)		10–25	Dust removal effects (mg/Nm^3)		30–50
	Dust removal rate, %	＜1μ	＞90	Dust removal rate, %	＜1μ	20
		1～10μ	＞99		1～10μ	＞95
		＞10μ	＞99		＞10μ	＞99
	Heavy metal and dioxin removal effects		Relatively good	Heavy metal and dioxin removal effects		Poor
	Acidity and alkalinity resistance		Depending on material quality of filter bag	Acidity and alkalinity resistance		Relatively good
	Head loss (Pa)		～1000	Head loss (Pa)		200–300
	Power consumption		Slightly low	Power consumption		Slightly high
	Operation and maintenance		Slightly low	Operation and maintenance		Relatively high

	Bag house filter		Electrostatic Collector	
	costs		costs	
Advantages	Baghouse filter has stable and reliable performances, with good adaptability to load changes, simple operation and management. It is particularly suitable for collecting fine and dry dusts, and the dry dusts are easy to be treated and reused. It may be maintained and repaired without shutting down the equipment. It takes limited area, and special design may be conducted according to the site requirements. It has high level of automation, with detecting and alarming functions on all the devices of the dust collecting system, and it is not demanding for the operators.		The dust collecting efficiency may be above 99%, and it can collect very fine dusts under 1μm. However, for economic considerations, it is to generally control a reasonable dust collecting efficiency. It can treat large volume of flue gas, and it may be used in circumstances with high temperature (it may be as high as 500℃), high pressure and high humidity (relative humidity may be as high as 100%). It can be continuously operated, and it can be automated.	
Disadvantages	Baghouse filters are used to purify dusts containing oil mist, water mist and high agglutinating value. It has corresponding requirements for filter materials, and it is necessary to take explosion-proof measures while purifying dusty gases with explosion dangers or sparks. While it is used to treat dusty gases with high relative humidity, it is necessary to take heat insulation measures (especially in winter), so as to avoid "paste bag" due to condensation. When it is used to purify corrosive gases, it is necessary to select corrosion-proof filter materials. When it is used to treat high-temperature flue gas, it is necessary to take cooling measures to cool the flue gas temperature down below the temperature tolerable for long-term operation of the filter bags, and it is to try to use filter materials with good resistance to high temperatures.		The equipment is quite large and consumes a lot of steel, and it requires high-voltage power transformation and rectifying devices. Generally, the peak output voltage of the high-voltage power supply equipment is 70-100kV, so investments will be quite high. It requires high technical levels of manufacturing, installation and management. The dust collecting efficiency is subject to great impacts of specific resistance of dusts. Without taking certain measures, the dust collecting efficiency will be affected. Dusty gases with initial density greater than 30g/cm^3 will need equipment pretreatment devices. It has off-line repair functions. Once the equipment defaults, it may operate with problems, or the incinerator has to be shut down for repair.	
Reliability	① It can guarantee dust emission density to be <50mg/m^3 for a long time. It is not subject to the impacts of dust density and specific resistance at the entrance. ② The service life of the main component - filter material, is over 30,000h. ③ The service life of the main component - electromagnetic pulse, is over 1 million times. ④ It is to inspect the alarming devices of all the operating equipments, which can find out the defaults and alarm without any delay; ⑤ The main maintenance job - replacing filter bags, can be done by two people; ⑥ Repair and maintenance may be conducted by using offline functions without affecting normal operation of boiler; ⑦ In severe coldness in North China, it is to adopt strict heating and insulation measures for the compressed air flushing system and dust collector, which can avoid condensation.		① In the early stage of putting into operation, it may reach expected dust collecting efficiency. However, it is subject to impacts of flue gas status; ② After operating for a certain period of time, the electrode may deform and cause electric field changes, and dust collecting efficiency will be lowered accordingly. ③ Maintenance and repair cannot be realized until the incinerator is shut down.	
Maintenance convenience	Once there is a default to the Baghouse filter, alarms and indications may be obtained from the control system. Therefore, the chamber may be repaired and maintained independently offline (maintaining normal operation of boiler). All the troubleshooting can be conducted outside the machine, and there is no need to enter the deduster. In the course of daily maintenance, concealing measures may be taken to broken filter bags (when the filter broken rate is below 5%), so as to further reduce daily jobs.		Since electromagnetic dust collector does not have offline maintenance and repair functions, once there is a default, it is necessary to shut down the incinerator for maintenance and repair. Otherwise, it must operate with problems. While conducting maintenance and repair, the workers must enter the deduster, where the working environment is hostile. Level and position of damage inside the deduster must be entirely checked by manpower, with high labor intensity of maintenance.	

241. It can be seen from Table V.4that the advantages of adopting Bag house filter in this project are as follows:

i.Bag house filter can meet the stricter and stricter environmental protection requirements. Presently, some industrialized countries generally adopted

Bag house filters in dust removal of MSW incineration flue gas, which has been extended as a mature technology. Moreover, the service life of Bag house filter is also very long, which are generally over 2 years, and some of which are over 6 years.

ii. Dust collecting efficiency of Bag house filter is high, and it takes limited space (in comparison with electrostatic dust collector with more than four electric fields). It is particularly noteworthy that in recent years, due to development of manufacturing technologies, the corrosion and abrasions of filter bags have been effectively solved, which provided a powerful guarantee for application of Bag house filter.

iii. Bag house filter has the characteristic of not being subject to specific resistance of dust or impacts of load.

iv. Operation, fault and normal diagnosis of Bag house filter may adopt automatic monitoring and management, which may realize maintenance by chambers without shutting down machines, making its operation and management simple and easy, which can effectively guarantee dedusting efficiency.

v. With the same treatment efficiency, the investments and operation costs of Bag house filters are relatively lower than those of electrostatic dust collectors.

vi. Since the temperature at incinerator flue gas outlet is quite high, the high-temperature will conduct water-cooled heat transfer at the combustion chamber, sequentially conduct heat convection with high-temperature super heater, low-temperature super heater, coal economizer and air preheater, and enter deduster after the temperature drops to 150℃, which may maintain a long service life of the filter bag.

vii. The dedusting effects of Bag house filter in MSW incineration flue gas will be the best. Since the flue gas contains a little chlorine element, the hypochloric acid and chloric acid formed will be seriously corrosive to the metal components of electric deduster. However, since cloth bag of the Bag house filter are nylon, its corrosion resistance will be better than electric deduster.

242. Since the pollutants in MSW incineration flue gas are quite complicated, and contains such toxic and hazardous substances as heavy metals and dioxins, it is to adopt Bag house filter in the design of this project. According to *Technical Code for Projects of Municipal Waste Incineration* (CJJ90-2009), it is to prefer Bag house filter

as the end equipment of flue gas purification system, and it is to install deduster bypass.

243. In summary, since the pollutants in MSW incineration flue gas are complicated, and contain such toxic and hazardous substances as heavy metals and dioxins, moreover, according to Technical Code for Projects of Municipal Waste Incineration (CJJ90-2009), it is necessary to install Bag house filter for MSW incineration flue gas, so it is to adopt Bag house filter in the design of the proposed project, the dedusting efficiency of which will be 99.8%, which is technically mature and economically reasonable.

Chapter VI ANTICIPATED IMPACTS AND MITIGATION MEASURES

244. This section identifies and assesses the potential for adverse environmental and social impacts that may occur during the project construction and/or operational phases, and the mitigation measures that should be implemented in the detailed design and pre-construction, construction, and operation phases of the project.

A. Detailed design and pre-construction phase: measures to be implemented

245. The following measures will permanently become part of the infrastructure and will be included in the detailed design of facilities by the design institutes.

i. Technical design of pollution control must meet the Class II of Pollution *Control Standards for Pollutants from Municipal Solid Waste Incineration (GB18485-2001).*

ii. Technical design of fly ash treatment must meet the *Hazardous Waste Storage Pollution Control Standards* (GB18597-2001) and *Hazardous Waste Landfill Pollution Control Standard* (GB18598-2001).

246. The following measures will be implemented in the pre-construction phase to ensure the project's environment management readiness.

（i） Institutional strengthening, including (a) appointment of one qualified environment specialist within Zhangqiu PMO; (b) hiring of loan implementation environment consultants (LIEC) within loan administration consultant services by Zhangqiu PMO; and c) contracting of environmental monitoring station by ZPMO to conduct environment impact monitoring. The organization will be third party and authorized by related government. LIEC will be hired by the Zhangqiu PMO and the main responsibilities of LIEC are:

- Review the project EIA and the recommended environmental management plan (EMP)
- Conduct due diligence on prior land acquisition and resettlement undertaken by the local government.
- Fully comply with the monitoring and reporting requirements during the construction
- Report its environmental and social management activities as part of its annual reports.
- Implement an appropriate public information program related to its environmental and social management activities, and

（ii） Land-take confirmation. The Resettlement Plan will be updated with final inventory. This will be the responsibility of Zhangqiu PMO, using a local design institute.

（iii） Contract documents. All tender documents will include the EMP obligations,

including the environmental monitoring program. This will be the responsibility of the local design institute, with support of Zhangqiu PMO and the LIEC.

（iv） Environmental protection training. Environmental specialists and/or officials from Zhangqiu EPB will be invited to provide training on implementation and supervision of environmental mitigation measures to contractors. This will be the responsibility of Zhangqiu PMO, with support of the LIEC.

B. Construction phase: potential impacts and their mitigation

1. Impacts on Air Quality

247. **Air pollution due to exhaust gases from equipment and transport vehicles**. Construction machinery on all sites will consume petrol and diesel, releasing gaseous SO_2, CO, and NOx. Equipment will be properly maintained to ensure performance efficiency and avoid incomplete combustion of fuel that may result to air pollution. High-horsepower equipment will be provided with tail gas purifiers. Atmospheric monitoring will be carried out during the construction period. All vehicle emissions will be in compliance with relevant PRC emission standards.

248. Dust emissions from the excavation and transport of materials. In the course of construction, earth excavation, open piling of soil and rock, as well as truck transportation will all generate flying dusts. The road flying dusts caused by transportation of trucks in the job site will account for over 50% of the total flying dusts of the job site. The volume of flying dusts on the road are related to driving speed of the trucks, load weight, contact area between wheels and the round, pavement conditions, and relative humidity of air, etc. Flying dusts affect the respiratory health of the neighbouring residents and pedestrians passing by, and also affect the scenery nearby. In the course of construction, soil excavation and flying dusts of piling soil will vary with the different construction areas, which affect local areas. The impacts will be short-term impacts, which will disappear with the completion of construction. Flying dusts of transportation will generally be within 30m on both sides of the dust-generating road, which vary with different roads, and the TSP content of unsurfaced roads will be 2 – 3 times higher than that of concrete roads. Before construction of the proposed project, it is to have the municipal department to build the neighbouring roads as asphalt pavement, which may effectively lower the flying dusts of road transportation.

249. There are few environmental sensitive points and no intensive residential areas in project area. The distance from the proposed project to the nearest Wangzhong Village is 510m,so the dust during construction has minor impacts on the human environment. The mitigation measures for raised dust impact will be as following:

i. The construction site will be enclosed to avoid the dust emissions. The access

permission should be issued only for the transport vehicle that loads waste or gravel.

ii. Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic only apart from the contractor's car park which will be overlapped only.

iii. Material stockpiles equipment will be equipped with dust shrouds. For the earthwork management for backfill, measures should include surface press and periodical spraying and covering. The extra earth or dreg should be cleared from the project site in time to avoid the long term pile. The height of stockpiles should be less than 0.7m.

iv. The operators will regularly maintain the dust shrouds to ensure their effective operation. For both construction sites and construction roads, water spraying for the suppression of dust and maintenance of driving surfaces will be standard site management practice. It is required that each construction road section will be equipped with one watering cart. The water spraying times will be determined based on weather. The basic principle is once during 8:00-09:30, once during 12:00-13:30 and once during 18:00-19:30. These are peak hours where heavy traffic is usually observed.

v. Vehicles carrying soil, sand, or other fine materials to and from the construction sites will be covered. These vehicles should be flushed for removal of mud and covered to avoid the leakage along the road.

vi. Vehicles using site roads will have their speed restricted, and this speed restriction must be enforced rigidly. On any un-surfaced site road, this will be 20 kph, and on hard surfaced roads as site management dictates.

vii. Assign haulage routes and schedule to avoid the transport occurring in the central area, traffic intensive area or intensive residential areas. For the areas with high-demand on environmental quality, transport should be arranged at night. Any earth spilt on the roads during transportation should be cleared at once.

250. At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust would be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

2. Noise Impacts

251. Noise can be expected during construction due to construction machinery operation and transport activities. Construction activities will involve bulldozers, graders, excavators, concrete-mixing plants, rollers, and other heavy machinery. Noise intensity from these large machines operating is typically in the range of 80–98 decibels at the site (5m from operating machinery). The transport of material, aggregate, concrete and waste material to and from sites will also cause noise

impacts along the haulage routes. Activities with intensive noise levels will not only have an impact on the residents, but may also cause injury to construction workers operating the equipment. The noise levels from major construction machinery are shown in Table VI.1 below.

Table VI.1: Testing Values of Construction Machinery Noise

No.	Name of Machine	Noise Level, dB(A)	No.	Name of Machine	Noise Level, dB(A)
1	Bulldozer	78～96	6	Excavator	80～93
2	Mixer	75～88	7	Earth-moving trucks	85～94
3	Pneumatic hammer, pneumatic drill	82～98	8	Air compressor	75～88
4	Concrete breaker	85	9	Drill	87
5	Windlass	75～88			

Note: All the data listed in the table were measured at about 1.5m away from the noise source.

252. Different requirements are proposed for different construction stages based onthe Emission Standard of Environmental Noise for Boundary of Construction Site(GB12523-90-Attachment 25), and details of noise limits may be referred to in Table VI.2.

Table VI.2: Noise Limits in the Construction Site

Construction Stage	Main Noisy Machines	Noise Limits, dB(A)	
		Day	Night
Cubic meter of earth and stone	Bulldozers, excavators, and loaders, etc.	75	55
Piling	All kinds of piling machines, etc.	85	Construction Prohibited
Structure	Concrete, vibrator and electric saw, etc.	70	55
Decoration	Crane and lift, etc.	65	55

253. Referring to the projected results of noise impact of similar construction machines, the range of noise impacts of construction machines during the day is 60m, and that of the night is 180m. The distance from the factory area to Wangzhong Village, the closest village, is 510m. Therefore, the noise of the project on the residents of the neighboring villages during the construction period will be limited. The noise impacts during the construction of the Project are temporary and can be minimized by the implementation of the mitigation measures.

254. Trumpets of trucks, motor roaring, concrete agitating noises and noises generated by road compactors are all noises generated by construction activities. In order to minimize impacts of construction noises on the residents, it is generally necessary to take the following measures:

i. Noise levels from equipment and machinery conform to the PRC standard of GB 12523-2011, and properly maintain machinery to minimize noise;

ii. Equipment with high noise and high vibration are not used in village or township areas and only low noise machinery or the equipment with sound insulation is employed;
iii. According to the regulations on noise control promulgated by the local environmental protection agencies, it is to conduct construction by different periods of time, avoid the hours in which the residents are sensitive to noises. In the job sites where it is a must to conduct construction at night, which may affect the neighboring residents' lives, it is to adopt measures to lower the noises of the construction machines;
iv. It is to prohibit construction operations of equipment with high noise levels at night;
v. It is to try to minimize the collision and abrasion noises in the course of construction;
vi. It is to install such devices as temporary sound barriers around the job site or settlements, so as to guarantee the sonic environment quality of the residential areas.

3. Solid Waste

255. In the course of constructing the buildings in the project, certain amount of construction wastes will be generated, such as aggregate, cement, bricks and timber, etc. If it is not properly disposed, once there is a heavy rain, it may be eroded to the water bodies nearby and cause water pollution. It is suggested that the construction contractor should standardize transportation, move the surplus and waste construction materials and construction wastes to designated locations and move out promptly. It is absolutely not allowed to randomly dump or discharge construction wastes into rivers and water bodies nearby. During the construction period, the construction workers should timely collect the domestic wastes, and have the local sanitation departments to collectively move them out for treatment.

256. During the project construction period, Dynagreen Regeneration Energy Ltd. and the contractor will contact the local sanitation department to promptly clean the domestic wastes from the job site. In the course of construction, if any toxic or hazardous wastes are encountered, it is to suspend construction, and promptly contact the local environmental protection agencies, and construction cannot be resumed until after they have taken measures accordingly. After completion of construction, it is to clean the job site and properly dispose of the construction wastes. It is to establish dustbins and hygiene responsibility area in the job site, determine responsible persons and the circle of regular sweeping.

4. Water Impact

257. Construction wastewater generated during the construction period mainly include muddy water, truck flushing water, domestic wastewater and restaurant wastewater. Construction requires excavating soil, piling, flushing materials and

curing concrete, which need to use a lot of excavation machines, transportation machines and other auxiliary machines, which may cause such accidents as spillage and leakage of oils in the course of operation, maintenance and repair, and may cause pollution of surface water and underground water by such means as flushing and rainwater. During the construction period, considerable number of construction workers and managers will be mobilized to the job site, and if the domestic wastewater generated by these people cannot be properly treated, it may pollute surface water and underground water. Moreover, while conducting civil construction, it is necessary to discharge water siltation with water pump, which contains a lot of mud. If this part of mud drains into rivers nearby with surface runoff, it will cause suspended solids in recipient water body to increase. Simultaneously, since the muddy water contains organic impurities, waste oil of construction machine and solid wastes at the time of construction may also cause the densities of CODcr, NH_3-N and oils to increase, and dissolved oxygen to decrease, causing water pollution. As the wastewater will be transported to Zhoujiatun Harmless Landfill Percolate Treatment Station or the municipal wastewater pipe network for further treatment, it will not cause environmental pollution to Luo River.

258. Field investigation indicated that the water consumption of mixing and curing concrete at the job site accounts for about 90% of total water consumption; domestic wastewater from construction people and a little oil-containing wastewater in maintenance and repair of construction machines. Due to uncertainties of machine repair process, the amount of oil-polluted water generated by machine repair is also limited. The main pollutants in wastewater during the construction period include COD, BOD5, NH3-N, oils and SS, etc. Northwest part of the proposed project area is in close proximity to Zhoujiatun Harmless Landfill Percolate Treatment Station, domestic wastewater of the construction workers cannot be randomly discharged; instead, it is to be discharged to Zhoujiatun Harmless Landfill Percolate Treatment Station or the municipal wastewater pipe network, whichever is closer. The oil-polluted water generated in the course of maintaining and repairing the construction machines should be collected and uniformly treated. It will be sent to WWTP for further treatment (see Attachment 15).

259. Mitigation measures include:

i. Keep the drainage system clean and free from any wastes.
ii. It is suggested to establish sediment settling tank in the job site for treating construction muddy wastewater. Whenever conducting agitation operations in the job site, it is necessary to install settling tank at the foreground of agitator and truck washing place, and wastewater should be settled and reused for spraying to control dusts.
iii. It is to reasonably plan the temporary water supply and drainage facilities of the job site, and take effective measures to eliminate leakage of water from pores, valves, drips and taps.

iv. Domestic wastewater of the construction team should be promptly collected and treated.
v. It is to strictly manage and save water consumption for construction and domestic purposes.
vi. Oil-polluted wastewater generated from maintaining and repairing construction machines should be duly collected and treated, and it is to install temporary devices for separating and treating oil, and it is prohibited to be randomly dumped.
vii. During the construction period, all the wastes should be piled at designated locations and promptly cleaned, and prevent them from being washed away into the sewer and flow into the water body nearby.
viii. There are many activities of breaking grounds and piling soil on the job site. It is to promptly clean soils to permitted piling spots, and it is not allowed to be randomly dumped.

5. Ecology

260. The land for the proposed project is the planned municipal construction purpose land, which is presently a parcel of saline-alkali soil. Therefore, construction of the proposed project will have very limited impacts such as dust generation on the surrounding ecological environment.

6. Physical Cultural Relics

261. The EIA has reviewed the status of cultural heritage within the project area and concluded that the presence of any physical cultural resources is unlikely. Should buried artifacts of archaeological significance be uncovered, construction will be stopped and immediately reported to the Zhangqiu Cultural Heritage Bureau in accordance with the PRC's Cultural Heritage Protection Law.

7. Impacts on socio-economic conditions

262. **Scope of Land Acquisition and Resettlement Impacts.** Totally, 123.36 mu (8.228 ha) collective land was acquired permanently, including 113 mu (7.5370 ha) for the construction of the plant (within the red line) and 10.36 mu land for the access road. It was confirmed that there was no house demolition impacts induced by the project. There is no residential house within the buffer zone (400 meters) as verified by the site visit. There are 122households comprised of490persons from Houjia Village, which is 560 meter far away were affected and all of them are Han people. It is confirmed by the village committee that there was no vulnerable people affected by land acquisition. However, some ground attachments were affected including public facilities, such as the pipelines, well and water channels which belong to the village and trees which belong to individuals.

Table VI.3Land Acquisition

Component	Type of land	Quantity	
		ha	Mu
Plant	Farmland	3.1962	47.94
	Forest land	4.0482	60.72
	Construction land	0.2926	4.39
	Subtotal	7.537	113
Access road	Construction land	0.691	10.36
Total		8.228	123.36

8. Impacts on health and safety

263. **Occupational health and safety.** Due to its nature the construction industry is a hazardous industry with the potential for accidents. The civil works contractors will implement adequate precautions to protect the health and safety of construction workers. Contractors will manage occupational health and safety risks by applying the following measures.

（i） Construction site sanitation:

a) Effectively clean and disinfect project sites. During site formation, spray with phenolated water for disinfection. Disinfect toilets and refuse piles and timely remove solid waste.
b) Ensure that no stagnant water collects on construction sites (e.g. in drains or open containers) to reduce the incidence of mosquitos or other disease vectors.
c) Exterminate rodents on site at least once every 3 months, and exterminate mosquitoes and flies at least twice each year.
d) Provide public toilets in accordance with the requirements of labor management and sanitation departments in the living areas on construction site, and appoint designated staff responsible for cleaning and disinfection. The construction camps will be constructed and the contractor will responsible for the occupational and health safety. Dynagreen will also take part in the management
e) Provide awareness training to all construction workers (around 300 during peak construction) to minimize disease risk (e.g. washing hands after using the toilet).

（ii） Occupational safety:

a) Provide safety wear (hats, shoes, goggles, ear plugs, respiratory masks) to all construction workers and ensure they are used in all necessary construction activities.

（iii） Food safety: Inspect and supervise food hygiene in cafeteria or canteen on site regularly. Cafeteria workers must have valid health permits. If food poisoning is discovered, implement effective control measures immediately

to prevent it from spreading.

（iv） Disease prevention and safety awareness:

a) Provide all construction workers with physical examination before starting employment and implement semi-annual health checks. If infectious disease is found, the patient must be isolated for treatment to prevent the disease from spreading. From the 2nd year onwards, conduct physical examination on 20% of the workers every year.

b) Establish health clinic at location where workers are concentrated, which should be equipped with common medical supplies and medication for simple treatment and emergency treatment for accidents.

c) Specify (by the PMO and contractors) the person responsible for health and epidemic prevention responsible for the education and propaganda on food and toilet hygiene and disease prevention to raise the awareness of workers.

264. **Community health and safety.** Traffic congestion may worsen as construction traffic increases during rush hours, causing temporary inconvenience to traffic, residents, commercial operations, and institutions. Construction sites will be partly located close to residential and commercial areas, presenting a threat to public health and safety. The project may also contribute to road accidents through the use of heavy machinery on existing roads, temporarily blocking pavements for pedestrians etc. The following project mitigation measures will be adopted by all project agencies and contractors.

（i） Traffic management: A traffic control and operation plan will be prepared by the contractor together with the local traffic management authority prior to any construction. The plan shall include provisions for diverting or scheduling construction traffic to avoid morning and afternoon peak traffic hours, regulating traffic at road crossings with an emphasis on public safety through clear signs, controls and planning in advance.

（ii） Information disclosure: Residents and businesses will be informed in advance through media of the road improvement activities, and the dates and duration of disruption.

（iii） Construction sites: Public signs will be placed at construction sites, warning people of potential dangers such as moving vehicles, hazardous materials, and excavations, and raising awareness on safety issues. Heavy machinery will not be used after day light (to reduce night time construction noise) and all such equipment will be returned to its overnight storage area/position before night. All sites will be made secure, discouraging access by members of the public through appropriate fencing whenever appropriate.

265. **Utilities provision interruption.** Construction may require relocation of municipal utilities such as power, water, communication cables. Temporary suspension of services (planned or accidental) can affect the economy, industries, businesses and residents' daily lives. Mitigation of impacts on utilities provision will be

through a number of activities defined in the EMP, to be incorporated in the bid documents and construction contracts:

（i） Contractors will assess construction locations in advance for potential disruption to services and identify risks before starting construction.

（ii） If temporary disruption is unavoidable the contractor will, in collaboration with relevant local authorities such as power company and water supply company and communication company, develop a plan to minimize the disruption and communicate the dates and duration in advance to all affected people.

C. Environmental Impact and mitigation measures during Operations

1. Air Quality

266. Air dispersion modeling was carried out using the United States Environmental Protection Agency's (USEPA) regulatory model (AERMOD) (Attachment 39). The aim of the study was to assess the impact in the ambient environment of emissions from the facility. Modeling was also conducted under abnormal operating conditions to assess any short-term impact due to these infrequent events. The dispersion model study consisted of the following components:

- Review of design emission levels and other relevant information needed for the modeling study;
- Identification of the significant substances which will be released from the facility;
- Review of background ambient air quality in the vicinity of the proposed facility;
- Air dispersion modeling of significant substances released from the facility;
- Identification of predicted ground level concentrations of released substances beyond the facility boundary and at sensitive receptors in the immediate environment;
- Evaluation of the significance of these predicted concentrations, including consideration of whether these ground level concentrations are likely to exceed the most stringent ambient air quality standards and guidelines which have been set for the protection of human health;
- Impact on public health and the environment in the unlikely event of "abnormal" operating conditions.

267. Modeling and a subsequent impact assessment were undertaken for the following substances released from the facility:

Table VI.3 Air Quality Prediction

Source	substances	Predicted points	Concentration
Normal operating	PM_{10},SO_2,NO_2,HCl,Fluoride,Cd, Pb, Hg, Dioxin, NH3, H2S	Sensitive receptors, grids, maximum ground concentration	Hourly concentration, daily average, annual average

Abnormal operating condition	PM_{10},SO_2,NO_2,HCl,Fluoride,Cd, Pb, Hg, Dioxin, NH3, H2S	Sensitive receptors, grids, maximum ground concentration	Hourly concentration

FIG VI.4 Environmental Sensitive Receptors and Location

No.	village	UTM X（m）	UTM Y（m）
1	wangzhong	-352	-1025
2	xiushui	-2451	-319
3	houjia	-395	916
4	taiping	513	768
5	jujia	323	2118
6	chizitou	1810	-498
7	Zhangqiu city	-4234	-87

a. Pollution Source Intensity

268. PRC emission standard has outlined stringent operating conditions in order to ensure sufficient combustion of waste, thus ensuring that dioxin formation is minimized. Indeed, due to the advanced post-combustion flue gas cleaning technology employed, expected average emission values will be lower than the standard limit. Table VI.5 and VI.6 show the pollutants emission and dust emission values.

Table VI.5Flue Gas Air Pollutants Emission Values from the Project

FLUE GAS (Nm^3/h)	ITEM	output		Purification rate	emission		Annual emission (t/a)	Standard rate (mg/m^3)		[Chimney] Height Diameter Temp.
		mg/Nm^3	kg/h		mg/Nm^3	kg/h				

126025	SO_2	666.61	84.01	≥85%	99.99	12.60	100.80	260	confirm	80m 2.5m 150℃
	HCl	884	111.39	≥95%	44.19	5.57	44.56	75	confirm	
	NOx	300	37.81	≥33 %	200	25.21	201.64	400	confirm	
	DIOXIN	——	——	——	0.1 TEQng /Nm^3	1.26 $\times10^{-8}$	1.01 $\times10^{-7}$	0.1 TEQng /Nm^3	confirm	
	CO	100	12.60	——	100	12.60	100.82	150	confirm	
	Hg	--	--	≥90%	0.003	0.00038	0.00304	0.2	confirm	
	Cd	--	--	≥90%	0.0001	0.00001	0.00008	0.1	confirm	
	Pb	--	--	≥90%	0.002	0.00025	0.0020	1.6	confirm	
	DUST	13741	1731.74	≥99.8%	27.48	3.47	27.71	30	confirm	

Table VI.6Dust Emission Values from the Project

NO	SITE	Dust remover	No.	Removal rate	Waste gas Nm^3/h	Emission concentration mg/Nm^3	Emission rate kg/h	Emission amount t/a	Standard mg/Nm^3	Height/diameter
1	Ash bunker	bagfilter	1	≥99.8%	1500	20	0.030	0.263	30	22m，0.28m
2	Lime bunker	bagfilter	1	≥99.8%	1000	20	0.020	0.175	30	16m，0.18m
3	Ash, lime passage	bagfilter	1	≥99.8%	6500	20	0.130	1.139	30	16m，0.50m

b. Modeling Location

269. In relation to the spatial assessment of emissions from the facility, modelling has been carried out to cover locations at the boundary and within a scope of 10km X 10km around the facility. Moreover, concentration at sensitive receptors is also calculated.

c. Modeling Study Methodology

270. The air dispersion modeling input data consists of detailed information on the physical environment (including building dimensions and terrain features), design details from all emission points on-site and a full year of worst-case meteorological data. Using this input data, the model predicts ambient ground level concentrations beyond the site boundary for each hour of the modeled meteorological year. The model post-processes the data to identify the location and maximum value of the worst-case ground level concentration in the applicable format for comparison with the relevant limit values. This worst-case concentration is then added to the existing background concentration to give the worst-case predicted ambient concentration. The worst-case ambient concentration is then compared with the relevant ambient air quality standard for the protection of human health to assess the significance of the releases from the site.

271. Based on PRC EIA guideline for air (HJ2.2-2009), the most appropriate regulatory model for the current application is the AERMOD model (one of the recommended models listed in the PRC EIA guideline for Air). The model is applicable in both simple and complex terrain, urban or rural locations and for all averaging periods.

d. Meteorological Considerations

272. Meteorological data is an important input into the air dispersion model. The local airflow pattern will be greatly influenced by the geographical location. Important features will be the location of hills and valleys or land-water-air interfaces and whether the site is located in simple or complex terrain.

273. Surface meteorological data is from Zhangqiu Meteorological Station. Monthly average data of 20 years and hourly meteorological data for 2010 were used during the prediction. Upper meteorological data for the prediction is from the USA NCAR MM5 and revised based on the PRC Ministry of Meteorology MICAPS3.0data.

274. The wind rose from Zhangqiu Meteorological Station for the years 1991 - 2010 is shown in Figure VI.1.

Figure VI.1 Wind rose for the years 1991 to 2010

Table VI.8 the average Wind Direction Frequency (%) of recent 20 years, Zhangqiu

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	C
平均	3.0	2.6	4.4	5.4	7.9	8.0	4.8	4.3	11.4	10.7	6.3	3.8	3.8	4.0	4.3	3.0	12.1

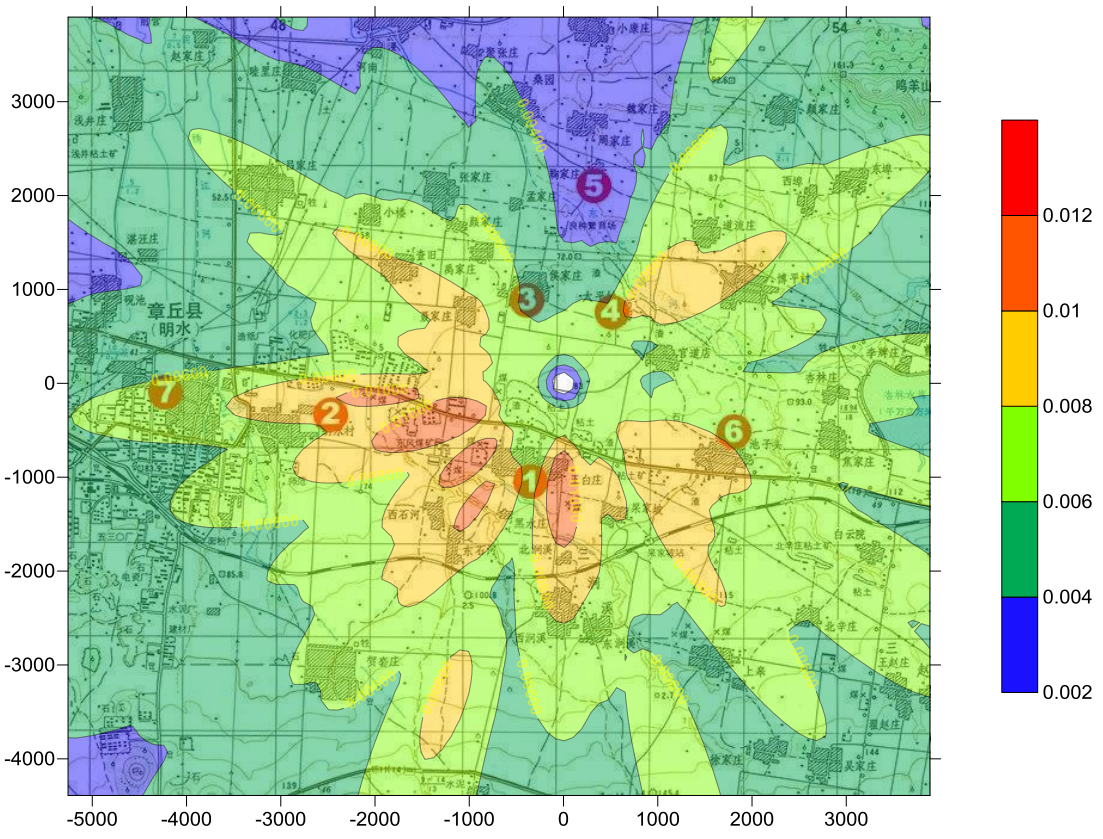
e. Modeling Results and Assessment

275. **Hourly Concentration:** The Predicted Hourly Concentration, see Table VI.9.

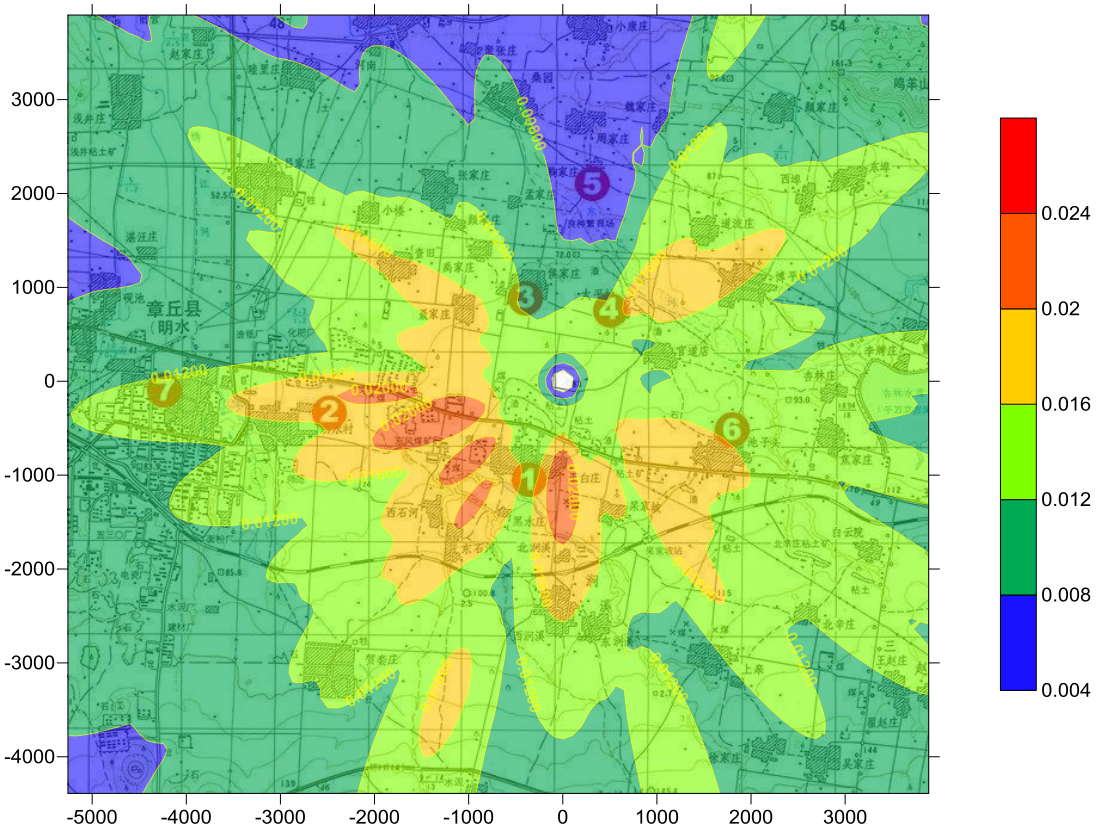
Table VI.9 Predicted Hourly Concentration (unit: mg/m^3)

pollutant	concentration	Ground concentration	Accounting rate（%）	date	UTM	
				YYMMDDHH	East (m)	North (m)
SO_2	1ST	0.0119	2.38	12051307	-1233	-410
	2ND	0.0098	1.96	12071307	-1233	-245
	3RD	0.0092	1.84	12020410	-1599	-245
	4TH	0.0079	1.58	12072807	-1599	-162
	5TH	0.0076	1.52	12072807	-1416	-162
NO_2	1ST	0.0238	11.90	12051307	-1233	-410
	2ND	0.0196	9.80	12071307	-1233	-245
	3RD	0.0184	9.20	12020410	-1599	-245
	4TH	0.0157	7.85	12072807	-1599	-162
	5TH	0.0153	7.65	12072807	-1416	-162
HCl	1ST	0.0053	10.60	12051307	-1233	-410
	2ND	0.0043	8.60	12071307	-1233	-245
	3RD	0.0041	8.20	12020410	-1599	-245
	4TH	0.0035	7.00	12072807	-1599	-162
	5TH	0.0034	6.80	12072807	-1416	-162
gaseous Cd	1ST	<0.00001	<0.10	12051307	-1051	-328
	2ND	<0.00001	<0.10	12071307	-1051	-245
	3RD	<0.00001	<0.10	12052407	-959	-1074
	4TH	<0.00001	<0.10	12111009	-868	-991
	5TH	<0.00001	<0.10	12071207	-1416	-79

276. Modeling results indicate that ambient ground level concentrations of NO_2 and SO_2will be below the limits of Class II of *Ambient Air Quality Standards(GB3095-1996-*Attachment 20). Concentration of HCl, Fluoride and Cd will be below the limits of *Hygienic Design Standard for Industries (TJ36-39-*Attachment 21)- residential area. The hourly concentration (including background concentration) of SO_2, NO_2, HCl, and Cd are 2.38%、11.90%、10.60%、0.10%。of the standard limits. The projected contribution to the ground concentration is less than 11.9% of the standard. Thus, no adverse impact on public health or the environment is envisaged to occur under these conditions at or beyond the facility boundary.



Hourly concentration of SO2



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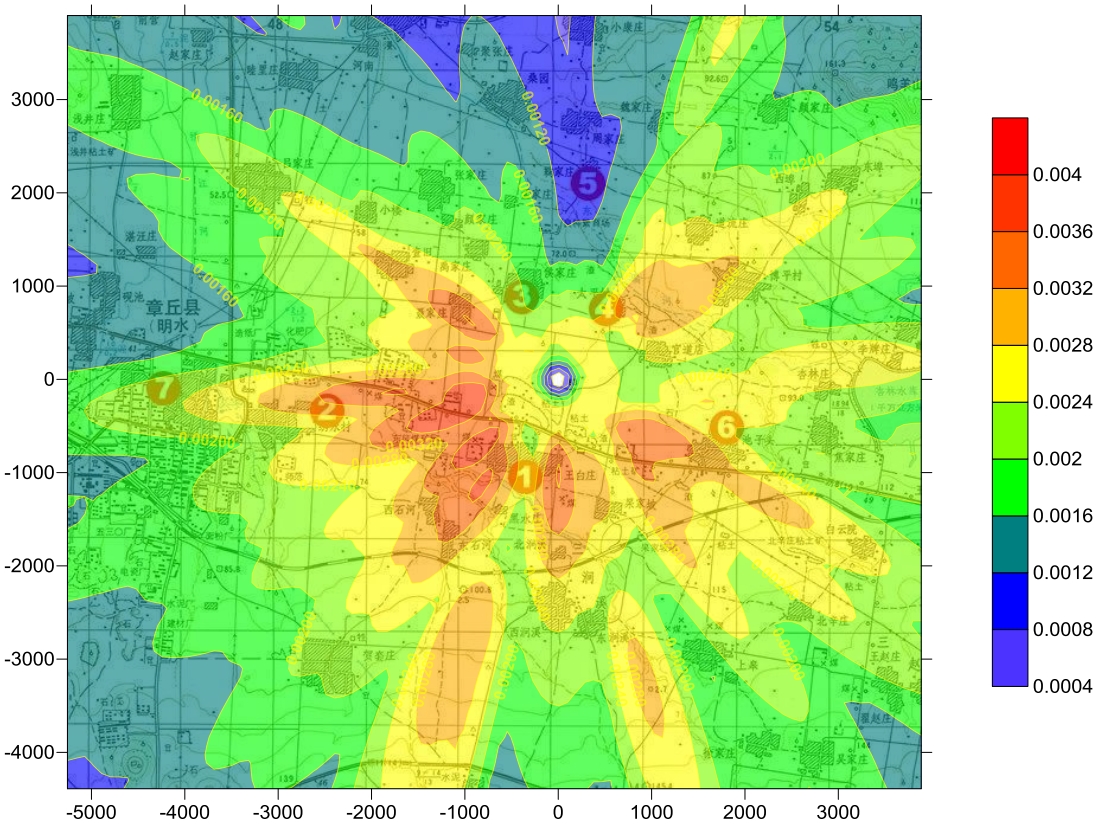


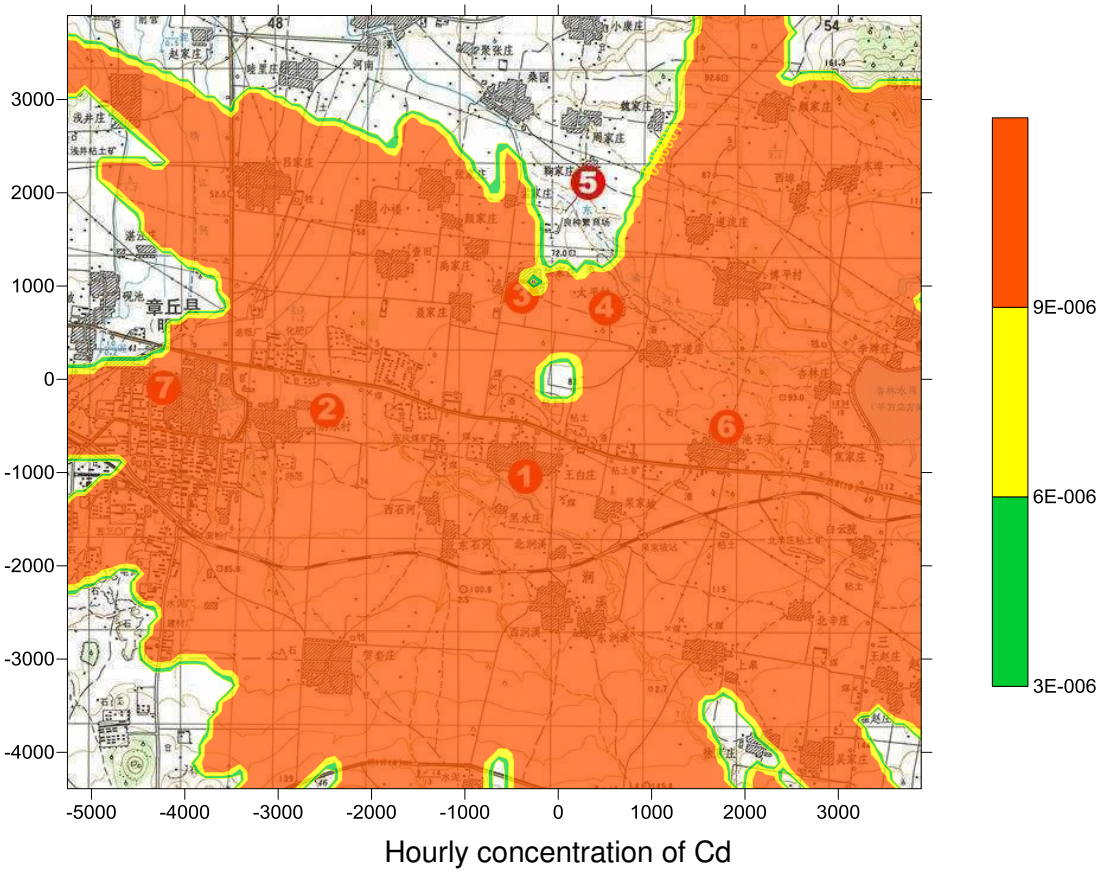


Figure VI.2 Hourly Concentration Distribution

277. The hourly ground concentration at sensitive receptors is shown in Table VI.10. It can be seen from the table that the concentration of SO_2, NO_2, HCl and Cd is 61.80%、61.25%、88.20%、0.10% of the standard limits. The SO2 and NO2 reach the class 2 of "Ambient Air Quality Standard" (GB3095-2012), HCl and gaseous Cd reach the habitation maximum concentration of "Design of Industrial Enterprises Health Standards".

Table VI.10 Predicted Hourly Ground Concentration at Sensitive Receptors (unit: mg/m^3)

position		wangzhong	xiushui	houjia	taiping	jujia	chizitou	Zhangqiu city
SO_2	Predicted maximum	0.18	0.205	0.159	0.18	0.179	0.178	0.0067
	Background value	0.097	0.104	0.088	0.085	0.081	0.086	---
	Overlay value	0.2770	0.3090	0.2470	0.2650	0.2600	0.2640	0.0067
	Accounting rate(%)	55.4	61.8	49.4	53	52	52.8	1.34
NO_2	Predicted maximum	0.0137	0.0185	0.0110	0.0132	0.0058	0.0137	0.0134
	Background value	0.097	0.104	0.088	0.085	0.081	0.086	---
	Overlay value	0.1107	0.1225	0.0990	0.0982	0.0868	0.0997	0.0134
	Accounting rate(%)	55.35	61.25	49.50	49.10	43.40	49.85	6.70
HCl	Predicted maximum	0.0030	0.0041	0.0024	0.0029	0.0013	0.0030	0.0030
	Background value	0.03	0.04	0.04	0.03	0.03	0.04	---
	Overlay value	0.0330	0.0441	0.0424	0.0329	0.0313	0.0430	0.0030
	Accounting rate(%)	66.00	88.20	84.80	65.80	62.60	86.00	6.00
气态Cd	Predicted maximum	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
	Background value	---	---	---	---	---	---	---
	Overlay value	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
	Accounting rate(%)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

278. **Daily Concentration:** Predicted daily maximum ground concentration (including background) of SO2、NO2、PM10、TSP、HCl、gaseous Pb and gaseous Hg are 1.73%、6.50%、0.47%、0.56%、7.67%、0.14%、0.33% of the relevant standard limits. The SO2, NO2,PM10 and TSP reach the class 2 of "Ambient Air Quality Standard" (GB3095-2012), HCl and gaseous Pb and Hg

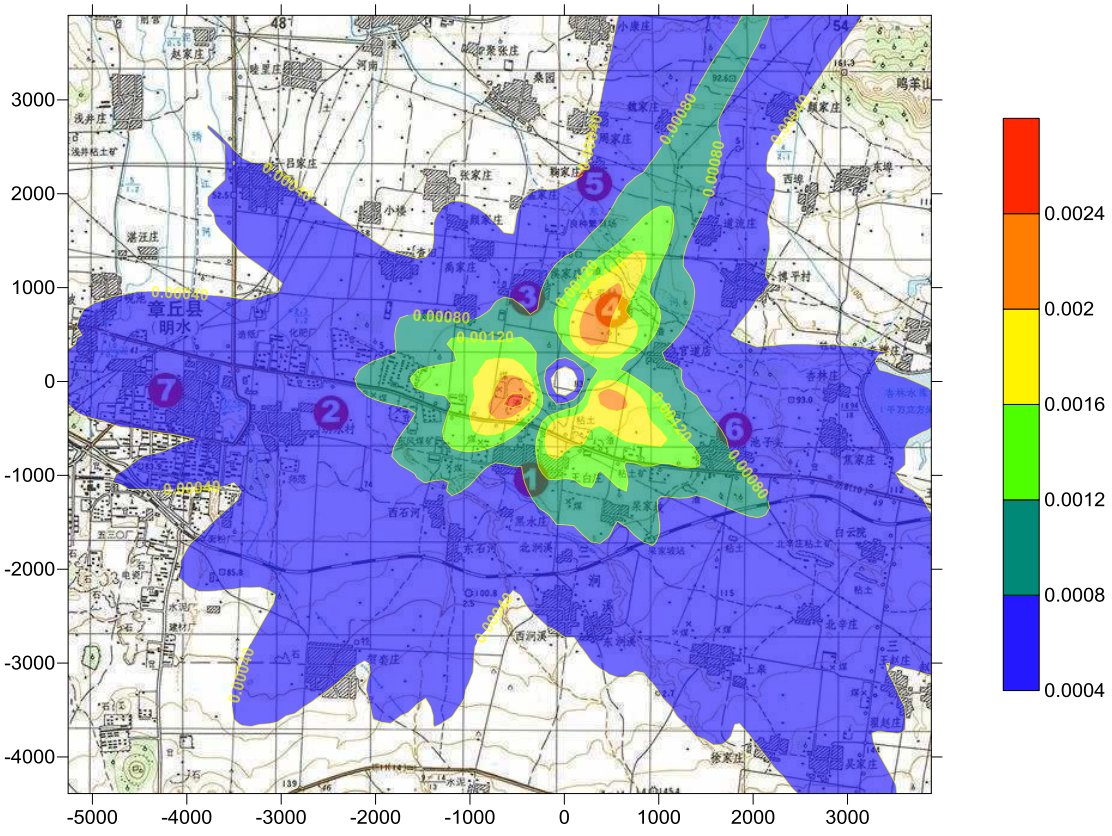
reach the habitation maximum concentration of "Design of Industrial Enterprises health standards".

279. The cumulative daily concentration of all pollutants is within the standard limit. Details are shown in Table VI.11 and Figure VI.3.

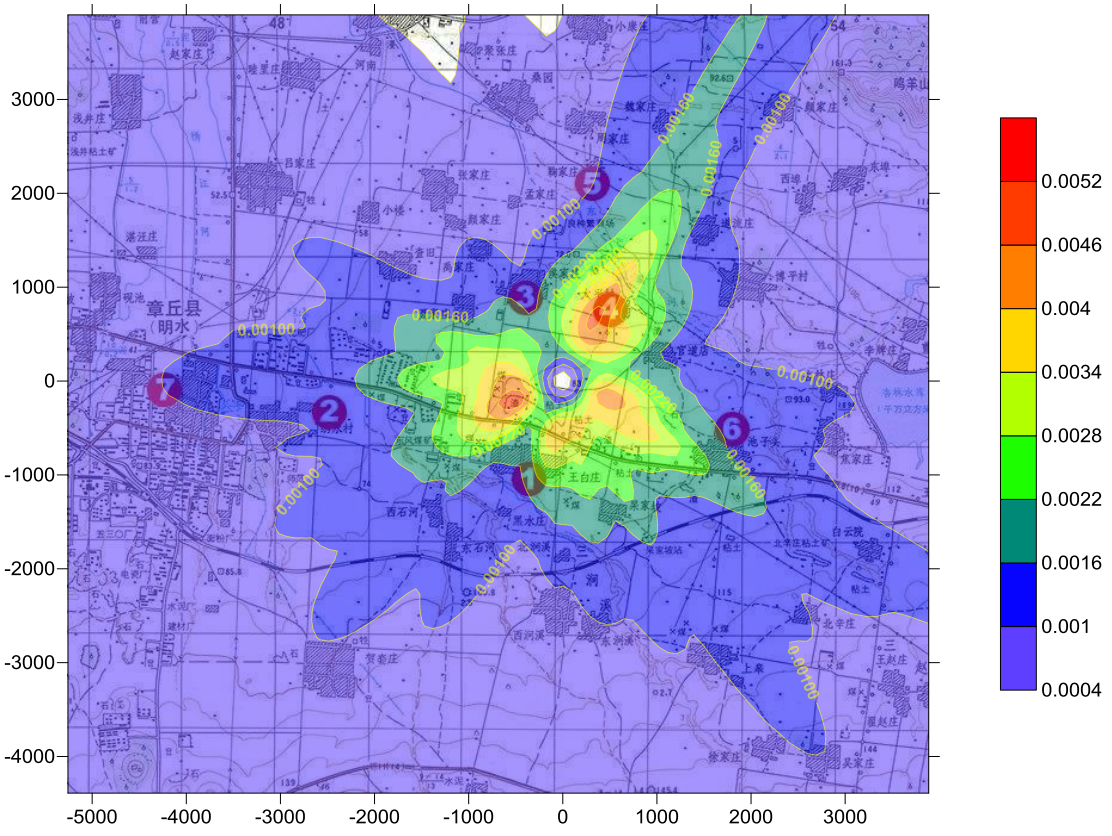
Table VI.11 Predicted Daily Maximum Ground Concentration

pollutant	NO.	Ground concentration	Accounting rate（%）	date	UTM	
				YYMMDD	East (m)	North (m)
SO_2	1ST	0.0026	1.73	12070224	-502	-162
	2ND	0.0024	1.60	12062124	321	667
	3RD	0.0023	1.53	12052924	321	667
	4TH	0.0022	1.47	12062024	321	585
	5TH	0.0022	1.47	12061924	321	585
NO_2	1ST	0.0052	6.50	12070224	-502	-162
	2ND	0.0048	6.00	12062124	321	667
	3RD	0.0045	5.63	12052924	321	667
	4TH	0.0044	5.50	12062024	321	585
	5TH	0.0043	5.38	12061924	321	585
Flue gas	1ST	0.00071	0.47	12070224	-502	-162
	2ND	0.00066	0.44	12062124	321	667
	3RD	0.00062	0.41	12052924	321	667
	4TH	0.0006	0.40	12062024	321	585
	5TH	0.00059	0.39	12061924	321	585
TSP	1ST	0.00169	0.56	12061924	123	121
	2ND	0.00149	0.50	12060124	123	121
	3RD	0.00136	0.45	12072224	123	121
	4TH	0.00125	0.42	12060124	138	170
	5TH	0.00118	0.39	12062124	123	121
HCl	1ST	0.00115	7.67	12070224	-502	-162
	2ND	0.00106	7.07	12062124	321	667
	3RD	0.001	6.67	12052924	321	667
	4TH	0.00097	6.47	12062024	321	585
	5TH	0.00095	6.33	12061924	321	585
Gaseous Pb	1ST	<0.000001	<0.14	12070224	-502	-162
	2ND	<0.000001	<0.14	12060124	413	667
	3RD	<0.000001	<0.14	12052924	321	667
	4TH	<0.000001	<0.14	12062024	321	585
	5TH	<0.000001	<0.14	12061924	321	585
Gaseous Hg	1ST	<0.000001	<0.33	12051307	-1233	-410
	2ND	<0.000001	<0.33	12071307	-1233	-245
	3RD	<0.000001	<0.33	12020410	-1599	-245

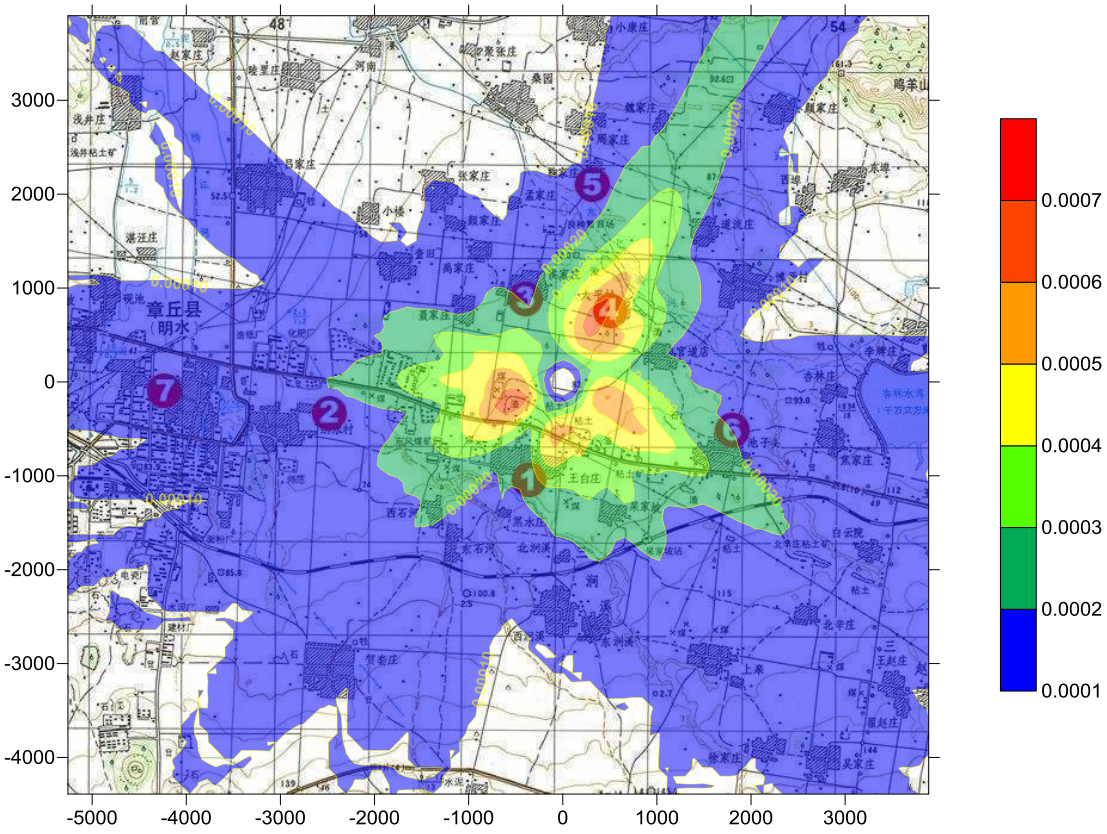
	4TH	<0.000001	<0.33	12072807	-1599	-162
	5TH	<0.000001	<0.33	12072807	-1416	-162



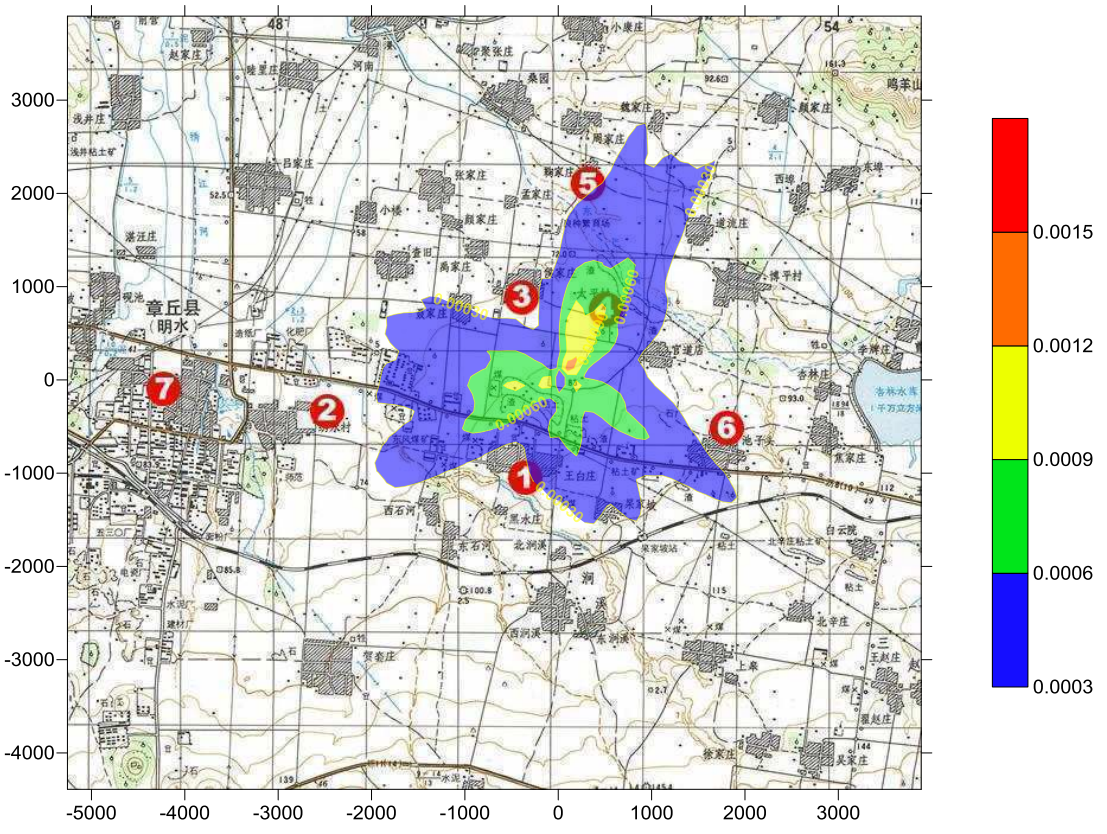
Daily SO2 CONCENTRATION



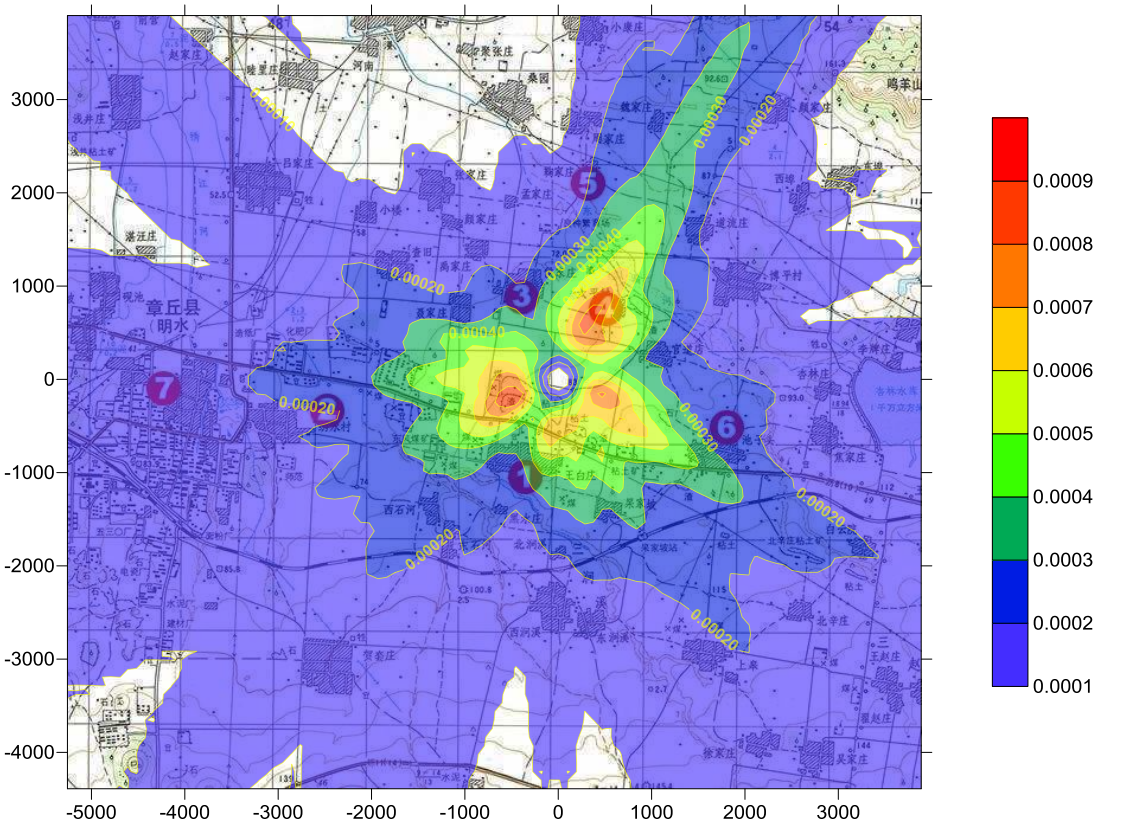
DAILY NO_2 CONCENTRATION



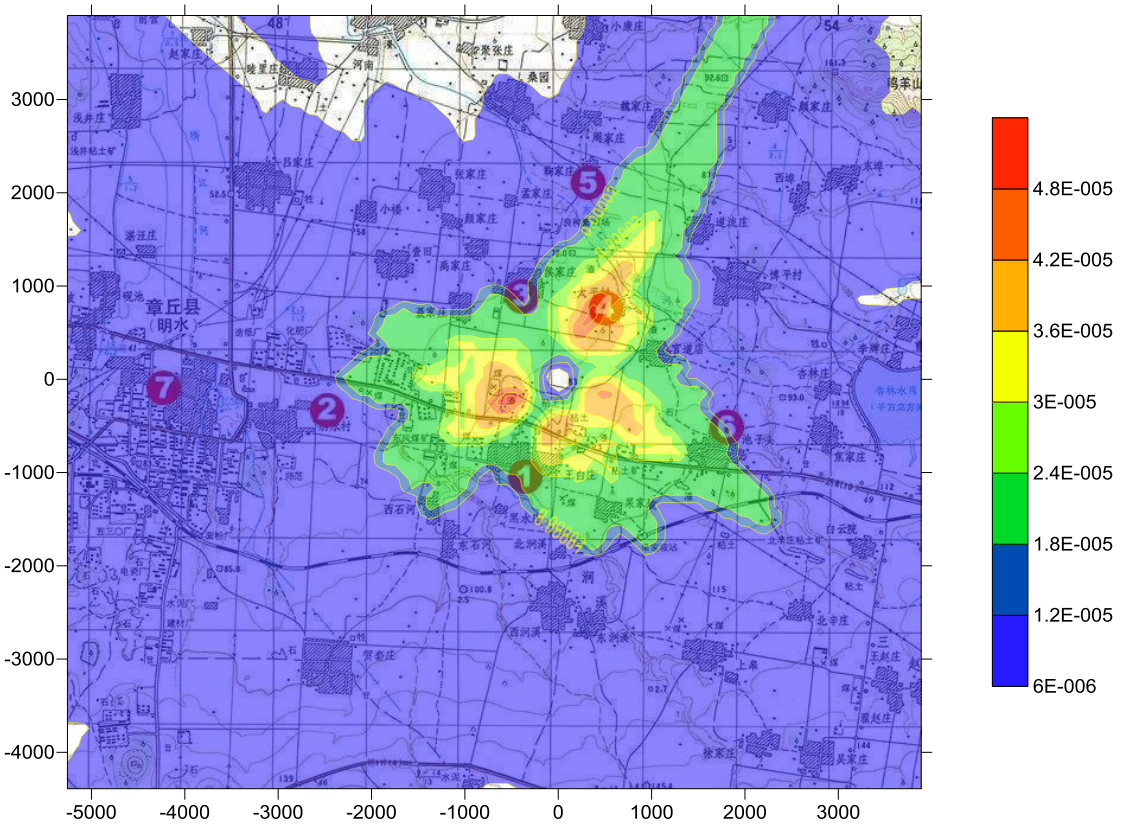
DAILY PM_{10}concentration



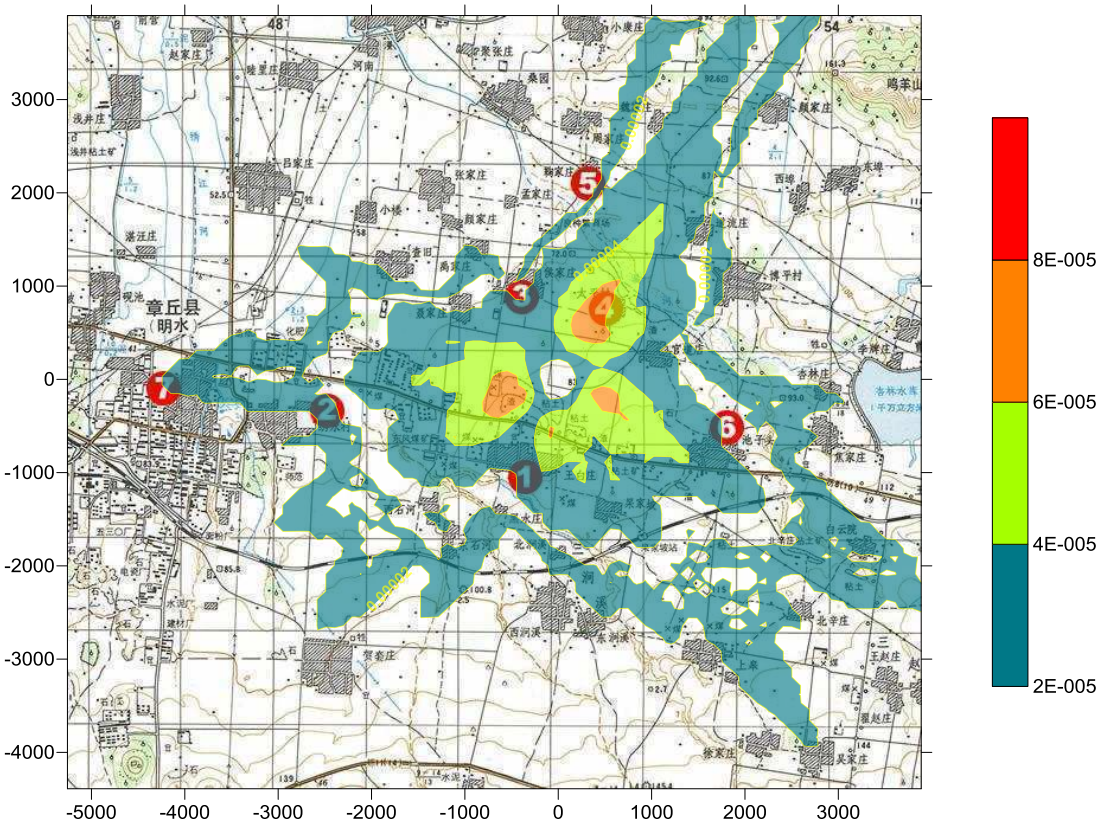
DAILY TSP concentration



DAILY HCl concentration



DAILY Pb concentration



DAILY Hg concentration

Figure VI.3Daily Concentration Distribution

280. The daily ground concentration at sensitive receptors is shown in Table VI.12. It can be seen from the table that the concentration of SO2、NO2、PM10、HCl、TSP、Pb is 91.73%、91.13%、168.80%、54.67%、146.40%、87.14%of the standard limits. Hg<0.00001 mg/m3.The SO2 and NO2 reach the class 2 of "Ambient Air Quality Standard " (GB3095-2012), HCl and gaseous Pb and Hg reach the habitation maximum concentration of "Design of Industrial Enterprises health standards"（TJ36-79.）The $PM_{10}$and TSP concentration slightly exceed the standard limit due to the dry weather and ground dust.

Table VI.12 Daily Ground Concentration at Sensitive Receptors (unit: mg/m^3)

position		wangzhong	xiushui	houjia	taiping	jujia	chizitou	Zhangqiu city
SO_2	Predicted maximum	0.0009	0.0006	0.0006	0.0022	0.0005	0.0007	0.0005
	Background value	0.132	0.137	0.124	0.112	0.118	0.116	---
	Overlay value	0.1329	0.1376	0.1246	0.1142	0.1185	0.1167	0.0005
	Accounting rate(%)	88.60	91.73	83.07	76.13	79.00	77.80	0.33

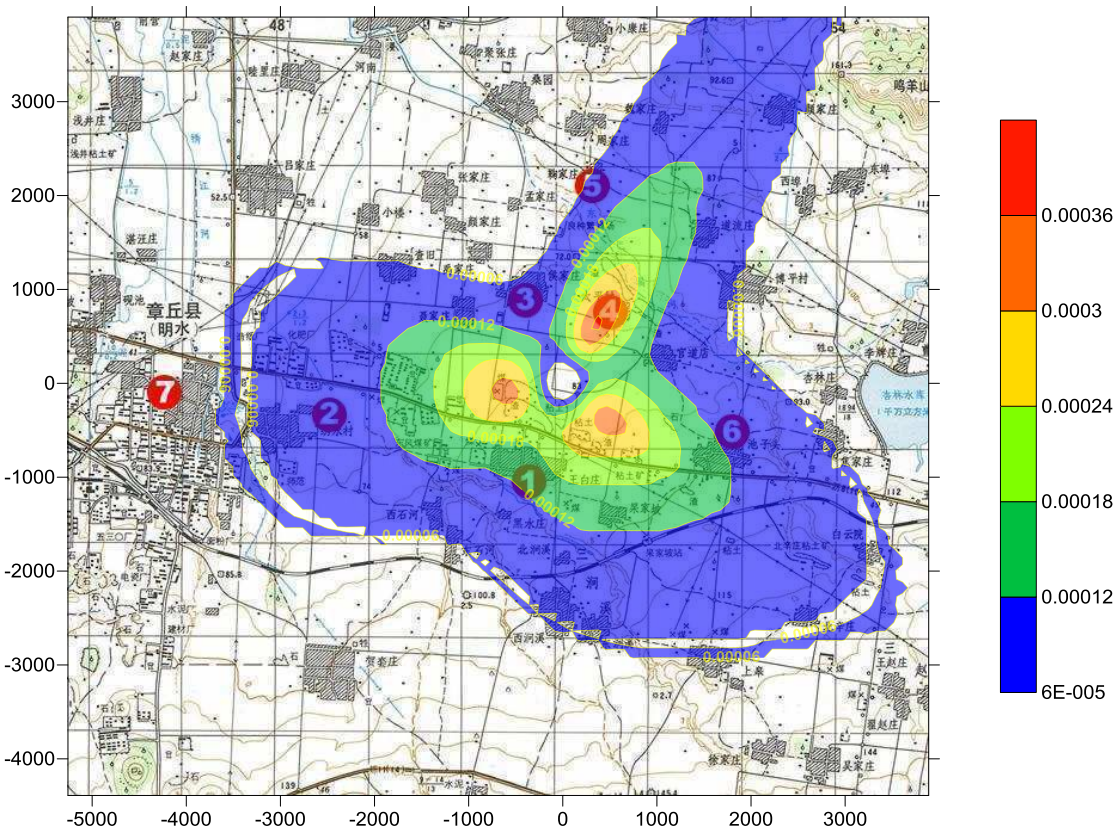
NO_2	Predicted maximum	0.0019	0.0012	0.0013	0.0044	0.0010	0.0014	0.0010
	Background value	0.071	0.068	0.063	0.06	0.071	0.065	---
	Overlay value	0.0729	0.0692	0.0643	0.0644	0.0720	0.0664	0.0010
	Accounting rate(%)	91.13	86.50	80.38	80.50	90.00	83.00	1.25
PM_{10}	Predicted maximum	0.0003	0.0002	0.0002	0.0006	0.0001	0.0002	0.0001
	Background value	0.211	0.253	0.215	0.176	0.197	0.206	---
	Overlay value	0.2113	0.2532	0.2152	0.1766	0.1971	0.2062	0.0001
	Accounting rate(%)	140.87	168.80	143.47	117.73	131.40	137.47	0.07
HCl	Predicted maximum	0.0004	0.0003	0.0003	0.0010	0.0002	0.0003	0.0002
	Background value	0.005	0.007	0.005	0.007	0.008	0.005	
	Overlay value	0.0054	0.0073	0.0053	0.0080	0.0082	0.0053	0.0002
	Accounting rate(%)	36.00	48.67	35.33	53.33	54.67	35.33	1.33
TSP	Predicted maximum	0.0003	0.0003	0.0002	0.0010	0.0003	0.0002	0.0002
	Background value	0.403	0.42	0.439	0.364	0.387	0.415	---
	Overlay value	0.4033	0.4203	0.4392	0.3650	0.3873	0.4152	0.0002
	Accounting rate(%)	134.43	140.10	146.40	121.67	129.10	138.40	0.07
Gaseous Pb	Predicted maximum	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
	Background value	0.0005	0.0006	0.0005	0.0005	0.0005	0.0005	---
	Overlay value	<0.00051	<0.00061	<0.00051	<0.00051	<0.00051	<0.00051	<0.00001
	Accounting	<72.86	<87.14	<72.86	<72.86	<72.86	<72.86	<1.43

	rate(%)							

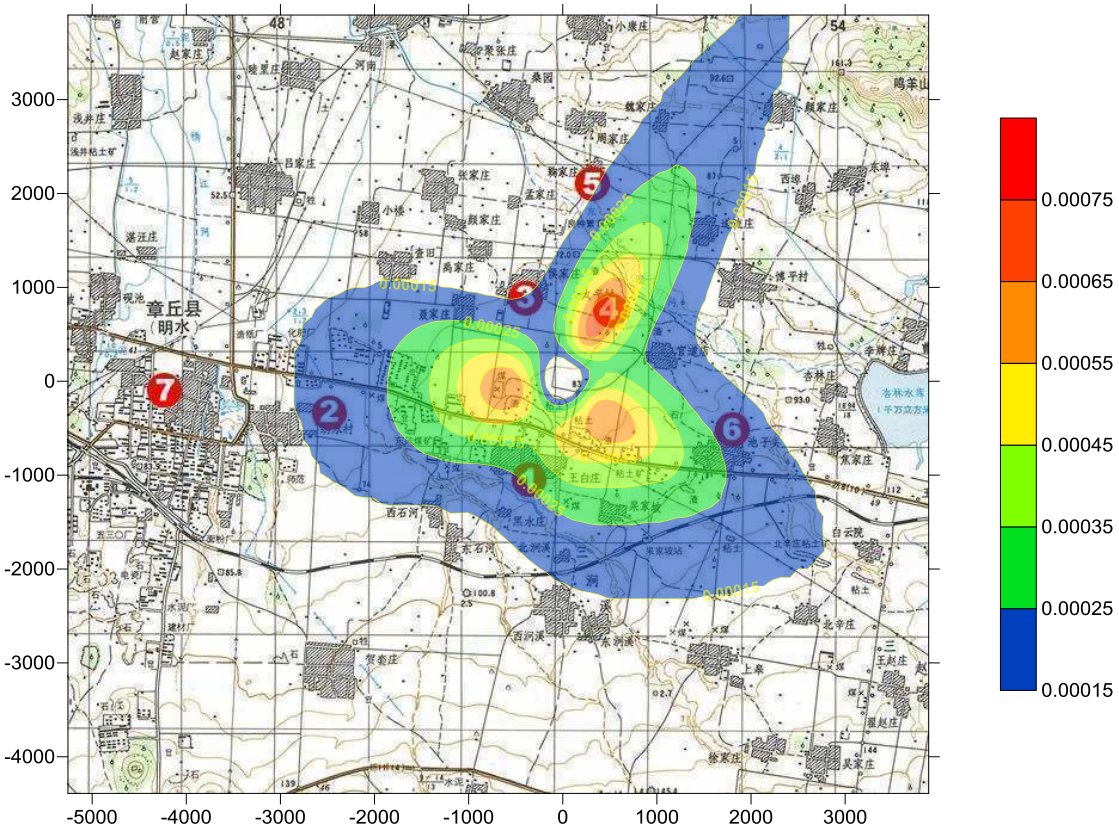
281. **Annual Average Concentration:** The predicted annual average concentration of SO_2, NO_2,flue gas and TSP are 0.62%、1.85%、0.14%、0.11% of the Class II of Ambient Air Quality Standard (GB3095-1996), as shown in Table VI. 13 and Figure VI.4.

Table VI.13 Annual Average Concentration Prediction (mg/m3)

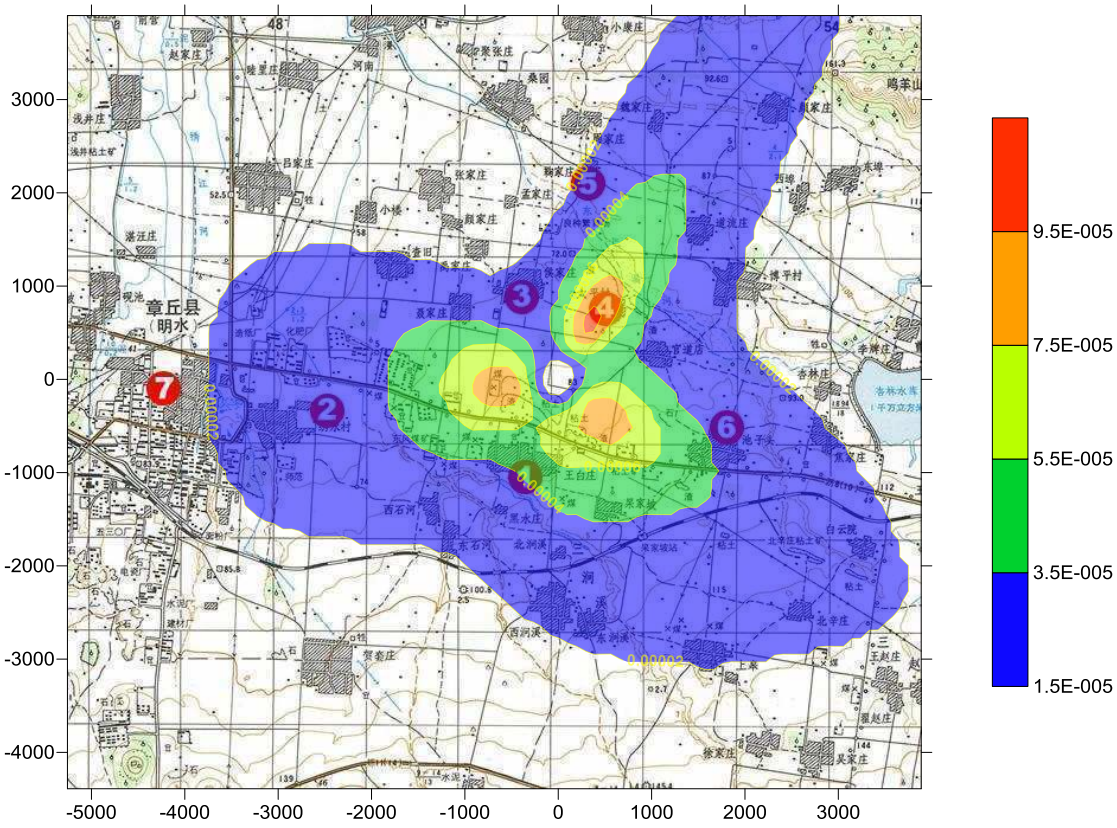
pollutant	No.	Ground concentration	Accounting rate（%）	UTM	
				East (m)	North (m)
SO_2	1ST	0.00037	0.62	321	585
	2ND	0.00037	0.62	413	667
	3RD	0.00036	0.60	321	667
	4TH	0.00036	0.60	413	750
	5TH	0.00036	0.60	413	585
NO_2	1ST	0.00074	1.85	321	585
	2ND	0.00074	1.85	413	667
	3RD	0.00073	1.83	321	667
	4TH	0.00072	1.80	413	750
	5TH	0.00071	1.78	413	585
FLUE GAS	1ST	0.0001	0.14	321	585
	2ND	0.0001	0.14	413	667
	3RD	0.0001	0.14	321	667
	4TH	0.0001	0.14	413	750
	5TH	0.0001	0.14	413	585
TSP	1ST	0.00022	0.11	123	121
	2ND	0.00021	0.11	138	170
	3RD	0.00018	0.09	138	87
	4TH	0.00018	0.09	230	336
	5TH	0.00018	0.09	230	253



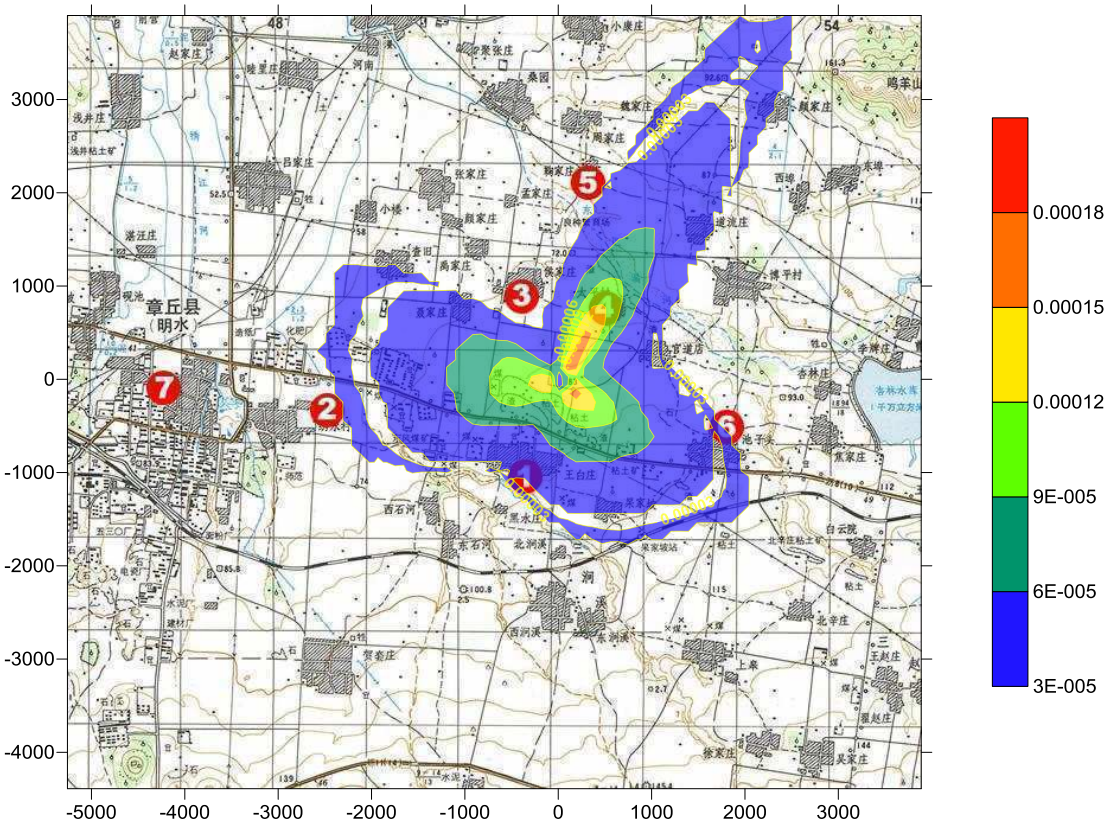
SO2 CONCENTRATION



NO_2CONCENTRATION



FLUE GAS CONCENTRATION



TSP CONCENTRATION

Figure VI.4Annual Concentration Distribution

282. Annual Average Concentration Prediction of SO_2, NO_2,$PM_{10}$and TSP are 0.57%、1.75%, 0.13% and 0.05% of the standard limits, as shown in Table VI.15.They all reach the class 2 standard of the "Ambient Air Quality Standard" (GB3095-2012).

Table VI.15 Annual Average Concentration Prediction (mg/m^3)

POSITION	SO_2		NO_2		PM_{10}		TSP	
	Annual concentration (mg/m^3)	Accounting rate (%)	Annual concentration (mg/m^3)	Accounting rate (%)	Annual concentration (mg/m^3)	Accounting rate (%)	Annual concentration (mg/m^3)	Accounting rate (%)
wangzhong	0.00014	0.23	0.0003	0.75	0.00004	0.06	<0.0001	<0.05
xiushui	0.00009	0.15	0.0002	0.50	0.00002	0.03	<0.0001	<0.05
houjia	0.00007	0.12	0.0002	0.50	0.00002	0.03	<0.0001	<0.05
taiping	0.00034	0.57	0.0007	1.75	0.00009	0.13	0.0001	0.05
jujia	0.00007	0.12	0.0001	0.25	0.00002	0.03	<0.0001	<0.05
chizitou	0.0001	0.17	0.0002	0.50	0.00003	0.04	<0.0001	<0.05
Zhangqiu city	0.00005	0.08	0.0001	0.25	0.00001	0.01	<0.0001	<0.05

f. Abnormal Emission

283. For the abnormal operating scenario, it has been assumed that the emission point is continuously operating at its maximum operating volume flow, and the pollutant treatment facilities failed operation. This will over-estimate the actual mass emissions from the facility. The pollution source intensity is shown in Table VI.16.

Table VI.16 Pollution Source Intensity under Abnormal Operation Condition

Stack parameters	Pollutant	Unit	Emission Concentration
Volume flow:127436m^3/h; Temp:150℃ Height:80m; Exit Diameter:2.5m	HF	mg/m^3	20
	HCl		1106
	Dioxin	ng TEQ/m^3	3

284. Maximum hourly concentrations of HCl, HF and Dioxin under abnormal operation condition are 0.116mg/m^3, 0.0021mg/m^3 and 0.315ng/TEQ/m^3 respectively, accounting for 232%, 11% and 18% of the standard limits. (Table VI.17). The maximum HCl ground concentration exceeds the standard by 1.32 times. Therefore, operation should be stopped immediately when operation is abnormal.

Table VI.17 Maximum Hourly Ground Concentration Under Abnormal Operation Condition (unit: mg/m3)

	Pollutants		
	HCl	HF	Dioxin (ng TEQ/m^3)
Prediction concentration	0.116	0.0021	0.315
Standard Limit	0.05	0.02	1.8
Percentage of the Standard Limit (%)	232	11	18

g. Odor Impacts

285. The hourly ground concentration at plant boundary sites is shown in Table VI.18. It can be seen from the table that the concentration of NH3, H2S and CH_3SH are below the limits set in Odor Pollutants Emission Standard (GB14554-93).

Table VI.18 Hourly Ground Concentration at Plant Boundary Sites (unit: mg/m^3)

Plant Boundary Sites	Xm	Ym	NH_3	H_2S	CH_3SH
1	-107	-135	0.3264	0.0183	0.0002
2	-141	-110	0.3190	0.0178	0.0002
3	-98	-54	0.3744	0.0209	0.0002
4	-67	-2	0.2457	0.0137	0.0001
5	-20	69	0.0966	0.0054	0.0001
6	0	96	0.1094	0.0061	0.0001
7	76	50	0.2820	0.0158	0.0001
8	164	-8	0.1557	0.0087	0.0001
9	233	-54	0.1049	0.0059	0.0001
10	201	-102	0.0866	0.0048	0.0001
11	130	-127	0.1023	0.0057	0.0001
12	33	-157	0.2373	0.0133	0.0001
13	-39	-177	0.2472	0.0138	0.0001
14	-78	-153	0.4490	0.0251	0.0002
Standard Limits（mg/m^3）(GB14554-93)			1.5	0.060	0.007

Note: Coordinate 0,0 is the location of the stack.

286. **Protection Distance:** The proposed solid waste storage house has a volume to store 5,200tons of solid waste to meet 8 days supply to the furnace. The calculated emission of H_2S, NH_3 and CH_3SH are 0.09kg/h, 1.61kg/h and 0.0008kg/h respectively. The source area is 39m in length, 33 in width and 16m in height. The environmental protection distance for H_2S, NH_3 and CH_3SH are 400m, 350m and 0m. Therefore, the final environmental protection distance is defined as 400m.

h. Dioxin Impacts

287. The EA refer to the EU standard: annual average of 0.1TEQpg/Nm^3. The values are also in accordance with the World Bank Group's guideline for dioxin

of 0.1ngTEQ/Nm^3 (for 6-8 hour average).(Please see Attachment 41of IFC EHS Guidelines for Waste Management Facilities).

288. The amount of dioxin emission is quite small. The maximum hourly ground concentration of dioxin is 0.0105TEQpg/Nm^3, accounting for 0.58% of the standard. Calculated daily concentration is 0.0017TEQpg/Nm^3, annual average concentration is below 0.0002TEQpg/Nm^3, accounting for 0.03% of the standard limit. Therefore, the dioxin impact from the project is minor.

i. Mitigation measures

289. A number of measures have been incorporated into the design of the waste-to-energy plant to ensure that emissions from the plant do not exceed regulatory emission limit values as documented in Chapter II. The designed facilities will have following removal efficiencies:

- De-dust: 99.8%.
- De-sulphur: 85%
- De-NOx: 33.33%
- De-Chloride: 95%
- De-Fluoride 90%
- De-metals: 90%

290. In short, the proposed project site and layout are reasonable. Designed air pollution mitigation measures can reduce project air pollutants emission to a level below the relevant air emission standard.

2. Surface Water

a. Pollution Source

291. The wastewater discharged from the circulating cooling water system of the proposed project will be drained into the rainwater pipeline network as clean sewer. The neutralized acidic and alkali wastewater will be entirely used as supplementary water for the slag discharging system. The wastewater discharged from boiler is partially reused as supplementary water of the slag discharging system, and partially discharged into the rainwater pipe network as clean sewer. Leachate and workshop flushing wastewater of the project will be treated in the matching percolate treatment system to meet the criteria of *Standard for Pollution Control on the Landfill Site of Municipal Solid Waste* (GB37 16889－2008)(Attachment 32). This will be drained into the municipal wastewater pipe network together with the domestic wastewater collected in septic tank and preliminarily settled, and discharge to ZWWTP where it is treated to have the effluent quality meeting 1A criteria of *Discharge Standard of*

Pollutants for Municipal Wastewater Treatment Plant(GB18918-2002)(Attachment 30)before being discharged into Luo River.

b. Surface Water Impact

292. Discharge of wastewater pollutants of the proposed project may be referred to in Table VI.19.

Table VI.19 Discharge of Wastewater Pollutants of the Proposed Project

Sources of Wastewater	Wastewater Volume (m^3/h)	Generation of COD_{cr}		Amount of COD_{cr} discharged into sewer network		Amount of COD_{cr} after treatment at ZWWTP		Note
		Concentration (mg/L)	Volume (t/a)	Concentration (mg/L)	Volume (t/a)	Concentration (mg/L)	Volume (t/a)	
Percolate	5	20000	800	100	4	50	2	——
Ground flushing wastewater in the factory area	1.16	1000	9.28	100	0.93	50	0.46	——
Vehicle flushing wastewater	0.84	1000	6.72	100	0.67	50	0.34	
Domestic wastewater	0.28	300	0.67	300	0.67	50	0.11	——
Wastewater volume entering wastewater treatment plant	7.28	——	816.67	——	6.27	——	2.91	——
Wastewater discharge of circulating water	10.34	40	——	——	——	——	——	Clean Effluent
Wastewater discharge from boilers	0.58	20	——	——	——	——	——	
Total clean effluent	10.92	——	——	——	——	——	——	——

Note: In this EIA, the values of effluent quality of ZWWTP were taken conservatively, which were calculated by Level 1A standard value in *Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant*(GB18918-2002).

293. We may see from the table that the final discharge concentration of wastewater concentration in the proposed project could meet Level 1A criteria in *Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant*(GB18918-2002) before it is discharged into LuoRiver. Therefore, we may see that construction of the proposed project will have limited environmental impacts on surface water.

294. Moreover, construction of the proposed project will greatly reduce the amount of garbage that will be landfilled within the service scope, extend the landfill's service life, and greatly reduce landfill leachates and its impacts on the surface water.

c. Mitigation Measures during Operation

295. The project will adopt the process of Materialization + UASB Anaerobic Reactor + MBR membrane bioreactor + Two-step FU Ultrafiltration Membrane System for treatment of leachate in the project.

296. Leachate is lifted into the grid trenches by percolate lifting pump, remove large sized suspended articles and floating articles with mechanical grizzly, then enters influent and wastewater regulating pond, have the wastewater, adequately mixed with concentrated sludge supernatant of circumfluence and sludge liquor, and conduct water quality and quantity regulation.

297. The wastewater regulated in regulating pond is pumped into coagulation reaction tank, added with alkaline and flocculent, then enters flocculation and sedimentation tank for treatment and removal of macromolecular suspended particulate matter and COD, and simultaneously removes part of the ammonia nitrogen, lowers organic compound of biochemical treatment and impacts of excessive ammonia nitrogen on bacterial strains, so as to guarantee effective biochemical treatment.

298. Effluent of flocculation and sedimentation tank enters into the intermediary pond, pressurized by pump and enters the UASB anaerobic treatment system of up flow anaerobic sludge bed reactor, where wastewater is to conduct anaerobic reaction, and disintegrate macromolecular organic matter into organic matter with smaller molecules, so as to improve the biodegradability of the percolate.

299. Anaerobic effluent automatically flows into the MBR membrane bioreactor system, sequentially treated by denitrification – nitrification – rear-attached denitrification pond, and the COD, BOD, ammonia nitrogen and other pollutants in the wastewater will be greatly reduced. After aerobatic treatment, the effluent of rear-attached denitrification pond will be treated by MBR ultrafiltration membrane system. Since MBR ultrafiltration membrane has very high activated sludge concentration, it may effectively remove organic matter. After the two-step ultrafiltration treatment, the effluent of MBR ultrafiltration membrane system may meet the criteria in Table 2 of *Standard for Pollution Control on the Landfill Site of Municipal Solid Waste* (GB37 16889 — 2008-Attachment 32) and *Wastewater Discharge Standards for Discharge of Municipal Sewers* (CJ343-2010-Attachment 31), and discharged to ZWWTP via the municipal sewer line network.

300. After treatment in the ZWWTP, the effluent quality meets Level 1A in *Discharge Standard of* Pollutants *for Municipal Wastewater Treatment Plant* (GB18918-2002-Attachment 30) before being discharged into the Luo River.

301. Sludge generated from percolate treatment comes from residual sludge of biological treatment. In order to give way to the biological adsorption roles of residual sludge of biological treatment and improve dehydrating properties of sludge, the residual sludge of biological treatment is discharged to the flocculation and sedimentation system (i.e., sludge concentration pond), flocculated and sludge concentrated, supernatant overflows back to the regulating pond, concentrated sludge is pumped by sludge pump to dewatering filter press for dehydration treatment, and the dehydrated sludge cake will be transported to garbage storage pit, and enter incinerator for incineration together with garbage. The filtrate will be collected and pumped to the regulating pond.

302. The expected removal rates at different stages of garbage percolate treatment process may be referred to in Table VI.20

Table VI.20List of expected removal rates at different stages of leachate treatment process

Unit	Item	CODcr (mg/l)	BOD(mg/l)	NH_3-N(mg/l)	SS(mg/l)
Regulating Pond Coagulatory Settler	Influent	20,000	5,000	600	600
	Effluent	14,000	3,500	540	120
	Removal Rate	30%	30%	10%	80%
UASB Anaerobic Reactor	Influent	14,000	3,500	540	120
	Effluent	4,200	1,225	378	84
	Removal Rate	70%	65%	30%	30%
MBR Reactor	Influent	4,200	1,225	378	84
	Effluent	210	61.3	37.8	17
	Removal Rate	95%	95%	90%	80%
Two-step Ultrafiltration System	Influent	210	61.3	37.8	17
	Effluent	84	18.4	11.3	8.5
	Removal Rate	60%	70%	60%	50%
Limits of Standard CJ343-2010		≤300	≤ 150	≤35	≤ 400
Limits of Standard DB37/ 535—2005		100	20	15	70

d. Due Diligence of Zhangqiu Wastewater Treatment Plant (ZWWTP)

303. Zhangqiu City Wastewater Treatment Plant adopts two kinds of biochemical sewage treatment technology, and the water quality of treated effluent after passing cloth filter may meet Level 1A in Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant.

304. Water quality indicators of influent and effluent of ZWWTP may be referred to in Table VI.21.

Table VI.21Water Quality Indicators of Influent and Effluent of ZWWTP

Items	CODcr(mg/L)	BOD_5(mg/L)	NH_3-N(mg/L)	pH Value
Designed Water Quality of Influent	300	150	25	--
Designed Water Quality of Effluent	50	10	5	6～9
Level 1A criteria in GB18918-2002	50	10	5(8)	6～9

305. The proposed project is located 2,000m southwest of ZWWTP, and the municipal sewer collecting pipe network has been laid to the battery limit. The designed handling capacity of ZWWTP will be 60,000m^3/d, and the designed handling capacity in Phase 1 will be 30,000 m^3/d. The wastewater volume to be discharged into ZWWTP will be 174.72m^3/d, accounting for about 0.58% of the designed handling capacity of ZWWTP. Calculating by ZWWTP's influent volume of 30,000 m^3/d and influent COD concentration of 300mg/l, the COD quantity of the proposed project discharging into ZWWTP will be 6.27t/a, accounting for about 0.2% of the designed handling capacity of Phase 1 of ZWWTP. Therefore, Phase 1 of ZWWTP will have the capacity to absorb the wastewater to be generated by the proposed project.

306. According to Wastewater Admission Certificate (Attachment 11-March 2013, ZWWTP), ZWWTP has agreed that the wastewater of the project may be treated up to the standard, discharge into the municipal sewage pipe network, and enter ZWWTP.

307. Since the proposed project is quite close to the municipal wastewater pipe network, and the treated wastewater may be discharged into the municipal wastewater pipe network and drain to ZWWTP for further treatment, while ZWWTP is capable and has agreed to admit the wastewater to be generated by the project (including garbage percolate, ground flushing wastewater and domestic wastewater). It is assessed that the discharge of wastewater from the proposed project is feasible.

3. Ground Water

a. Impacts

308. The links that may cause underground water pollution mainly include: Improper installation of anti-seepage of garbage percolate collection and conveyor system, wastewater treatment system, wastewater collection and discharge system causing direct infiltration of production wastewater, affecting the shallow underground water, and; Infiltration or leakage of blow-off lines polluting shallow underground water near the pipes.

309. The mineral department of Zhangqiu City has proved that the project will not cover any mine.

310. The closest water source to the proposed project is Southern Suburb Reservoir, which is a reservoir with single water supply function, and it is a small reservoir in size. Level 1 protection area is entirely waters, the scope of which is 200m around the water intake of the reservoir area. Level 2 protected waters is the entire waters beyond Level 2 protected area, while the land scope is 200m extending outward in the east, south and west along the bank of the reservoir, extending to South 2 Road in the north. The water source of Southern Suburb Reservoir is located about 13.4km northwest of the proposed project, which is not located upstream of the water source. Moreover, it is learned from the local geological conditions of local surface water system and underground water that construction of the proposed project will not impose impacts on the water source of Southern Suburb Reservoir.

311. According to investigation, the domestic water supplies for residents in villages around the proposed project are supplied by municipal tap water, and the project construction will not affect the drinking water supplies of the local residents.

312. On the other hand, construction of the proposed project will greatly reduce the landfill quantity of the landfill within its scope of service, extend its landfill service life, and greatly reduce the generation of garbage percolate of landfill and its impacts on underground water.

b. Mitigation Measures

313. Part of the wastewater discharged from the circulating cooling water system of the proposed project will be used as vehicle flushing water, unloading hall and workshop ground flushing water, flying dust solidification water, and the remaining part will be discharged into the rainwater pipe network as clean sewer. Acidic and alkali wastewater will be neutralized and entirely used as supplementary water for the slag system. The wastewater discharged from boiler will be partially used as supplementary water for the slag system and partially discharged into the rainwater pipe network as clean sewer. Garbage percolate and workshop flushing wastewater of the proposed project will be treated at the matching percolate treatment system to meet criteria in No. III time interval of Local Standard of Shandong Province: Municipal Solid Wastes Landfill Water Pollutants Discharging Standard (DB37/535－2005), discharged into the municipal sewer line network together with the domestic wastewater collected and preliminarily settled in septic tanks, discharge into Coastal New Materials Park Wastewater Treatment Plant for treatment to enable the effluent quality meeting Level 1A criteria in Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant(GB18918-2002-Attachment 30), and finally discharged into the Luo River.

314. The ground of the factory area in the project is to be hardened, it is to adopt strict anti-seepage measures for garbage storage pit, wastewater treatment station,

drainage pipe, flying dust consolidation field, and use natural or artificial materials to build anti-seepage layers, simultaneously build dike and dam to prevent settling of ground, especially to prevent uneven or partial settling. It is to select pipe materials with good anti-seepage properties for drainage pipes, such as Polymer polyvinyl chloride pipe, etc. After the project is put into operation, it is to adopt strict measures for managing water consumption and drainage in the factory area, duly conduct maintenance and repair of the drainage pipes, so as to prevent underground water pollution caused by leakage from pores, valves, drips and taps. Moreover, it is to further improve measures for saving water and improving water recycling rate in the course of design and actual production, so as to minimize discharge of wastewater.

315. Once adopted, the abovementioned measures will effectively prevent the proposed project from polluting the underground water near the factory area. Once the project is put into operation, it will not cause significant impacts on the surrounding underground water, nor will it affect the original use value of the local underground water.

4. Noise

a. Noise Source

316. The main noisy equipment of the proposed project may be referred to in Table VI.22.

Table VI.22 Main Noise Sources from the Project

No.	Main Noise Sources	Equipment	Nr	Intensity dB(A)	Spectral characteristics	Noise Reduction Measures	Factory Building Source Intensity dB(A)	Note
1	IncineratorRoom	Incinerator	3	82	Medium and low frequency	Arranged in factory building	65	
		Waste heat boiler	3	85	Medium and low frequency			
2	Steam turbine room	Steam turbine	1	95	Medium and low frequency	Arrange acoustic shield in steam engine room	75	
		Generator	1	95	Medium and low frequency			
3	Main Transformer	Main Transformer	1	67	Medium and low frequency		67	Outdoor
4	Air Compressor room	Air Compressor	2	95	Medium and low frequency	Silencer Arranged in air compressor room	75	
5	Induced Draft Fan Room	Induced Draft Fan	1	98	Medium and high frequency	Acoustic shield, Silencer	78	
6	Blower Room	Blower	1	101	Medium and high frequency	Acoustic shield, Silencer	81	
7	Circulating water pump	Circulating water pump	2	82	Medium and high frequency	Arranged in pump house	62	1 in service and 1 standby

No.	Main Noise Sources	Equipment	Nr	Intensity dB(A)	Spectral characteristics	Noise Reduction Measures	Factory Building Source Intensity dB(A)	Note
	room							
8	Cooling Tower	Cooling Tower	1	80	Medium and high frequency	Silencer, Sound silencing louver	62	Outdoor
9	Machine and boiler exhaust	Machine and boiler exhaust	--	120	—	Silencer	110	Outdoor, instantaneous
10	Blowtorch Noise	Blowtorch Noise	--	120	—	Silencer	110	Outdoor, instantaneous

317. In this EIA, the model recommended in the *Technical Guidelines for Noise Impacts Assessment* (HJ/T2.4-1995) - industrial noise projection model was adopted for conducting projections.

318. The maximum contributions of all the noise sources to all the factory boundaries were calculated and confirmed by the projection models and parameters in HJ/T2.4-1995, which may be referred to in Table VI.23

Table VI.23: List of Maximum Contribution Values of Noises of All the Noise Sources to All the Factory Boundaries

No.	Name	Source Intensity dB(A)	Straight-line distance from all the factory boundaries, m				Maximum contribution values to all the factory boundaries, dB(A)			
			North	West	South	East	North	West	South	East
1	Incinerator Room	65	78	128	184	178	48.4	42.9	42.0	40.0
2	Steam turbine room	75	54	130	227	178	50.9	48.3	43.4	45.6
3	Main Transformer	67	70	107	226	224	30.1	26.4	19.9	20.0
4	Air Compressor Room	75	106	197	185	98	34.5	29.1	29.7	35.2
5	Induced Draft Fan Room	78	91	77	207	245	38.8	40.3	31.7	30.2
6	Blower Room	81	78	154	187	144	43.2	37.2	35.6	37.8
7	Circulating water pump room	62	50	44	228	288	46.0	38.7	34.8	22.4
8	Cooling Tower	62	82	25	191	284	43.7	46.1	36.4	25.0

319. It can be seen from Table VI.23 and master plane layout of the proposed project that, considering the shielding effects between buildings, the west factory boundary is subject to the greatest impacts from the Cooling Tower and Circulating Water Pump Room, while the north factory boundary is subject to the greatest impacts from the Blower Room, the Incinerator Room, and Circulating Water Pumps. The east factory boundary and the south factory boundary are farther away from the noisy equipment, and the impacts of Steam Engine Room on them are relatively significant. The highest contribution values of noises of the proposed projects on all the factory boundaries are shown in Table VI.24.

Table VI.24 List of Locations Where the Projected Highest Noise Levels Appear

No. Of Projection Locations	Factory Boundary	Noise Sources with Great Impacts	Contribution Values of All the Noise Sources dB(A)	Projected Highest Noise Level, dB(A)	Locations Where the Projected Highest Noise Levels Appear
Y1	North Factory Boundary	Steam Engine Room	50.9	54.03	91m away from West Factory Boundary
		Incinerator Room	48.4		
		Circulating water pump room	46		
		Blower Room	43.2		
Y2	West Factory Boundary	Steam Engine Room	48.3	51.46	63m away from North Factory Boundary
		Cooling Tower	46.1		
		Incinerator Room	43.2		
		Induced Draft Fan	40.3		
Y3	South Factory Boundary	Steam Engine Room	43.4	45.77	65m away from West Factory Boundary
		Incinerator	42		
Y4	East Factory Boundary	Steam Engine Room	45.6	46.66	50m away from North Factory Boundary
		Incinerator	40		

b. Impact Assessment

320. Evaluation standard: In this EIA of noise, it is to implement the criteria for Class 3 functional areas in *Emission Standard for Industrial Enterprises Noise at Boundary(GB12348-2008-Attachment 26)*, i.e., 65dB(A) during the daytime, and 55dB(A) during the nighttime. Evaluation results may be referred to in Table VI.25.

TableVI.25: List of EIA Results of Noises

Projection Spots		Daytime, dB(A)			Nighttime, dB(A)		
		Projected Values	Standard Values	Exceed	Projected Values	Standard Values	Exceed
Y1	North Factory Boundary	54.03	70	-15.97	54.03	55	-0.97
Y2	West Factory Boundary	51.46	65	-13.54	51.46	55	-3.54
Y3	South Factory Boundary	45.77	65	-19.23	45.77	55	-9.23
Y4	East Factory Boundary	46.66	65	-18.34	46.66	55	-8.34

321. Based from Table VI.25,once the proposed project is finished, the factory boundary during the day and the night can meet the criteria for Class 3 functional area in *Emission Standard for Industrial Enterprises Noise at Boundary(GB12348-2008-Attachment 26).*

c. Noise Impact from Instantaneous Exhaust Steam and Blowpipe

322. Instantaneous venting of steam from the generator boiler is noise generated by the boiler to depressurize for protection of the main equipment at the time of excessive pressure. It is an irregular high-frequency steam venting noise, which normally last dozens of seconds, and the acoustic level is 110～130dB(A); Blowpipe

noise is the steam venting noise generated while sweeping to eliminate impurities in the system with steam to prepare for operation after the system is installed, which lasts dozens of seconds each time, and the acoustic level is 110～130dB(A).Although the frequency of instantaneous venting of steam from the generator boiler is lower than that of blowpipe noise, since its noise level is high, it spreads farther and has large range of impacts. By adopting such noise reduction measures as silencers, its noise level may be controlled within 110 dB(A). Therefore, in this EIA, instantaneous noise source intensity is determined as 110 dB(A), and the location of the source intensity is at the top of the boiler.

323. The instantaneous noise source intensity of this project is calculated by 110dB(A), its decay distances are projected by the recommended spot source model in Technical Guidelines for Noise Impacts Assessment (HJ/T2.4-1995), and its projection results may be referred to in Table VI.26.

Table VI.26: List of Projection Results of Instantaneous Noises

Decay Distance	100m	200m	300m	317m	380m	400m	500m	600m	700m	800m	900m	1,000m
Noise, dB(A)	70.0	64.0	60.5	60.0	58.4	58.0	56.0	54.4	53.1	51.9	50.9	50.0

324. It can be learned from Table VI.26 that due to impacts of instantaneous noise sources, the substandard areas of noises during the daytime will be within 317m from the sources of instantaneous noises, while the substandard areas of noises during the nighttime will be within 1,000m from the sources of instantaneous noises. There is no village within 500m of the boundary of the proposed project area, and while its environmental quality of instantaneous noises cannot meet the criteria for Class 2 functional zones in Environmental Quality Standards for Noises (GB3096-2008-Attachment 22), it can meet the requirements for the maximum value of sudden noises at night not exceeding the standard value of 15 dB(A).

d. Mitigation Measures

325. In order to further reduce the impacts of boiler steaming venting noises and blowpipe noises on the areas around the factory site, it is necessary to take corresponding measures.

326. Instantaneous steam venting noises of generator boiler: It is to install High-efficiency micro porous silencer for instantaneous steam venting of boilers, which may control its noise level within 110dB(A); Moreover, it is to reinforce operation management in the course of power plant operation, reduce the times of boiler venting steam, and venting steam will be forbidden during the night.

327. Blowpipe noises: Firstly, it is to be careful about pipe hygiene while conducting installation, and prevent large foreign matters from entering the pipes; Secondly, it is to select valves with low noises while designing the pipe valves. It is to install

silencers and reducing orifice after the valve, install auxiliary regulating valve to duly distribute pressure drop, and lay damping sound insulation layers outside the pipe; Thirdly, it is to reasonably design and arrange pipelines, prevent sharp bending, crossing, radical changes of sections and T-shaped confluence. Supporting brackets of the pipeline must be solid. It is to install corrugated expansion joints or other soft connections at the vibration sources, and it is to change rigid connections to flexible connections when the pipeline runs across buildings; Fourthly, it is to install pipe silencers; Fifthly, it is to change the pipe-blowing direction, and avoid objects sensitive to environmental noises; Sixthly, it is to adopt pits or discharging circulating water pipe and other underground venting means to vent steam of the blow pipe for further reduction of noises; Seventhly, it is to adopt the announcement system in management, notify the neighbors the times and noise intensities that the company will blow pipes, arrange blowpipes during the day, and avoid the rest hours of the residents, and prohibit blowing pipes in the night.

328. In short, the environmental noise status of the factory boundaries of the proposed project during the day and the night could both meet the criteria for Class 3 functional areas in Environmental Quality Standards for Noises (GB3096-2008-Attachment 22). Once the proposed project is finished, the projected values of all the factory boundaries during the day and the night could meet criteria for Class 3 functional areas in Emission Standard for Industrial Enterprises Noise at Boundary (GB12348-2008-Attachment26). In the course of operating the power plant, it is to reinforce operation management, and avoid venting steam in the night, and prohibit blowing pipes in the night. This will ensure that the environmental noises around the project meet the relevant criteria in Environmental Quality Standards for Noises (GB3096-2008-Attachment 22).

5. Solid Waste

a. Solid Waste Sources

329. The solid wastes to be generated by the proposed project will mainly be wastes incineration ash, plus 20.15t/a of domestic solid wastes. The ashes to be generated in the proposed project may be referred to in Table VI.27.

Table VI.27: List of Ash Generation in the Proposed Project

Hourly Amount of Ash (t/h)		Daily Amount of Ash (t/d)		Annual Amount of Ash (in 10,000 t/a)	
Amount of Slag	Amount of Ash	Amount of Slag	Amount of Ash	Amount of Slag	Amount of Ash
5.13	1.53	123.12	36.72	4.49	1.34

b. Mitigation Measures

330. The slag and fly ash generated by MSW incineration will be separately collected, conveyed, stored and processed, and it is to adopt comprehensive utilization means of pneumatic removal of slag and dry removal of fly dust. The ash of

bag filter will be conveyed to ash storage via bin pump, and regularly move away. The slag is to be cooled with slag cooler, dropped to embedded scraper transporter, and conveyed to the main factory building and enter the slag silo. Both the slag removal system and ash removal system will be operated in entirely enclosed manner, and no flying dust will be generated. The slag silo and incinerator are integral, slag will be packed and directly delivered to the customers by trucks instead of storing them in the factory. The trucks belong to Liyuanxinxing building material factory of Zhangqiu. It may reduce land use, and neither generate flying dust pollution due to piling nor pollute underground water due to infiltration of percolate.

331. The MSW generated from project living area and office estimated to be20.15t/a will be directly sent to MSW incinerator of the project.

Ash Removal System

332. Most of the fly dusts will be removed from the bag filtervia pneumatic chute into reactor, and a little will enter intermediary surge bin, so as to ensure system ash volume balance. Ash in the intermediary surge bin will be pumped into the ash storage via bin pump (pneumatic conveyance system). Semi-dry desulfurization and dust removal system will be arranged with two ash discharge points: One part of ash is to be discharged from the bottom of flue gas purification tower, and this part of ash is mainly dust stratification preliminarily settled from flue gas and accidental dust discharge of the tower, with limited quantity that can be manually removed, while the other part is the external discharging dust from screw conveyor under the bag filter, and this part of ash is to be conveyed to the dust storage via pipe.

333. In this project, it is to arrange 2 transfer dust silos with diameter of φ4m in the factory, the effective capacity of each dust silo will be 75m^3, which can store about 120t ash. The project will generate 38.64t/d fly ash, and it is to meet the specification requirement of “the capacity of dust silo for collecting fly dusts should be determined by no less than 3d of rated flying dust generation volume.”

Slag Removal System

334. The high-temperature slag discharged from each MSW incineration boiler will be cooled via the slag cooler, have the iron in the slag removed by magnetic separation via the slag conveyor, transfer to the bucket elevator, further lift to the slag storage for temporary storage, and trucked out for comprehensive utilization.

335. In this project, it is to arrange a 29.4m (Length)×5.95m(Width)×4m(Depth) slag storage, the storage capacity of which will be 700m^3, which can store 490t slag. When the MSW incineration boiler of this project is in operation, it will generate about 145.2t/d slag, which can meet the specification requirement of “the capacity of slag storage facilities should be duly determined by 3～5d.”

336. Slag mainly comprises incombustible parts of MSW, which is a heterogeneous mixture comprising fragments of ceramics and bricks, stone, glass, sinter, iron and other metals. Its mineral composites are simple, mainly being SiO_2, $CaAl_2Si_2O_8$ and Al_2SiO_5, also containing a little $CaCO_3$, CaO and $ZnMn_2O_4$, etc. Its chemical properties are relatively stable, with good durability. However, since the slag contains iron and other metals, it may generate H_2while contacting with acidic liquid. It may cause such unfavorable impacts as expansion in the course of utilizing slag as resources. It was clearly pointed out in the document "H.F. [2008] No. 82" that "Incinerator Slag is a general industrial solid waste, it is to arrange corresponding magnetic separation devices in the project to separate and recover the metals, and then conduct comprehensive utilization." Therefore, in this project, it is feasible to separate and recover metals in slag by magnetic separation, and then conduct comprehensive utilization.

337. The slag with iron being removed mainly contains sinter, fragments of ceramics, brick and glass, and the total content of combustibles will be less than 0.5%. Since slag is a product of high-temperature incineration, it has certain strength itself, which is equivalent to 110 degree in strength grading of cement. Therefore, it is relatively suitable for use as a construction material. Presently, incinerator slag is generally used to make bricks and cement at home and abroad. It has been proven by practices that hollow bricks produced with incinerator slag have high compressive strength, which has been extensively used in all kinds of construction projects.

338. Therefore, the slag generated by this project will be trucked to Zhangqiu City LiyuanXinxing Construction Material Factory for free to make bricks for comprehensive utilization. Slag is a construction material with good performance. It not only can totally solve the problem of land consumption for landfill of slag, but also can bring certain economic returns. Its means of treatment is reasonable and feasible.

Fly Ash Disposal

339. According to requirements in "H.F.[2008]No. 82" document, it is actively encouraged to comprehensively utilize incinerated fly dusts. However, the technologies used should ensure total destruction of dioxin and effective fixation of heavy metals, and it will not cause secondary pollution in the course of producing and using the products, which increased two new outlets for fly dusts - MSW landfill or comprehensive utilization. Based on the investigation, according to the methods stipulated in GB5085.3 -1996 standard, Zhejiang Provincial Environmental Monitoring Center Station conducted pollutant analysis about fly dust of Shaoxin Xinmin Thermal Power Plant (adopting Circulating fluidized bed refuse incinerator), and all the monitoring results were lower than the density limits of dangerous wastes provided in the standard.

340. Fly dust treatment measures of the proposed project: Fly dusts must be solidified first. Toxicity identification report of MSW incineration fly dusts identification

report will be conducted after the operation of the proposed project during actual production by a third party. If its moisture content is less than 30%, the dioxin content will be lower than 3 μg TEQ/kg, the density of hazardous elements in the leachate prepared by HJ/T 300 standard are lower than the prescribed limits. It is to conduct feasibility study and analysis about comprehensive utilization of fly dusts as a resource when the conditions are mature and under the guidance of relevant department of the state, try to turn wastes into resources, or directly send to Zhangqiu City MSW Landfill for landfill treatment. Otherwise, it is to be sent to eligible dangerous wastes disposal organization for final treatment.

c. Due Diligence of Solid Waste Receiver

341. **Zhangqiu City LiyuanXinxing Construction Material Factory** is a specialized producer engaged in autoclaved aerated concrete (ALC) slabs, aerated concrete bricks and autoclaved fly ash bricks. It is a technical, trading and industrial company integrating scientific research with development, design, manufacturing, sales, construction and technical services. It has 260 million RMB fixed assets, AAA level bank credits, and it is certified for ISO9001:2000. Its production lines are computer controlled for automatic production, and the process is advanced in China. Its production capacity is 450,000 m^3/a autoclaved aerated concrete blocks, 200 million pieces/a aerated fly ash bricks, 200,000 m^3/a autoclaved aerated concrete wall slabs and dry building materials, etc. It annually produces 950,000 m^3 new wall materials, which is a domestic leader in the industry.

342. The company is located at 212 South 2 Road, Zhangqiu City, about 15km away from the site of the proposed project. The said enterprise can absorb all the slag produced by the proposed project.

343. In summary, the slag of the proposed project will be comprehensively utilized, fly ash will be finally treated, and it is to adopt effective measures to lower dust emission in the course of collecting, storing and transporting slag. Therefore, construction of the project will have limited environmental impacts to the neighborhood.

D. Climate Change

344. Northwest China appears to be sensitive to changes in climate through increased desertification, increased variability in rainfall patterns (such as extreme precipitation events and longer droughts), and increased rate of glacial melt and nivation which feed a number of river systems in the region. The nationwide annual mean air temperature is predicted to increase by 1.3-2.1℃ in 2020 and 2.3-3.3℃ in

2050 (over 2000 levels)[4]. The warming will mainly occur in north-western and north-eastern China where significant temperature rise is projected. The National Climate Change Programme concludes that the arid areas in China will therefore probably become larger and the risk of desertification will increase, since the temperate grasslands in Northern China are on the verge of degradation and desertification because of drought and environmental deterioration. Snow cover is also expected to reduce with significantly larger inter-annual variation.

345. Recent trends show a significant decrease in annual precipitation in most of Northern China, averaging 20-40 mm per 10 year period. In the next 50-100 years, the mean annual runoff is likely to decrease in the northern arid provinces, and the National Programme indicates the possibility of a consequent gap between water resource supply and demand in northern China region.

346. The Project initiative in climate mitigation will introduce approaches and activities for developing climate resilience and carbon sequestration.

347. **Kyoto Protocol To The United Nations Framework Convention On Climate Change:** The Kyoto Protocol aims to reduce worldwide greenhouse gas emissions to 5.2 percent below 1990 levels in the period 2008 to 2012. The Kyoto Protocol sets specific emissions reduction targets for each industrialized nation, but excludes developing countries. To meet their targets, most ratifying nations would have to combine several strategies, such as: (i) place restrictions on their biggest polluters; (ii) manage transportation to limit or reduce vehicle emissions; (iii) make better use of renewable energy sources and displace the use of fossil fuels.

348. **Conformance of the Project to Policy Objectives.** As an alternative to landfill, the proposed waste-to-energy plant would reduce emissions from biodegradable municipal waste and generate energy from a non-fossil fuel source thereby meeting its Kyoto Protocol emissions targets.

349. **Climate Change 2007: Mitigation of Climate Change:** This report is the contribution from Working Group III towards the Intergovernmental Panel for Climate Change publication, the Fourth Assessment Report. It is designed to inform policy makers on the relative impacts of different activities on climate change, and to identify any activities that help reduce overall emissions.

350. The report finds that the main source of greenhouse gas emissions associated with waste management is landfill. It notes that as an alternative strategy to landfill *"Greenhouse gas generation can be largely avoided through controlled anaerobic composting and thermal processes such as incineration for waste-to-energy".* More

[4]National Development and Reform Commission 2007, *China's National Climate Change Programme*, Beijing June 2007.

specifically, waste-to-energy is identified as being: *"costly, but can provide significant mitigation potential for the waste sector, especially in the short term"*. The report also found waste-to-energy to be the most energy efficient technology for waste treatment when compared with landfill, Mechanical Biological Treatment and anaerobic digestion and that: *"incineration and industrial co-combustion for waste-to-energy provide significant renewable energy benefits and fossil fuel offsets..."*

351. **Assessment of the Project in the light of the Report:** The publication confirms that the proposed waste-to-energy plant can provide significant mitigation potential for greenhouse gas emissions by providing an alternative to landfill. It also confirms that the project will provide a highly efficient option for residual waste treatment.

352. **The National Climate Change Strategy** details the proposed measures to be taken to limit the emission of greenhouse gases such as carbon dioxide (CO_2), methane (CH_4), nitrous oxides (NOx) and certain fluorinated gases from all sectors of the economy. It also demonstrates how these measures position the nation, identifying the areas in which further measures are being researched and developed. The Strategy notes that emissions from the waste sector consist mainly of methane from landfills. Emissions reductions in the sector are to be achieved primarily through the diversion of biodegradable waste from landfill. The preferred options listed for the residual treatment of biodegradable waste are listed as thermal treatment with energy recovery or mechanical-biological treatment. The renewable portion of electricity generated will be supported. The strategy confirms that this type of hybrid support mechanism is fully consistent with the overall 'hierarchy of waste' treatment approach. The Strategy states that, *"strengthen the research and development of solid waste incineration technology, promote the incineration industry development…";* and *"promote the development of bio-energy by constructing incineration power plant at economic developed areas and land resource* s*carce area…".*

353. **Conformance of the Project to Policy Objectives.** The National Climate Change Strategy is supportive of proposals for waste-to-energy developments. The Strategy considers these technologies will help reduce greenhouse gas emissions, and highlights the role that such developments can play in meeting the Nation's Kyoto obligations. The grate furnace will harness the energy potential of the biomass in residual waste, which is estimated at 74% of MSW. The renewable energy generated from this biomass will be supported under the Strategy to encourage the development of waste-to-energy facilities. In addition to the greenhouse gas benefits of generating renewable energy, diverting this biodegradable fraction away from landfill will also reduce national methane emissions. The project proposal not only reduces the amount of waste being landfilled thereby avoiding greenhouse gas emissions from such facilities but also produces renewable electricity.

354. The GHG reduction in (CO2 equivalent) by the WTE plant is estimated to be about 1000030 ton. The calculation formula is presented below:

(NOTE: The annual waste capacity of phase I and phase II is 1050365 ton, the design MSW heat value is 6280kj and the standard coal heat value is 6000kj.)

355. As an alternative to landfill, the proposed waste-to-energy plant would reduce emissions from biodegradable municipal waste and generate energy from a non-fossil fuel source. It will reduce methane emissions from the landfill.

E. Environmental Risk Assessment

a. Potential Risk Source

356. The potential risk sources of the proposed project include leachate, flue gas and natural gases. Risk processes include leachate collection and transportation, flue gas treatment, diesel transportation. Risk pollutants include HCI, HF, dioxin and CO. There is no significant risk source according to the *Category of Significant Dangerous Sources (GB18218-2009).*

b. Assessment scope

357. Since the project will not involve in significant dangerous source and the project area is not a sensitive area, according to the Risk Assessment Guideline, the risk assessment is categorized as Class II. The assessment scope is 3km diameter from the stack.

c. Assessment Standards

The assessment standards are listed in Table VI.28

Table VI.28 Risk Assessment Standards

Pollutants	Standards	Limits
Dioxin	Notice on Strenghening EIA for Bio-energy projects	Human body daily tolerable contact dose is 4pgTEQ/kg; if intake through respiratory system, the tolerable dose is 0.4 pgTEQ/kg
	National Research Council. Risk assessment in the federal government: managing the process [M]. Washington DC: National Academic Press, 1983.	SF:1.5×10^{5}[mg/(kg•d)]$^{-1}$
HCl	Maximum Allowable Concentration for Working Site (MAC)	7.5mg/m^3
	The United States National Institute of Occupation Safety and Health(NIOSH) published documents DHHS No.90-117version, IDLH concentration	150mg/m^3
	LC50	4600mg/m^3,1hour
HF	Maximum Allowable Concentration for Working Site (MAC)	2mg/m^3
	The United States National Institute of Occupation Safety and Health (NIOSH) published documents	25mg/m^3

Pollutants	Standards	Limits
	DHHS No.90-117version, Immediately Dangerous to Life or Health (IDLH) concentration	
	LC50	1082mg/m^3,1hour
Natural Gas	China MAC(mg/m^3):	No
	Former Soviet Uniion MAC	300 mg/m^3
	Threshold Limit Value (TLV):	asphyxiating gas

d. Risk Possibility

358. Through analysis of the project process, the most likely risk identified is failure of operation of the flue gas treatment facilities that can cause flue gas emissions to the environment without any treatment. The possibility of such situation lasting for 10 minutes is 6.8×10^{-4}/a. Assuming the accident time is 10 minutes, the pollutants will be discharged to the atmosphere without any treatment.

e. Emission during Accidents

359. The emission intensity during accidents of flue gas treatment facilities failing in operation is listed in Table VI.30.

Table VI.30 Emission during Accident

Type of Accidents	Stack parameters	Pollutant	Unit	Emission
Crack of flue gas purification tower stack	Volume flow: 35.40m^3/s; Temp:150℃ Diameter:2.5m; Crack percentage:100%	HF	mg/m^3	20
		HCl		1106
		dioxin	ng TEQ/m^3	3
	Location: exit of flue gas purification tower; Height: 3.5m			

f. Prediction Model

360. The Gaussian puff model is selected for the EIA from the list recommended models in Environmental Risk Assessment Technical Guideline (HJ/T169-2004).

$$C(x,y,o)=\frac{2Q}{(2\pi)^{3/2}\sigma_x\sigma_y\sigma_z}\exp\left[-\frac{(x-x_o)^2}{2\sigma_x^2}\right]\exp\left[-\frac{(y-y_o)^2}{2\sigma_y^2}\right]\exp\left[-\frac{z_o^2}{2\sigma_z^2}\right]$$

where：C(x,y,0)—downwind ground concentration at location of (x,y);

x_0、y_0、z_0—center puff coordinates;

Q—Emission quantity during accident;

σx、σy、σz—x, y,z direction diffusion parameters (m). σx =σy.

g. Modeling Results

361. The dispersion model study considered the following conditions:

- Stabilities: B, C, D, E and F;
- Wind speeds: 1m/s, 2m/s and 4m/s;
- Last time: 5min, 10min, 30min;
- Pollutants: HF, HCl and Dioxin

362. Statistics of the modeling results is shown in Table VI.31.

Table VI.31 Summary of Modeling Results

Pollutant	Maximum ground concentration	Unit	Distance from source	Conditions
Dioxin	0.0067	ng TEQ/m^3	300m	Stability C, V＝4.0m/s, t＝10min/5min
HCl	2.0514	mg/m^3	300m	Stability C, V＝4.0m/s, t＝10min/5min
HF	0.0444	mg/m^3	300m	Stability C, V＝4.0m/s, t＝10min/5min

363. It can be seen from the table that the maximum ground concentrations are 2.0514mg/m^3, 0.0444mg/m^3 and 0.0067ng TEQ/m^3 which occurred at a distance of 300m from the stack. The concentrations are below the corresponding LC_{50}, and are below the limits of IDLH and MAC.

h. Hazard Identification

364. According to the predicted concentration and the toxicity of HCl, HF and dioxin, dioxin is selected as the assessment parameter since it might cause both acute and chronic adverse effects on health.

i. Toxicity Assessment

365. The risk assessment defines toxicity, dose-response relationship, for each surrogate chemical. The output takes the form of mathematical constants for insertion into risk calculation equations. The hazard index is the standard unit for quantifying risk of a particular chemical.

366. **Carcinogenic risk:** Defined as the chronic daily intake dose (developed in the previous step, exposure assessment) times the carcinogenic slope factor. The risk is the probability of excess lifetime cancer from exposure to the chemical:

HI=CDIxSF (Carcinogenic hazard index)

Where:

CDI=chronic daily intake dose mg/ (kg.d)；

SF =Slope factor, $[mg/ (kg.d)]^{-1}$.

i. **Slope factors (SF).** Dose-response relationships for carcinogens are conventionally reported as incidence of lifetime cancer versus dose. The slope known as the slope factor represents the carcinogenic potency for the chemical. The probability of cancer for a given exposure is calculated by multiplying the slope factor times the dose.

ii. Chronic Daily Intake Dose (CDI)is calculated by the following:

$CDI=C_{air}xL_{in}x\eta_{air}/BW$

Where:

C_{air} =concentration of contaminant in air, mg/m^3;
L_{in} =inhalation air volume，m^3/d(adult 20，child 11);
η_{air} =hazard material absorption rate，%;
BW =body weight，kg(adult 70，child 16)

367. **Non-carcinogenic risk** is characterized by the hazard index which is the ratio of the estimated intake dose from exposure to the reference dose, RfD as follows:

HI=CDI/RfD (Non-carcinogenic hazard index)
Where:
CDI=chronic daily intake mg/ (kg.d);
RfD=reference doses mg/(kg.d)；non-carcinogens exhibit a threshold effect which is defined as the reference dose (RfD) which is the estimated daily intake that is not believed to be associated with adverse health effects.

368. According to the above formula, the health index are calculated and summarized in Table VI.32.

Table VI.32 Risk Assessment Results

Dioxin	CDI ng/(kg•d)		RfD ng/(kg•d)	SF [ng/(kg•d)]$^{-1}$	HI of Non-carcinogenic risk		HI of carcinogenic risk	
	Child	Adult			Child	Adult	Chid	Adult
Maximum ground concentration	4.62×10^{-3}	1.92×10^{-3}	4.0×10^{-4}*	0.15**	11.55	4.80	6.93×10^{-4}	2.88×10^{-4}
Yumin village	3.99×10^{-3}	1.66×10^{-3}	4.0×10^{-4}*	0.15**	9.98	4.15	5.99×10^{-4}	2.49×10^{-4}

369. It can be seen from the Table VI.32 that the HI of non-carcinogenic risk for adult and child are 4.80 and 11.55, respectively. This means the exposure of dioxin will have adverse effect on human beings.

370. The hazard index of carcinogenic risk for adult and child are $2.88\times10^{-4}$and 6.93×10^{-4} respectively. Both of them are within the acceptable level.

Mitigation Measures

371. The mitigation measures for prevention of dioxins formation and their removal upon formation include:

i. **Minimization of precursors for dioxin formation**. Good combustion is essential for the minimization of reactive aromatic species which generate the precursors such as benzene, phenol etc. for dioxins formation. The keys to good combustion are the three T's of combustion (temperature, time and turbulence) with the mixing of fuel and combustion are (both primary and secondary) being the most important. International advanced automatic control software will be used to ensure the furnace temperature at 850℃～950℃ and the time at 850℃>2s. An ignition burner and an auxiliary burner will be provided to ensure the furnace temperature is higher than 850℃.

ii. **Prevention and/or reduction of dioxins formation:** Prevention and/or reduction of dioxins formation: The inhibition of catalytic activity in dioxin formation can be accomplished in the presence of ammonia, lime, etc. The continuous cleaning of boiler tubes and avoidance of steam will reduce dioxins formation. The project will inject ammonia and lime to reduce dioxin formation. Boiler will also be regularly cleaned.

iii. **Post-formation emission control and destruction:** The project will use semi-dry technology to remove dioxin fly ash with condensed dioxins. The injection of sorbent consisting of active carbon with lime will also be used specifically for dioxin and heavy metal removal.

372. Risk prevention measures are listed in Table VI.33.

Table VI.33 List of Risk Prevention Measures

Types of Risks	Risk Prevention Measures
Incineration System Faults	Incinerator fault may cause changes to load of incineration flue gas treatment system, at such time it is to return the incineration flue gas to the incinerator for secondary heating, and further reduce the contents of pollutants in flue gas. Simultaneously, it is to duly reduce the MSW incineration quantity, and increase the retention time of MSW and incineration flue gas in incinerator.
Flue gas purification and emission system faults	Once there is a fault with the flue gas purification device, it is to immediately stop operation and start the standby spray tower, and it is to avoid acidic gas without removing HCl, SO_2 and HF getting into dedusting and subsequent equipment and causing high emissions. Discharging system fault mainly refers to leakage of exhaust pipeline, and at such time, it is to immediately find out the location of the accident, find out means to plug the leakage or cutting the gas supply to control the leaking point. The incineration flue gas may be

	diverted to the downstream flue gas treatment device via the bypass, so as to ensure normal operation of the equipment.
Initiating fuel system faults	Initiating fuel system faults mainly refer to diesel pipe leakage, fire and explosion, etc., and in case of pipe leakage, it is to immediately close the master supply valve, repair the valves as soon as possible, and test if it is usable after it is duly repaired. In case of fire or explosion, it is to immediately initiate firefighting preplan, close rainwater pipeline network, cut off rainwater drainage outlet, and simultaneously open regulating water pond, and collect all the firefighting water generated in case of fire and accident. Before collecting firefighting water, it is to conduct oil separation and adsorption to the accident water.
Wastewater treatment system faults	Wastewater treatment system faults mainly refer to wastewater pipe being broken, treatment facilities being leaking and treated wastewater failing to meet the standard, etc. Once there is such a circumstance, it is to firstly stop operation of the wastewater treatment facilities, find out breaking and leaking points, and have them timely repaired. Wastewater in the treatment facilities may be firstly stored in the 500m^3emergency pond, and after completion of the accident, it is to treat the wastewater in the emergency pond to meet the standard before discharging.
Risk management and emergency treatment	It is to reinforce company risk education and risk management; It is to regularly conduct risk emergency rehearsal; It is to install complete waste gas and wastewater online monitoring devices, and regularly maintain and keep the working status of online equipment. Once there is an abnormality to the online monitoring device, it is to immediately organize relevant departments to conduct risk investigation, and eliminate the risk hazards.

373. According to the *Technical Guideline of MSW Incineration Project,* to reduce emission during abnormal operation, on-line monitoring facilities with emergency alarm system should be installed. Monitoring parameter and location are listed in Table VI.34.

Table VI.34 On-Line Monitoring and Alarm System

Parameters	Location	Note	Alarm
SO_2, NOx, CO, HCl, HF, Dust	Inlet and outlet of Stack	Recorder concentration and volume flow	Alarm in case of emission exceed standard
Pressure	Solid waste storage house	Recorder the pressure of the solid waste storage house	Alarm if not negative pressure
	Wastewater treatment facilities	Recorder wastewater treatment facilities	
	Pipes connect furnace and flue gas purification tower	Recorder pressure within the pipes	Alarm if high pressure fluctuation found, possible pipeline breakage
	Pipes conncect flue gas purification tower and bag house filter		

Parameters	Location	Note	Alarm
Temp	Furnace	Recorder temperature	Alam if temperature is out of the range of 800～1000℃
	De-acid reaction tower		Alarm if tower temperature is higher than 145℃, or the outlet temperature is lower than 30℃ which indicate de-acid facilities abnormal
	Bag house filter		Alarm if temperature greater than 230℃or less than140℃

Note: The entire sites PLC signal will be connected with the control center DCS system.

F. Emergency Response Plan

1. Basic Contents of the Emergency Response Plan

374. The main contents of the proposed emergency response plan for project risk accidents are shown in Table VI.35.

Table VI.35 List of Basic Content of the Emergency Response Plan

No.	Project	Content
1	General	1.1 Purpose of Compilation
		1.2 Basis of Compilation
		1.3 Classification and Grading of Environmental Events
		1.4 Scope of Application
		1.5 Working Principles
2	Command and Responsibility of Organization	
3	Early Warning	
4	Emergency Response	4.1 Response Mechanism
		4.2 Emergency Response Procedures
		4.3 Information Submission and Processing
		4.4 Command and Coordination
		4.5 Emergency Disposition Measures
		4.6 Emergency Monitoring
		4.7 Emergency Termination
5	Emergency Support	5.1 Financial Support
		5.2 Equipment Support
		5.3 Communication Support
		5.4 Human Resource Support

No.	Project	Content
		5.5 Technical Support
		5.6 Advocacy, Training and Drilling
		5.7 Evaluation of Emergency Capability
6	Rehabilitation Treatment	
7	Management and Update of the Plan	

2. Composition of the Emergency Response Plan

a. Command Structure

375. The company established the “command leadership team” for emergency rescue. The team members include the general manager (factory director), the relevant deputy managers (deputy factory manager), and the department heads from production, environmental safety, office, equipment, analysis and test center, and other relevant departments. The emergency rescue office is set within the environmental safety department, which is responsible for the daily work of emergency rescue. When there is major accident, based on the command leadership team (also the emergency rescue headquarter), the general manager and the deputy general manager serve as commander and deputy commander, and take charge of the organization and command of the emergency rescue work. The headquarters is located at the production control center.

376. Note: If the general manager (factory director) and the deputy general manager (deputy factory director) are not in the factory, then the heads of production department and environmental safety department should be responsible for the emergency rescue work as the temporary commander and deputy commander.

b. Responsibility

377. The responsibilities of each commanding agency and member are shown in the Table VI.36.

Table VI. 36 List of Responsibilities of Commanding Agency and Member

Name of Commanding Agency/Member	Responsibilities
Command Leadership Team	①Take charge of formulating and revising the emergency response plan for the company；②Build the professional emergency rescue teams and organize implementation and drills；③Inspect and urge the officers to do the preparation work for major accident prevention and emergency rescue.
Command Headquarter	① When the accident happens, the command headquarter should take charge of issuing and clearing the command and signal of emergency rescue；②Organize and command the

	rescue team to implement the rescue operations；③Report the accident information to the superiors and neighboring companies, and request rescue help from relevant units if necessary；④Organize accident investigation and summarize the experience and lessons of emergency rescue work。
Personnel Division of Command Headquarter	
Commander	Organize and command the whole factory to do the emergency rescue work
Deputy Commander	Assist the commander to take charge of the specific commanding work of emergency rescue
Head of Environmental Safety Department	Assist the commander to take charge of accident alarm, situation report and accident disposal
Head of Production Department or Chief Controller	① Responsible for direct shutdown or open of the production system during accident；② Accident site and external communication；③Take charge of disposing the accident site and decontaminating the harmful materials within the diffusion region；④Represent the command headquarter to publish information if necessary
Director of Office	①Support and transport the materials and goods needed for emergency rescue；②Support the living necessities for staff who rescue the wounded and poisoned people；③Command the medical aid at the accident site, classify the wounded and poisoned people, and transferred the injured people；④Take charge of disinfection, fire extinguishing，alert, public security，evacuation and road control
Head of Equipment Department	Assist the commander to organize engineering rescue and repair; mobilize the technical staff to repair equipment
Director of Analysis Test Center	Take charge of the accident site and monitor the diffusion region of harmful substances.

378. All the functional departments and employees are responsible for accident emergency rescue. The professional rescue teams are the backbones of emergency rescue. Their fundamental task is to undertake the rescue and disposal of different kinds of accidents which happen within the factory. Responsibility of the emergency teams is listed in Table VI.37.

Table VI.37 Responsibilities of Each Emergency Response Team

Team	Responsibility
Communication team	Director of the environment department responsible for communication with other teams and outside agencies.
Security team	Director of Office: responsible for the security, traffic and evacuate people from the site
Emergency team	Directors of Production and Office: responsible for identification of toxicant, propose mitigation measures, infection, rescue and

	evacuate people.
Firefighting team	Environmental and Safety Department director: responsible for firefighting, rescue wounded.
Equipment Maintenance	Equipment department director responsible for the equipment repairing.
Medical team	Director of clinic: responsible for rescue of the wounded and intoxicated
Material supply team	Office: responsible for material supply

Note: Only small accident will be dealt with in the plant. For significant accident, government emergency response mechanism will be launched.

3. Emergency Operations

379. The Emergency Operational Measures are shown in the Table VI.38.

Table VI.38 List of Proposed Emergency Operational Measures

Location of Accident	Reason of Accident	Emergency Measures
Furnace problem	Furnace blast	In case of furnace blast, all of the operation related to the furnace will be suspended including flue gas treatment. Cut all of the pipes related the furnace. Transport the untreated solid waste to landfill.
	Abnormal combustion condition	In case three T's obviously variation identified, immediately check the on-line monitoring results, identify causes of the accidents. Pipe the flue gas to furnace to reduce pollutants amount within the flue gas. Meanwhile, reduce solid waste feeding to increase duration of solid waste and flue gas within the furnace.
Flue gas purification system fault	Stop operation of the facility and launch the auxiliary spray tower to avoid untreated flue gas to be emitted to the de-duster and other following system.	
Leakage of pipes	Check the pressure meters to identify location. Seal or cut the gas supplyto the pipe and divert flue gas to bypass pipes.	
Blast of diesel tank	Launch firefighting response plan immediately, cut running water discharge network, open the adjust water tank. Collect water from firefighting and treat with oil filter.	

Chapter VII INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

380. **Legislative framework for consultation, participation and information disclosure.** Public participation in project planning and implementation is an important safeguard requirement and can reflect public perceptions of environmental quality in a project's area of influence. The Environmental Protection Law of PRC and Regulations on the Administration of Construction Project Environmental Protection (Order of the State Council, No. 253) require that "Environmental Impact Report" formulated by construction unit shall be in accordance with relevant laws to solicit the opinions of units concerned and inhabitants of project construction site". In January 2011, the MEP circulated the draft Technical Guidelines for Environmental Impact Assessment: Public Participation for public commenting, which specifies the requirements of information disclosure and stakeholder opinion survey. ADB's SPS (2009) also requires meaningful participation, consultation and information disclosure.

381. **Information disclosure.** Information disclosure and public consultation were conducted for preparation of the EIA, comprising: internet disclosure, poster information at public places, informal communication with residents, local authorities and relevant institutions and authorities and a questionnaire survey. Details of the project were placed on the website of the Zhangqiu Municipal Government (ZMG) on 2 February 2012 and 1March 2012. Information disclosure was undertaken by the Shangdong Environmental Research Institute from 2 February2012 (upon commencement of the EIA) to14 March 2012 (to disclose preliminary findings and mitigation measures). Both events were published on the website:(http://www.zhangqiu.gov.cn/publish/portal1/tab713/info47233.htm)

382. **Results of public consultation. Two rounds of public consultation and participation were conducted during preparations of the domestic and project EIA. The first round was by questionnaire surveys of stakeholders and affected people at the beginning of the domestic EIA process in April 2011.** The questionnaire (Attachment 40) survey was distributed in November 2012: 100 questionnaires were distributed and 100 (100%) responses were received. Of these, 89% were from males and 11% from females. Age of interviewees was: ≤20 years old (1%), 20-45 years (47%) >46 (52%). Fifty percent of interviewees had only attended middle school, 30% had attended high school, and 20% had attended university. Sixty-eight percent of interviewers are farmers and 7% are workers, 2% are teachers and students, 23% are officers. The following responses were received.

（i） "Have you heard of the project?" 100% stated they heard of the project.

（ii） 'What are the environmental problems that concern you the most?' 73% and 20% stated that air pollution and surface water pollution respectively were their main concerns, followed by ground water (18%) , noise 6% pollution and 1% of others [some interviewees chose more than one answer].

（iii） ‘What environmental problem do you think needs resolving immediately?’ 57% and 37% indicated water pollution and ecological deterioration respectively were their main concerns, followed by air (29%) and noise (23%) pollution [some interviewees chose more than one answer].

（iv） ‘What do you think will be the major environmental pollution issues during construction?’ 67% and 28% stated dust and noise respectively were their main concern, followed by construction waste (11%) and soil erosion (6%) [some interviewees chose more than one answer].

（v） ‘Will you be affected by the project construction?’ 65% stated they would be would benefit from the project and 35% stated they would not be affected.

383. The second round of consultation was on 1 March 2012, after completion of the draft domestic Environmental Impact Report (EIR). A key public concern raised was the need for a ‘complaint center’ to be established for the project. Explanations were given by the Zhangqiu Project Management Office (ZPMO) and the Shandong Academy of Environmental Science to all questions and concerns raised, and which subsequently guided the project design process.

384. **Continuing public participation for project construction**. Public consultation will continue during the detailed design, construction and operation phases. The ZPMO will organize public consultations, with the support of the Loan Implementation Environmental Consultant (LIEC) to be hired by ZPMO under the loan implementation consulting services. Contractors will be required to communicate and consult with the communities in the project area of influence, especially those near project works areas. Public notice boards will be set at the work site to provide information on the purpose of the project activity, the duration of disturbance, the responsible entities on-site (contractors, ZPMO), and the project Grievance Redress Mechanism (GRM). Contact information of all GRM entry points and ZPMO will be disclosed on the construction site information boards. Consultation will focus on any public complaints and concerns for public health and well-being e.g. noise, dust, dust, traffic disturbance, and other environmental and social concerns.

385. Future consultation and participation will also include (i) involvement of affected people during inspection and monitoring of EMP implementation during construction and operation phases; (ii) participatory evaluation on the environmental and social-economic benefits and impacts; and (iii) consultation with the public after project completion. The EMP includes plans for future public participation.

386. The following measures for information disclosure will also be conducted: (i) Final IEE (English-language) will be placed on the ADB public website (www.adb.org) upon receipt by ADB; and, (ii) during project implementation, the annual environment monitoring reports will be disclosed on ADB’s public website.

Chapter VIII GRIEVANCE REDRESS MECHANISM

387. To settle unforeseen issues effectively, an effective and transparent channel for lodging complaints and grievances will be established. The grievance redress mechanism (GRM) is detailed in the EMP (Attachment A) and the basic process is presented below. The EMP, including the GRM, will be refined during the detailed design phase of the project when more design details become available. The updated documents will be approved by the ADB.

Basic steps for resolving complaints are as follows and illustrated in Figure A.1.

i. Step 1: For environmental problems during the construction stage, the affected persons (AP) can register their complaints directly with the contractors as well as the Dynagreen, ZPMO, or ZEPB. Contractors are required to set up a complaint hotline and anonymous drop-box and designate a person in charge of handling complaints, and to advertise the hotline number at the main entrance to each construction site. The contractors will maintain and update a Complaint Register to document all complaints. Unless the comment was received anonymously, the contractors are required to respond to the complainant in writing within 7 calendar days on their proposed solution and how it will be implemented. If the problem is resolved and the complainant is satisfied with the solution, the grievance handling ends here. The contractors are required to report all complaints received, handled, resolved and unresolved to ZPMO monthly.

ii. Step 2: For environmental problems that could not be resolved at the contractor level, the affected person can take the grievance to the ZPMO and ZEPB. On receiving complaints by the ZPMO or ZEPB, the party receiving the complaints must notify the other party and document the complaint in writing in a Complaint Register. The ZPMO must immediately inform the ZPMO Environmental Specialist of a complaint and to agree on a course of action. The ZPMO and ZEPB must reply to each complain in writing within 14 calendar days on the proposed solution and how it will be implemented. If the problem is resolved and the complainant is satisfied with the solution, the ZPMO should document the complaint and resolution process in its Complaint Register, with quarterly reporting to Dynagreen and ZPMO.

iii. Step 3: If the affected person is not satisfied with the proposed solutions in Step 2, he/she can, upon receiving the reply, take the grievance to the Dynagreen and ZPMO (which will be received by the ZPMO Environment or Social Specialist). Upon receiving the complaint, ZPMO must deal with it within 14 calendar days. Once a complaint is documented and put on file, ZPMO through Dynagreen will immediately notify ADB. After discussing the complaint and potential solutions among ADB, ZPMO, the LIEC, the contractor, and the affected person, ZPMO must provide clear answers to the complainant within 14 calendar days from

when the complaint is documented and put on file.

The tracking and documenting of grievance resolutions by ZPMO will include the following elements: (i) tracking forms and procedures for gathering information from project personnel and complainant(s); (ii) regular updating of the GRM database by the ZPMO Environment and/or Social Specialist; (iii) processes for informing stakeholders about the status of a case; and (iv) procedures to retrieve data for reporting purposes, including the periodic reports to the ADB.

At any time, an affected person may contact ADB (Private Sector Operations Department) directly, including the ADB Resident Mission in the PRC.

If the above steps are unsuccessful, people who are, or may in the future be, adversely affected by the project may submit complaints to ADB's Accountability Mechanism. The Accountability Mechanism provides an independent forum and process whereby people adversely affected by ADB-assisted projects can voice, and seek a resolution of their problems, as well as report alleged violations of ADB's operational policies and procedures. Before submitting a complaint to the Accountability Mechanism, affected people should make a good faith effort to solve their problems by working with the concerned ADB operations department. Only after doing that, and if they are still dissatisfied, should they approach the Accountability Mechanism.[5]

[5] See: http://compliance.adb.org/

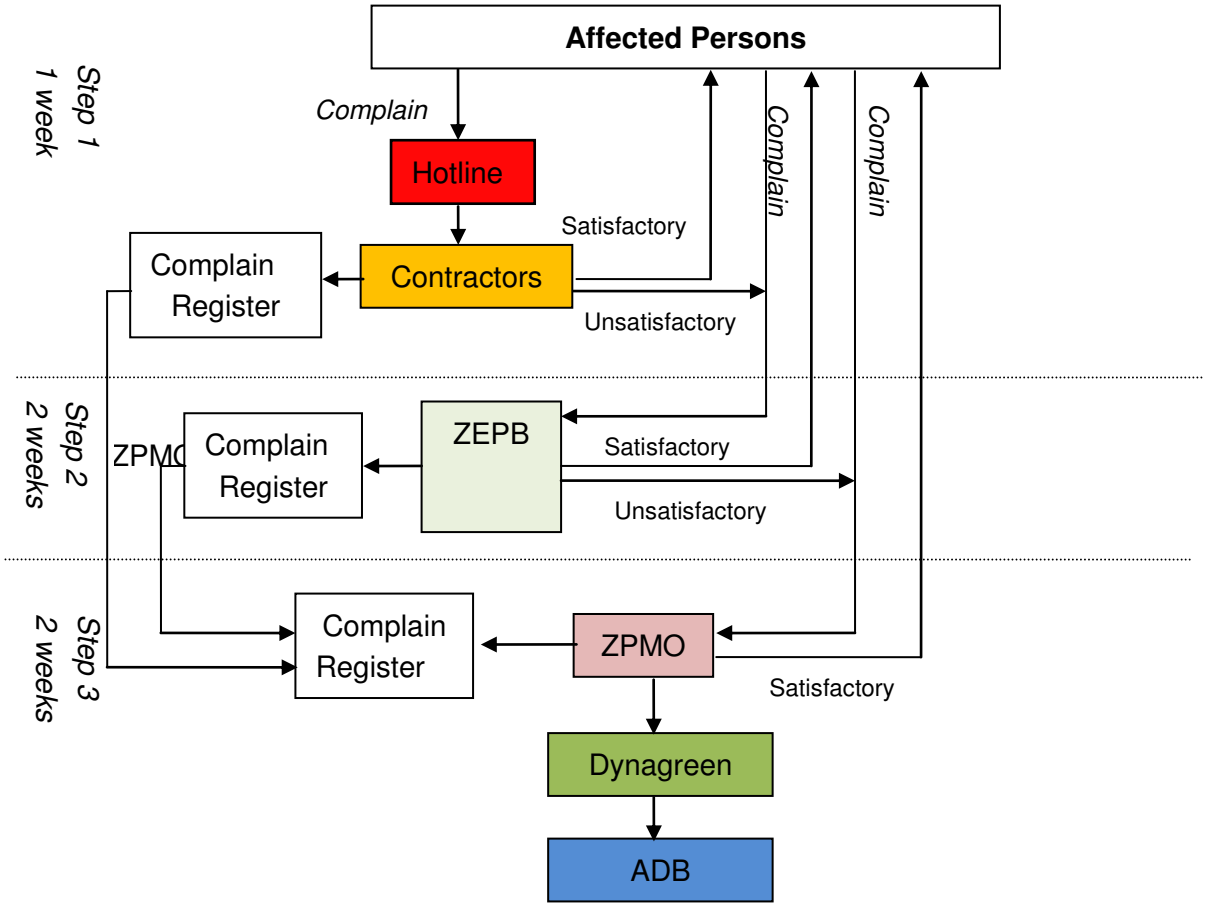


Figure A.1: Proposed Grievance Redress Mechanism

Chapter IX CONCLUSIONS AND RECOMMENDATIONS

A. Adverse impacts and mitigation measures

388. During construction, potential impacts include soil erosion, noise, fugitive dust, solid wastes, and community and occupational health and safety risks. Mainly, construction-related impacts are localized, short term, and can be effectively mitigated through the application of good construction and housekeeping practices and implementation of construction phase community and occupational health and safety plans.

389. Project operational impacts include air pollution, odor, leachate, fly ash, noise and slag.

390. Mitigation measures for the pre-construction, construction and operational phases have been designed to address these impacts, are tailored to site conditions, and are described in the project EMP (Attachment A). The EMP includes an environmental monitoring program.

391. The project will permanently utilize123.36 mu (8.228 ha) of land, mainly comprising farmland and land allocated for construction. A resettlement and compensation plan has been developed and meets the PRC and ADB applicable policies and requirements.

B. Risks and assurances

392. The key environmental safeguard risk is the relatively low capacity of ZPMO to effectively implement the EMP. This EIA has assessed impact severity on the assumption that the prescribed mitigation measures will be fully and effectively implemented. This risk will be mitigated by (i) providing training in environmental management under the project; (ii) appointing qualified project implementation consultants, (iii) adhering to the project mitigation and monitoring arrangements, (iv) ADB conducting regular project reviews; and (v) project assurances covenanted in the loan and project agreement with ADB.

393. The following project environmental assurances are included in the loan covenant to offset environmental risks.

（i） Project construction and environmental treatment measures must be simultaneously designed, simultaneously constructed and simultaneously put into operation, truly realize discharge of pollutants up to the standard, and it is to reinforce management while conducting daily operation, and ensure normal operation of all kinds of facilities.

（ii） It is to reinforce storage and piling of raw materials, prohibit fire in the storage area, post warning signs in eye-catching places in the plant area, and it is to put such firefighting apparatuses as fire extinguishers in production workshop and material storage room.It is to be equipped with emergency apparatuses, firefighting facilities and PPEs, which should be stored at designated places.

（iii） During construction, the ZPMO will provide monthly environmental monitoring reports to Dynagreen who will prepare and submit to ADB annual environmental reports in a format acceptable to ADB until the completion of all construction activities.

（iv） ZPMO will construct, operate, maintain, and monitor the project facilities in strict conformity with all laws and regulations on environmental protection, health, labor, and occupational safety and ADB's Safeguard Policy Statement (2009); and all environmental mitigation and monitoring measures detailed in the IEE and EMP for the Project shall be undertaken under the guidance of the relevant EPB or other environmental monitoring centers.

（v） ZPMO will implement the following measures in the pre-construction phase to ensure the project's environment management readiness: (i) appointment of one qualified environment specialist within ZPMO, (ii) hiring of loan implementation environment consultants (LIEC) within loan administration consultant services by ZPMO; and (iii) contracting of environmental monitoring station by ZPMO to conduct environment impact monitoring.

（vi） It is to duly conduct safe production during the operation period, reinforce safety, firefighting and environmental protection management, reinforce daily supervision and examination, establish safety inspection and purification device operation management system, and improve the environmental protection awareness of the entire staff, so as to enable clean production to become conscientious behavior of the staff, and ensure implementation and normal operation of all kinds of pollution control measures.

（vii） ZPMO will ensure that all contract and tender documents include the EMP obligations, including the environmental monitoring program.

（viii） Before and during project construction, ZPMO will organize and conduct training on implementation and supervision of the project EMP to the contractors.

（ix） ZPMO will ensure that a project Grievance Redress Mechanism for environmental and social matters is established by the ZPMO and ZEPB with clear procedures to receive, resolve, and document any grievances.

C. Overall conclusion

394. Construction of the proposed project conforms to such relevant national industry policies, conforms to relevant requirements of Environmental Protection Department of Shandong Province, such as Opinions on Further Implementing EIA and "Three Spontaneously" System (L. H. F. [2007]No. 131), and conform to Master Urban Planning of Zhangqiu City. After strictly implementing various environmental protection measures proposed in the EIA report, its construction will have limited impacts on the environmental air, surface water environment, underground water environment and sonic environment. The environmental protection measures and technologies adopted by the project are reliable and economically feasible, and the discharge densities and quantities of all kinds of pollutants can meet corresponding standard requirements. The project site selected meets the requirements for environmental protection distance. In summary, the proposed project will have sound

economic, environmental and social benefits. The project is in compliance with PRC regulations and the ADB Safeguard Policy Statement (2009).Therefore, from the perspective of environmental protection, construction of the proposed project is feasible.

Attachment A. Environmental Management Plan

ENVIRONMENTAL MANAGEMENT PLAN FOR THE ZHANGQIU WASTE TO ENERGY PROJECT

People's Republic of China

Prepared by the Dynagreen Environmental Protection Group Co., Ltd

Table of Contents

A. Introduction

1. This Environmental Management Plan (EMP) is developed for the Zhangqiu Municipal Solid Waste to Energy Project (the Project) and defines all potential impacts of the project components and the mitigation and protection measures with the objective of avoiding or reducing these impacts to acceptable levels. The EMP also defines the institutional arrangements and mechanisms, the roles and responsibilities of different institutions, procedures and budgets for implementation of the EMP. The EMP seeks to ensure continuously improving environmental protection activities during preconstruction, construction, and operation in order to prevent, reduce, or mitigate adverse impacts and risks. The EMP draws on the findings of the project IEE, and discussions and agreements with relevant government agencies and the Asian Development Bank (ADB).

2. This EMP is based on proposed project designs and domestic EIR. The EMP will be disclosed on the ADB public website (www.adb.org).It will also be included as a separate annex in all bidding and contract documents. The contractors will be informed of their obligations to implement the EMP, and to provide for EMP implementation costs in their bids for project works.

3. The EMP includes an environmental monitoring program. The monitoring results will be used to evaluate (i) the extent and severity of actual environmental impacts against the predicted impacts, (ii) the performance of the environmental protection measures and compliance with relevant laws and regulations, (iii) trends of impacts, and (iv)overall effectiveness of the project EMP.

B. Institutional arrangements and responsibilities for EMP implementation

4. The Dynagreen Environmental Protection Group Co., Ltd has established a Zhangqiu Project Management Office (ZPMO), who will be responsible for the day-to-day management of the project and the implementation of the EMP.

5. ZPMO will implement project components, administer and monitor contractors and suppliers, and be responsible for construction supervision and quality control.

6. The ZPMO will do the following.

(i) Prepare and provide the following specification clauses for incorporation in the bidding procedures: (i) environmental management requirements to be budgeted by the bidders in their proposals; (ii) environmental clauses for contractual terms and conditions; and (iii) the EMP.
(ii) Translate the EMP into Chinese-language and ensure that it remains consistent with this original version in English-language.
(iii) Ensure the EMP is implemented by the contractors, and that all contractors and project agencies comply with the EMP.
(iv) Implement the Grievance Redress Mechanism (Section G).
(v) Prepare and submit annual environmental monitoring reports to ADB.

(vi) Appoint one qualified environment specialist on its staff to implement the EMP, including supervision of the ZPMO and contractors, collection, storage and analysis of the monitoring data, and preparation of the annual environmental monitoring reports.

7. The Zhangqiu Environmental Monitoring Station (ZEMS) (under the Zhangqiu Environmental Protection Bureau) will be contracted by the ZPMO to implement the environmental monitoring program described in this EMP for the construction stage, and by the respective ZPMO (who are also the O&M Units) for the operational stage. ZEMS is a qualified entity to conduct environmental monitoring in Zhangqiu.

8. Loan Implementation Environmental Consultant (LIEC). A LIEC will be hired under the loan implementation consultancy services to assist the ZPMO Environmental Specialist with the following.

i. Before project implementation.

- Conduct a final review and - if necessary - revision of the EMP, to ensure that any environmental impacts that may result from the finalized engineering designs are identified and addressed in the EMP. Any revisions in mitigation measures may also require updating of the EMP budget.
- Submit the revised EMP to Dynagreen and ADB for review and approval.
- Support the ZPMO to ensure that tender and bidding documents, and civil works contracts, contain provisions requiring contractors to comply with the mitigation measures in the EMP, including compliance with national labor standards and measures to compliment with the international core labor standards[6], and that relevant sections of the project EMP (or updated EMP, if prepared) are incorporated in the bidding and contract documents.
- Establish the GRM.
- Develop procedures to collect, enter, store, and analyze the progress on implementation of the EMP, specifically: (a) any complaints and issues received and how these were addressed (GRM); (b) data collected by the ZEMS for the EMP environmental monitoring program, and the interpretation of this data (e.g. is project construction within the limits of air quality, noise levels etc. specified in the EMP?); (c) compliance of the contractors with the EMP; (d) a reporting schedule for the preparation and submission of the annual environmental monitoring reports to ADB.
- Provide training to ZPMO and contractors on the specific requirements of the EMP.
- EMP independent evaluation
- Assess the project components' environmental readiness prior to implementation based on the readiness indicators defined in Table A.3.

ii. During project implementation.

- Conduct regular EMP compliance assessment, undertake site visits as required, identify

[6]The core labor standards are the elimination of all forms of forced or compulsory labor; the abolition of child labor; elimination of discrimination in respect of employment and occupation; and freedom of association and the effective recognition of the right to collective bargaining, as per the relevant conventions of the International Labor Organization.

any environment-related and social-related (impact to communities, labor issues, etc.) implementation issues, propose necessary corrective actions, and prepare these in a corrective action plan.

- Assist ZPMO to prepare annual environmental monitoring progress reports for submission to ADB.
- Provide periodic 'refresher' training sessions to ZPMO and contractors on the EMP, to ensure that on-site personnel continue to comply with the EMP.
- Assist the ZPMO in conducting consultation meetings with relevant stakeholders as required, informing them of imminent construction works, updating them on the latest project development activities, and the GRM.

9. Construction contractors. The construction contractors will be responsible for implementing the EMP mitigation measures during construction, under the supervision of the ZPMO. The contractors will need to understand their requirements under the EMP. In their bids, contractors will be required to respond to the specific environmental management requirements in the EMP. Each contractor will be required to assign a specific member of their work team who will be directly responsible for the team's environmental, health and safety management, and compliance with labor standards. The contractors will work directly with the ZPMO Environmental Specialist and LIEC to ensure that prior to any works, the EMP is jointly reviewed and understood, and any site-specific measures are identified and agreed.

10. Overall environmental and social responsibilities are outlined in Table A.1.

Table A.1: Environmental responsibility

Phase	Responsible Agency	Environmental Responsibility
Project preparation	Design Institutes on behalf of ZPMO	Prepare project FSRs, EIR and EMP, RPs, conduct public consultation
	ShangdongEPB	Review and approve the project EIR and EMP
	Environmental consultant	Provide technical assistance, review domestic EIA, prepare IEE report
	ADB	Review and approve the IEE and EMP, including disclosure
Engineering detail design	Design Institutes on behalf of ZPMO	Incorporate mitigation measures defined in the EMP into engineering detail designs; Update the EMP in cooperation with the LIEC
	ZPMO, LIEC	Review updated EMP, confirm that mitigation measures have been included in engineering detail design
	ADB	Approve updated EMP, including disclosure
Tender & contracting	ZPMOand contractors	Incorporate EMP clauses in tender documents and contracts
	LIEC	Review bidding documents; confirm project's readiness
Construction	ZPMO	Supervise contractors and ensure compliance with the EMP for their respective components; coordinate construction supervision and quality control; act as local entry point for the project grievance redress mechanism (GRM).
	Dynagreen, ZPMP	Appoint environment and social specialists on its staff; supervise the effective implementation of the EMP; coordinate periodic environmental impact monitoring according to the approved monitoring plan; coordinate the project level GRM; prepare semi-annual environment progress reports and submit them to ADB; conduct public consultation and inspect implementation of mitigation measures.

Phase	Responsible Agency	Environmental Responsibility
	Contractors	Assign EMP implementation responsibilities; ensure implementation and monitoring of environment, health and safety measures and compliance with national labor standards and measures to comply with relevant core labor standards; implement mitigation measures; conduct frequent noise and dust monitoring around construction sites.
	ZEMS (contracted by ZPMO)	Undertake internal environmental monitoring; submit quarterly monitoring results to ZPMO, ZEPB.
	LIEC	Advise on the mitigation measures; provide comprehensive technical support to Dynagreen and ZPMO for environmental management; conduct training; conduct annual EMP compliance review; support ZPMO in preparing quarterly project progress reports and semi-annual environment monitoring reports
	ZEPB	Conduct periodic inspections of all construction projects relative to compliance with PRC regulations and standards.
Operation	Dynagreen, ZPMO	Ensure proper operation of component facilities according to design standards, and implement mitigation measures and public consultations
	Dynagreen, LIEC	Conduct EMP compliance review, instruct ZPMP on environmental management requirements; coordinate internal environmental monitoring; prepare quarterly project progress reports and semi-annual environment monitoring reports
	ZEMS (contracted by the ZPMO who are also the O&M Units)	Undertake internal environmental and social monitoring for the first year of operation; submit quarterly monitoring results to ZPMO, Dynagreen, ZEPB.
	ZEPB	Undertake periodic and random environmental and social monitoring and inspect environmental and social (labor) compliance
	ADB	Review and approve environmental progress report, disclose on ADB website
Notes: **ADB** = Asian Development Bank; **ZEMS** =Zhangqiu Environment Monitoring Station; **ZEPB** =Zhangqiu Environmental Protection Bureau; **ZPMO** = Zhangqiu Project Management Office; **LIEC** = Loan Implementation Environment Consultant.		

C. Summary of potential impacts and mitigation measures

11. Potential environmental issues and impacts during the pre-construction, construction and operation phases, and corresponding mitigation measures, are summarized in Table A.2. These include two types of mitigation measures:

(i) Measures that will permanently become part of the infrastructure such as flue gas purification facilities and odor removal equipment for the solid wastes. These will need to be included in the design of the facility by the design institutes. The costs of building and maintaining these systems have already been included in the infrastructure construction and operating costs and therefore will not be double-counted as part of the EMP costs.

(ii) Temporary measures during the construction stage (e.g. dust suppression by watering, use of quiet / low noise powered mechanical equipment, flocculants used to facilitate sedimentation of suspended solids in construction site runoff). These will need to be included in the tender documents; otherwise they will not be budgeted by the contractor and will not be implemented.

12. The mitigation measures defined in the EMP will be (i) checked and where necessary re-designed by the design institutes; (ii) incorporated into tender documents (where appropriate), construction contracts, and operational management plans; and (iii) implemented by contractors under supervision of ZPMO. The effectiveness of these measures will be evaluated based on the results of the environmental impact monitoring conducted by ZEMS, and through EMP compliance verification conducted by the ZPMO and LIEC.

Table A.2: Summary of Potential Impacts and Mitigation Measures

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
Detailed Design Stage						
Design of flue gas treatment system	Air quality	Air pollution	Design combined process of semi-dry process + active carbon spraying + bag filter system	Design Institute	ZPMO	Included in design contract
Design of NOx removal system	Air quality	NOx emission	Design of SNCR system (Selective non-catalytic reduction method)	Design Institute	ZPMO	Included in design contract
Design of odor escape	Odor	Odor escape from various places	Design of odor prevention system such as wind curtains at entrance and exit of MSW discharging hall, the MSW storage will be designed as entirely closed, and maintain at negative pressure state. The top is to be installed with extraction openings of primary wind and secondary wind with filter devices, and it is to suction odorous gases into the incinerator as combustion air for the incinerator, so as to prevent escape of odors.	Design Institute	ZPMO	Included in design contract
Design of leachate collection and treatment	wastewater	Wastewater discharge	Design of “physicochemical + UASB anaerobic reactor + MBR membrane bioreactor + two-step FU ultrafiltration membrane system	Design Institute	ZPMO	Included in design contract
Design of fly ash and slag collection and treatment	Solid waste	Solid waste impact	Slag will be entirely sold as raw material for brick plants; according to the MSW incineration fly dust leaching toxicity identification report in the actual production of the proposed project, solidified fly dusts will be directly sent to Zhangqiu City MSW Landfill for landfill or transported to eligible dangerous wastes disposal agency for final disposal.	Design Institute	ZPMO	Included in design contract
Water quality	Water quality and public health	Pipe burst	Design of pipe materials and connections must be adequate to prevent pipe burst.	Design Institute	ZPMO	Included in design contract
On-line	Waste gas	Air pollution, odor emission and	Design of waste gas and wastewater online monitoring devices	Design Institute	ZPMO	Included in

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
monitoring	and wastewater	water pollution				design contract
Climate	Climate change	GHG emissions	Take into account energy efficiency, energy conservation and low GHG emissions in all building and systems designs and equipment selection for the wastewater pump stations.	Design Institute	ZPMO	Included in design contract
Pre-construction Stage						
Institutional strengthening	-	Lack of environmental and social management capacities within Dynagreen and ZPMO	Appoint qualified environment and social specialist on staff within Dynagreen and ZPMO Contract loan implementation environment consultant (LIEC) within loan administration consultant services; Conduct environment management training.	Dynagreen, ZPMO, LIEC	ADB	ZPMO
	-	Lack of environmental and social monitoring capability and qualification	Contract Zhangqiu Environmental Monitoring Station to conduct project impact monitoring during construction.	ZPMO	ADB	ZPMO
			Contract Zhangqiu Environmental Monitoring Station to conduct project impact monitoring during the operational stage.	ZPMO	ZPMO	ZPMO
Tender documents	Air quality	Dust (TSP) impact to sensitive receptors	Put into tender documents dust suppression measures: Water unpaved areas, backfill areas and haul roads 7-8 times each day; Erect hoarding around dusty activities; Strengthen the management of stockpile areas with frequent watering or covering with tarpaulin; Minimize the storage time of construction and demolition wastes on site by regularly removing them off site; Do not overload trucks for transporting earth materials to avoid spilling dusty materials onto public roads. Equip trucks for transporting earth materials with covers or tarpaulin to cover up the earthy materials during transport; Install wheel washing equipment or conduct wheel washing manually at each exit of the works area to prevent trucks from carrying muddy or dusty substance onto public roads;	Design Institute	ZPMO; LIEC	Included in tendering agency contract

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
			Immediately cleanup all muddy or dusty materials on public roads outside the exits of the works areas; Sensibly plan the transport routes and time to avoid busy traffic and heavily populated areas when transporting earthy materials; Immediately plant vegetation in all temporary land take areas upon completion of construction to prevent dust and soil erosion.			
		Odor impact to sensitive receptors	Put into tender documents that the transport of MSW from the site of origin to the plant site must be in sealed containers.	Design Institute	ZPMO; LIEC	Included in tendering agency contract
	Noise	PME noise impact to sensitive receptors	Put into tender documents the following noise mitigation measures: Use quiet equipment; Adopt good O&M of machinery; Use temporary hoardings or noise barriers to shield off noise sources; Minimize night time construction between 2200 and 0600 hours. If night time construction is needed, consult and notify local communities beforehand;	Design Institute	ZPMO; LIEC	Included in tendering agency contract
	Water quality	Construction site wastewater impact on water bodies	Put into tender documents the following measures to treat wastewater and runoff from construction sites: Provide portable toilets or small package WWTPs for workers and canteens Install sedimentation tanks on-site to treat process water and muddy runoff	Design Institute	ZPMO; LIEC	Included in tendering agency contract
	Solid waste	Disposal or storage of excavated spoil	Specify in tender documents the spoil disposal or storage sites and that only these sites could be used.	Design Institute	ZPMO; LIEC	Included in tendering agency contract
	Labor, health &safety	Occupational health & safety of workers Compliance with labor standards (national and core labor standards)	Specify in tender documents the provision of personal safety and protective equipment such as safety hats and shoes, eye goggles, respiratory masks, etc. to all construction workers as well as responsibility of contractors to comply with national labor standards (minimum wages, insurance, etc) and core labor standards (prohibition of child labor, bonded labor, and non-discrimination).	Design Institute	ZPMO; LIEC	Included in tendering agency contract

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
Construction traffic	Traffic	Construction vehicles causing traffic congestion	Plan transport routes for construction vehicles and specify in tender documents to forbid vehicles from using other roads and during peak traffic hours.	Design Institute, Local traffic police	ZPMO; LIEC	Included in tendering agency contract
Estimated cost for Design and Pre-construction stage: Included in detailed design and contract tender fees						
Construction Stage						
Construction site good practice	Air quality	Dust (TSP) during construction	Frequent watering of unpaved areas, backfill areas and haul roads; Erect hoarding around dusty activities; Strengthen the management of stockpile areas with frequent watering or covering with tarpaulin; Minimize the storage time of construction and demolition wastes on site by regularly removing them off site; Do not overload trucks for transporting earth materials to avoid spilling dusty materials onto public roads; Equip trucks for transporting earth materials with covers or tarpaulin to cover up the earthy materials during transport; Install wheel washing equipment or conduct wheel washing manually at each exit of the works area to prevent trucks from carrying muddy or dusty substance onto public roads; Immediately cleanup all muddy or dusty materials on public roads outside the exits of the works areas; Sensibly plan the transport routes and time to avoid busy traffic and heavily populated areas when transporting earthy materials; Immediately plan vegetation in all temporary land take areas upon completion of construction to prevent dust and soil erosion.	Contractor	ZPMO,LIEC	$30,000

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
	Noise	Noise from PME and vehicles	Sensibly schedule construction activities, avoid noisy equipment working concurrently; Select advanced quiet equipment and construction method, and tightly control the use of self-provided generators; Comply with local requirements in areas with sensitive receptors very close by. If night time work is needed, set up temporary noise barrier, minimize use of noisy equipment, and consult and notify local communities beforehand; Control speed of bulldozer, excavator, crusher and other transport vehicles travelling on site, adopt noise reduction measures on equipment, strengthen equipment repair and maintenance to keep them in good working condition; Limit the speed of vehicles travelling (less than 20 km/hr), forbid the use of horns unless absolutely necessary, minimize the use of whistles; Maintain continual communication with nearby schools to avoid noisy activities near the schools during examination periods.	Contractor	ZPMO, LIEC	$30,000
	Water quality	Construction site wastewater discharge	Domestic and cafeteria wastewater will go through biochemical treatment and grease trap prior to discharge; The cafeteria will be designed and construct for employment and provide breakfast, lunch and dinner. Timely cleanup scattered materials on site, stockpiles must adopt measures to prevent being washed into water bodies by rain water; Reuse equipment and wheel wash WW for dust suppression;	Contractor	ZPMO, LIEC	$30,000
	Solid waste	Construction site refuse and spoil disposal	Transport construction waste in enclosed containers; Establish enclosed waste collection points on site, with separation of domestic waste and construction waste; Set up centralized domestic waste collection point and transport offsite for disposal regularly by sanitation department; Dispose spoil at designated disposal site. Backfilled area if not being used must	Contractor	ZPMO,LIEC	$30,000

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
			be planted with vegetation to prevent soil erosion.			
	Physical cultural resources	Destruction of cultural relics in stream bed and soil	Contractor must comply with PRC's *Cultural Relics Protection Law* and *Cultural Relics Protection Law Implementation Regulations* if such relics are discovered, stop work immediately and notify the relevant authorities, adopt protection measures and notify the Security Bureau to protect the site.	Contractor	ZPMO,LIEC	None
Health and Safety	Occupational health and safety	Construction site sanitation	Effectively clean and disinfect the site. During site formation, spray with phenolated water for disinfection. Disinfect toilets and refuse piles and timely remove solid waste; Minimize the risk of fly- or mosquito-borne diseases by maintaining well-drained and hygienic project sites; Remove standing water bodies and cover drums and other containers to avoid formation of stagnant water; Ensure personnel are aware of potential disease risks; Enforce on-site hygiene regulations to prevent litter; Provide public toilets in accordance with the requirements of labor management and sanitation departments in the living areas on construction site, and appoint designated staff responsible for cleaning and disinfection.	Contractor	ZPMO,LIEC	$30,000
		Occupational safety	Provide safety hats and shoes to all construction workers and enforce their use by the workers; Provide ear plugs to workers working near noisy PME.	Contractor	ZPMO,LIEC	$30,000
		Food safety	Inspect and supervise food hygiene in cafeteria on site regularly. Cafeteria	Contractor	ZPMO,LIEC	None

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
			workers must have valid health permits. Once food poisoning is discovered, implement effective control measures immediately to prevent it from spreading.			
		Disease prevention and safety awareness	Construction workers must have physical examination before start working on site. If infectious disease is found, the patient must be isolated for treatment to prevent the disease from spreading. From the 2nd year onwards, conduct physical examination on 20% of the workers every year. Establish health clinic at location where workers are concentrated, which should be equipped with common medical supplies and medication for simple treatment and emergency treatment for accidents. Specify the persons responsible for health and epidemic prevention, education on food hygiene, and disease prevention, to raise the awareness of workers.	Contractor	ZPMO,LIEC	$30,000
	Community health and safety	Temporary traffic management	A traffic control and operation plan will be prepared together with the local traffic management authority prior to any construction. The plan shall include provisions for diverting or scheduling construction traffic to avoid morning and afternoon peak traffic hours, regulating traffic at road crossings with an emphasis on ensuring public safety through clear signs, controls and planning in advance.	**Contractor**, local traffic police	ZPMO,LIEC	DYNAGREEN (traffic police department)
		Information disclosure	Residents and businesses will be informed in advance through media of the construction activities, given the dates and duration of expected disruption.	Contractor	ZPMO,LIEC	None
		Access to construction sites	Clear signs will be placed at construction sites in view of the public, warning people of potential dangers such as moving vehicles, hazardous materials, excavations, etc. and raising awareness on safety issues. All sites will be made secure, discouraging access by members of the public through appropriate fencing whenever appropriate.	Contractor	ZPMO,LIEC	None
		Utility services interruptions	Assess construction locations in advance for potential disruption to services and identify risks before starting construction. If temporary disruption is unavoidable, develop a plan to minimize disruption	**Contractor**, local service providers	ZPMO,LIEC	None

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
			with relevant authorities e.g. power company, water supply company, communication company, and communicate dates and duration in advance to all affected people.			
	Compliance with labor standards	Lack of compliance with national and core labor standards leading to violation of rights of workers	Contractors to comply with national labor standards on minimum wages, insurance, etc. Recruitment office to design and implement measures to ensure that there is no discrimination during hiring and that no child labor or bonded labor will be engaged in the construction activities.	Contractor	ZPMO,LIEC	
Grievance redress mechanism	Social & environmental	Handling and resolving complaints on contractors	Establish a GRM, appoint a GRM coordinator within ZPMO. Brief and provide training to GRM access points (ZPMO, contractors). Disclose GRM to affected people before construction begins at the main entrance to each construction site. Maintain and update a Complaint Register to document all complaints.	Contractor, ZPMO,, LIEC	ZEPB, LIEC	ZPMO budget,
						Estimated cost for the Construction Stage: $210,000
Operational Stage						
	Noise	Noise from steam engine room, cooling tower, incinerator room, circulating water pump room	In stall high efficiency microporous silencer for instantaneous steam venting of boilers. Keep the equipment in good working condition and with regular maintenance.	ZPMO	Dynagreen	O&M Unit's operation budget
	Flue gas	Air pollution	Regular check online monitoring system, and alarm system to keep all facilities in good operational condition.	ZPMO	Dynagreen	O&M Unit's operation budget
	Leachate	wastewater	Regular check online monitoring system, and alarm system to keep all facilities in good operational condition.	ZPMO	Dynagreen	O&M Unit's operation budget
	Fly ash	Solid waste	Regular check online monitoring system, and alarm system to keep all facilities in good operational condition. Proper treatment and after stabilization in plant, be transported to auxiliary landfill for burying	ZPMO	Dynagreen	O&M Unit's operation budget
	Slag		Regular check online monitoring system, and alarm system to keep all facilities	ZPMO	Dynagreen	O&M Unit's

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
			in good operational condition. After treatment in plant, comprehensively use as construction material.			operation budget
						Estimated cost for the Operational Stage: the cost will be included in the O&M budget

Key: **ADB** = Asian Development Bank; **CESMT** = Community Environmental Supervision and Management Team; Dynagreen = Dynagreen Environment Protection Group Co., Ltd; **ZEMS**= Zhangqiu Environment Monitoring Station; **ZEPB** = Zhangqiu Environmental Protection Bureau; **ZPMO** = Zhangqiu Project Management Office; **LIEC** = Loan Implementation Environment Consultant.; **O&M** = operation & maintenance; PME = powered mechanical equipment; TSP = total suspended particles.

D. Monitoring and reporting

13. Three types of project monitoring will be conducted under the EMP.[7]

(i) Project readiness monitoring. To be conducted by the LIEC.

(ii) Project impact monitoring. To be conducted by:(a) the Zhangqiu Environmental Monitoring Station (ZEMS) under the Zhangqiu EPB (for air, water, noise); and (b) the contractors, who will be required to conduct frequent noise and air quality monitoring around construction sites and to report monitoring results in the framework of their weekly progress reports to ZPMO.

(iii) Independent evaluation. To be conducted by the LIEC. To verify EMP compliance during project implementation.

14. ADB will oversee project compliance on the basis of the annual environmental monitoring reports provided by Dynagreen and site visits (generally 1-2times/year). Monitoring and reporting arrangements defined for this project are described below.

15. **Project readiness monitoring.** Before construction, the LIEC will assess the project's readiness in terms of environmental management based on a set of indicators (Table A.3) and report it to ADB and ZPMO. This assessment will demonstrate that environmental commitments are being carried out and environmental management systems are in place before construction starts, or suggest corrective actions to ensure that all requirements are met.

Table A.3: Project Readiness Assessment Indicators

Indicator	Criteria	Assessment
EMP update	• EMP was updated after technical detail design & approved by ADB	Yes No
Compliance with loan covenants	• The borrower complies with loan covenants related to project design and environmental management planning	Yes No
Public involvement effectiveness	• Meaningful consultation completed	Yes No
	• GRM established with entry points	Yes No
Environmental Supervision in place	• LIEC is in place	Yes No

[7]In addition to project-specific monitoring, Zhangqiu EPB will conduct independent ambient and/or enforcement monitoring as per national requirements. This is separate to, and not funded by, the project.

Indicator	Criteria	Assessment
	• Environment specialists appointed by ZPMO	Yes No
	• Environment monitoring station contracted by ZPMO	Yes No
Bidding documents and contracts with environmental safeguards	• Bidding documents and contracts incorporating the environmental activities and safeguards listed as loan assurances	Yes No
	• Bidding documents and contracts incorporating the impact mitigation and environmental management provisions of the EMP	Yes No
	• Environmental requirements of EMP included in contract documents for construction contracts	Yes No
EMP financial support	• The required funds have been set aside for EMP implementation	Yes No

16. **Project impact monitoring.** Table A.4(a) and Table A.4(b) show the environmental monitoring program designed for this project, defining the scope, location, parameter, duration and frequency, and responsible agencies, for monitoring during the construction and operational stages. Internal environmental monitoring will include monitoring of air quality, noise and water quality.

17. The internal environmental monitoring results will be compared with relevant PRC and international performance standards (Table A.5). Non-compliance with these standards will be highlighted in the monitoring reports. Monitoring results will be (i) submitted by ZEMS to ZPMO on a monthly basis, and (ii) then reported by ZPMO to ADB in annual environmental monitoring reports (prepared with the support of the LIEC – Table A.6).

Table A.4(a): Environmental Monitoring Program During Construction

Item	Parameter	Monitoring Location	Monitoring Frequency & Duration	Implementing Entity	Supervising Entity	Estimated Cost
Construction Stage						
Dust and noise	TSP, L_{Aeq}	At boundaries of all construction sites	2 times/day, three times/ week during construction period	Contractor	ZPMO	Included in Contractor budget
Air quality	TSP	Houjiacun, Taipingcun, Wangzhongcun(Attachment 42: The villages around the project site)	1 day (24-hr continuous sampling) per month when there is construction occurring within 200 m of the monitoring location	ZEMS (contracted through ZPMO)	ZPMO	$20,000
Noise	L_{Aeq}	Houjiacun, Taipingcun, Wangzhongcun(Attachment 42: The villages around the project site)	2 times per day (day time and night time); 1 day per month when there is construction occurring within 200 m of the monitoring location	ZEMS (contracted through ZPMO)	ZPMO;	$20,000
Social	Community	3-person Community Environmental Supervision and Management Team (CESMT) to monitor the environmental	Ad hoc	CESMT (contracted through	ZPMO	$9,000

Item	Parameter	Monitoring Location	Monitoring Frequency & Duration	Implementing Entity	Supervising Entity	Estimated Cost
		conditions during construction		ZPMO)		
						$49,000
Notes: **CESMT** = Community Environmental Supervision and Management Team; **ZEMS**= Zhangqiu Environment Monitoring Station; **ZEPB** = Zhangqiu Environmental Protection Bureau; **ZPMO** = Zhangqiu Project Management Office.						

Table A.4(b)Environmental Monitoring Program During Operation

Item		Monitoring Location	Sites	Parameters	Frequency	Internal/external	Estimated Cost
Gas	Online flue gas monitoring	Stack	2	Volume flow、dust、O_2、CO、NO_2、SO_2、HCl、HF	On-line	Internal	Included in O&M budget
		Furnace	2	Temp、CO、oxygen content	On-line	Internal	Included in O&M budget
	Sampling	Stack	2	Dust、HCl、SO_2、NO_2、CO、HF、Hg、Cd, Pb	Quarterly	Internal	Included in O&M budget
				Dioxin	Once a year	External RMB 20,000 Yuan	
		Plant boundary	4	H_2S、NH_3, Odor	Once during summer	External RMB 10,000 Yuan	
Waste water	Sampling	Inlet and outlet of leachate treatment system	1	pH、$CODc_r$、BOD_5、SS、NH_3-N、Hg、Cd, Pb	Once every shift	Internal	Included in O&M budget
	Sampling	Plant wastewater outlet	1	pH、$CODc_r$、BOD_5、SS、NH_3-N、Hg、Cd, Pb	Once every shift	Internal	Included in O&M budget
Noise	Plant boundary		4	Leq(A)	Quaterly	Internal	Included in O&M budget
Ambient air	Houjiacun, Wangzhongcun		5	SO_2、NO_2、TSP、PM_{10}、Hg, Cd, Pb、HCl、HF	Twice a year	Internal	Included in O&M budget

	Houjiacun, Taipingcun	2	Dioxin	Once a year	External	Included in O&M budget
	Houjiacun, Taipingcun	3	H_2S 、NH3 、CH3SH 、Odor	Twice a year	External	Included in O&M budget
Ground water	One at 10m away from solid waste storage pit One at 10m away from main buiding One at upstream of the plant: Chizitoucun One at downstream of the plant: Houjiacun	4	pH 、Hardness, total solvable solid waste,NH3-N, 、permanganate index 、 Nitrate, Nitrite, Volatile phenol 、cyanide 、Fluoride 、As, Hg, Cr, Pb, Cd, Zn, Total coliform, depth of well and ground water	Twice a year	External	Included in O&M budget
Soil	Side of solid waste storage house	1	pH 、Cd, Hg, As, Cu, Pb, Zn, Cr, Ni	Once a year	External	Included in O&M budget
	One at 300m northwest of the plant One at 800m southeast of the plant	2	Dioxin			
Solid waste	Fly Ash Leaching Test	1	Fly Ash Leaching Test	Once a month	External	Included in O&M budget

Table A.5: Monitoring Indicators and Applicable PRC Standards[8]

Phase	Indicator	Standard
Construction	TSP	Class II Ambient Air Quality Standard (GB 3095-1996)
	Noise limits of PME at boundary of construction site	Emission Standard of Environmental Noise for Boundary of Construction Site (GB 12523-2011)
	Water quality	Standard for Pollution Control on the Landfill Site of Municipal Solid Waste (GB37 16889－2008) and Wastewater Discharge Standards for Discharge of Municipal Sewers (CJ343-2010)
Operation	Odor (NH_3, H_2S)	Emission Standards for Odor Pollutants (GB 14554-93)
	Noise	Emission Standard for Industrial Enterprises Noise at Boundary (GB 12348-2008)
	Slag	General Solid Waste Storage and Disposal Site Pollution Control Standards (GB18559-2001); Pollution Control Standard for Hazardous Waste Storage (GB18597-2001)
	Fly ash	General Solid Waste Storage and Disposal Site Pollution Control Standards (GB18559-2001); Pollution Control Standard for Hazardous Waste Storage (GB18597-2001)
	Leachate	Standard for Pollution Control on the Landfill Site of Municipal Solid Waste (GB16889-2008)(Attachment Integrated Wastewater Discharge Standard (GB 8978-1996)

Note: DO = dissolved oxygen, PME = powered mechanical equipment, TSP = total suspended particles.

18. The Plant will purchase environmental monitoring instruments for the purpose of regular monitoring. Table A.6 listed the instruments needed.

Table A.6 Environmental Monitoring Instruments for the Project

No.	Equipment	Qty	Cost (10,000CNY)

[8]The project applies PRC standards. A comparison of PRC standards with internationally accepted standards (as defined in the World Bank's Environment Health and Safety Guidelines) was conducted for the EIA. The comparison confirmed that PRC standards are either internationally accepted, or have comparable standard limits with most of the international standards.

No.	Equipment	Qty	Cost (10,000CNY)
(1)	1/10000 balance	1	2
(2)	Ultraviolet Spectrometer Subsystem (UVS)	1	10
(3)	atomic absorption spectroscopy(AAS)	1	30
(4)	pH meter	2	0.2
(5)	heating resistance furnace	1	0.6
(6)	heat oven thermostat	1	0.4
(7)	current type flow meter	2	1.0
(8)	Refrigerator	2	0.5
(9)	Computer, printer	2	2.0
(10)	Proportional sampler	2	5.0
(11)	Reagents and glassware	some	2.0
(12)	Flue gas on-line monitoring system	1	292.00
(13)	Multifunctional noise analyzer	4	0.6
(14)	COD measure instrument	1	2.0
(15)	Biochemical incubator	1	1.0
(16)	chemical analysis glassware	some	2.0
(17)	others	--	24.0
(18)	Flue gas sampler	2	1
(19)	Constant temperature and flow air sampler	4	1
(20)	Integrated sampler	4	1
(21)	absorption bottle	20	30
(22)	Acoustic calibrator	1	0.1
(23)	Atomic fluorescence photometer	1	10
Sum			418.40

19. **Independent evaluation.** Independent evaluation on EMP implementation will be undertaken by the LIEC. ZPMO will report the LIEC's independent evaluation to ADB on the project's adherence to the EMP, information on project implementation, environmental performance of the contractors, and environmental compliance through quarterly project progress reports and annual environmental monitoring reports (Table A.6). The LIEC will support ZPMO in developing the semi-annual environmental monitoring reports. The reports should confirm the project's compliance with the EMP and local legislation (including the PRC's EIA requirements), the results of independent evaluation (both contractor compliance with the EMP and the results of environmental monitoring by the ZEMS), identify any environment related implementation issues and necessary corrective actions, and reflect these in a corrective action plan. The operation and performance of the project GRM, environmental institutional strengthening and training, and compliance with all covenants under the project will be included in the report.

20. **Monitoring by ADB.** Besides reviewing the annual environment monitoring reports from ZPMO and the verification reports from the LIEC, ADB missions will inspect the project progress and implementation on site. For environmental and labor issues, inspections will focus mainly on (i) monitoring data; (ii) the implementation status of project performance indicators specified in the loan documents for the environment, environmental and labor compliance, implementation of the EMP, and environmental institutional strengthening and training; (iii) the environmental performance of contractors, LIEC, and ZPMO; and (iv) operation and performance of the project GRM, among others. The performance of the contractors in respect of environmental compliance will be recorded and will be considered in the next bid evaluations.

21. **Environmental acceptance monitoring and reporting.** Following the PRC Regulation on Project Completion Environmental Audit (MEP, 2001), within three months after the completion of each project component, an environmental acceptance monitoring and audit report for the component shall be prepared by a licensed environmental monitoring institute. The report will be reviewed and approved by ZEPB, and then reported to ADB (Table A.7). The environmental acceptance reports of the component completions will indicate the timing, extent, effectiveness of completed mitigation and of maintenance, and the needs for additional mitigation measures and monitoring during operations.

Table A.7: Reporting Plan

Reports		From	To	Frequency
Construction Phase				
Internal progress reports by contractors	Internal project progress report by construction contractors, including monitoring results	Contractors	ZPMO, Dynagreen	Monthly
Internal environmental monitoring	Environmental monitoring report	ZEMS, Ornithologist,	ZEPB, ZPMO Dynagreen	Monthly
	Environment progress and monitoring reports	Dynagreen	ADB	Semi-annual
Acceptance report	Environmental acceptance monitoring and audit report	Licensed institute	ZEPB	Once; within 3 months of completion of physical works
Operational Phase				
Internal environmental monitoring	Environmental monitoring report (first year of operation)	ZEMS	ZEPB, ZPMO Dynagreen	Quarterly
	Environment progress and monitoring report	Dynagreen	ADB	Annual
Notes: **ADB** = Asian Development				

Reports	From	To	Frequency
		Bank; **ZEMS**= Zhangqiu Environment Monitoring Station; **ZEPB** = Zhangqiu Environmental Protection Bureau; **ZPMO** = Zhangqiu Project Management Office	

E. Institutional Capacity Building and Training

22. The capacity of Dynagreen, ZPMO, and contractors' staff responsible for EMP implementation and supervision will be strengthened. All parties involved in implementing and supervising the EMP must have an understanding of the goals, methods, and practices of project environmental management. The project will address the lack of capacities and expertise in environmental management through (i) institutional capacity building, and (ii) training.

23. Institutional strengthening. The capacities of the Dynagreen, ZPMO to coordinate environmental management will be strengthened through a set of measures:

1, The appointment of a qualified environment specialist within the Dynagreen and ZPMO staff to be in charge of EMP coordination, including GRM.

2, The appointment of LIEC under the loan implementation consultancy to guide Dynagreen, ZPMO in implementing the EMP and ensure compliance with ADB's Safeguard Policy Statement (SPS 2009).

24. Training. Dynagreen, ZPMO, contractors and O&M units will receive training in EMP implementation, supervision, and reporting, and on the Grievance Redress Mechanism (Table A.8). Training will be facilitated by the LIEC with support of other experts under the loan implementation consultant services.

Table A.8: Training Program

Training	Attendees	Contents	Times	Period (days)	No. of persons	Cost ($/person /day)	Total Cost
EMP adjustment and implementation	Dynagreen, ZPMO, contractors	Development and adjustment of the EMP, roles and responsibilities, monitoring, supervision and reporting procedures, review of experience (after 12 months)	Twice - Once prior to, and once after the first year of project implementation	2	15	100	$6,000
Grievance Redress Mechanism	Dynagreen, ZPMO contractors, ZEPB	Roles and responsibilities, Procedures, review of experience (after 12 months)	Twice - Once prior to, and once after the first year of project implementation	1	10	100	$2,000

Training	Attendees	Contents	Times	Period (days)	No. of persons	Cost ($/person /day)	Total Cost
Environmental protection	Dynagreen, ZPMO contractors, ZEPB	Pollution control on construction sites (air, noise, wastewater, solid waste)	Once (during project implementation)	2	10	100	$2,000
Environmental monitoring	Dynagreen, ZPMO contractors, ZEPB	Monitoring methods, data collection and processing, reporting systems	Once (at beginning of project construction)	1	10	100	$1,000
						Total estimated cost:	**$11,000**
Notes: **ADB** = Asian Development Bank; **ZEPB** = Zhangqiu Environmental Protection Bureau; **ZPMO** = Zhangqiu Project Management Office; **O&M** = operation and maintenance.							

25. Capacity building. In addition to training for EMP implementation, the project will provide consulting services and training to assist and train the staff of Dynagreen, ZPMO, project management, environmental management, land acquisition and resettlement, procurement, as well as external resettlement and environmental monitoring. The institutional components of the project will also involve training by loan implementation consultants in operation and maintenance of completed facilities. Part of this training will focus on teaching staff how to use a set of indicators to monitor performance of the completed facilities. These indicators will be designed by loan implementation consultants prior to operation start-up.

F. Consultation, Participation and Information Disclosure

26. Consultation during Project Preparation. Section VII of the EIA describes the public participation and consultation implemented during project preparation.

27. Future Public Consultation Plan. Plans for public involvement during construction and operation stages were developed during project preparation. These include public participation in (i) monitoring impacts and mitigation measures during the construction and operation stages; (ii) evaluating environmental and economic benefits and social impacts; and (iii) interviewing the public after the project is completed. These plans will include several types of public involvement, including site visits, workshops, investigation of specific issues, interviews, and public hearings (Table A.9). The budget for public consultation is estimated to be $8,500.

Table A.9: Public Consultation Plan

Organizer	Format	No. of Times	Subject	Attendees	Budget
Construction Stage					
ZPMO	Public consultation & site visit	4 times: 1 time before construction commences and 1 time each year	Adjusting of mitigation measures, if necessary; construction impact; comments and suggestions	Residents adjacent to components, representatives of social sectors	$4,000

Organizer	Format	No. of Times	Subject	Attendees	Budget
		during construction			
ZPMO	Expert workshop / press conference	As needed based on public consultation	Comments / suggestions on mitigation measures, public opinions	Experts of various sectors, media, civil society organizations	$1,500
ZPMO	Resettlement survey	As required by relevant resettlement plan	Comments on resettlement, improvement of living conditions, livelihood, and poverty reduction; comments and suggestions	Persons affected by resettlement and relocation	Included in the resettlement plan update survey budget
Operational Stage					
ZPMO	Public consultation and site visits	Once in the first year	Effectiveness of mitigation measures, impacts of operation, comments and suggestions	Residents adjacent to component sites, social sectors	$1,500
ZPMO	Expert workshop or press conference	As needed based on public consultation	Comments and suggestions on operational impacts, public opinions	Experts of various sectors, media, civil society organizations	$1,500
				Total budget:	**$8,500**
Notes: **ZPMO** = Zhangqiu Project Management Office					

G. Grievance Redress Mechanism

28. A Grievance Redress Mechanism (GRM) will be established as part of this EMP to receive and manage any public concerns or issues which may arise due to the project. The GRM comprises: (i) a set of clear procedures developed by the ZPMO to receive, record, and address any concerns which are lodged; (ii) specific contact individuals at the Dynagreen, ZPMO and (iii) the Zhangqiu Environmental Protection Bureau (ZEPB).

29. All contractors and work staff will be briefed by the ZPMO on the GRM. Contractors and workers will be instructed to be courteous to local residents and, in the event they are approached by the general public with an issue, to immediately halt their work and report the issue to the foreman. The foreman will immediately report the issue to the ZPMO and Dynagreen for action.

30. Multiple means of using this mechanism, including face-to-face meetings, written complaints, hotline number and telephone conversations, anonymous drop-boxes for written comments, and/or e-mail, will be available. All concerns received will be treated confidentially and professionally. The identity of individuals

will not be circulated among project agencies or staff and will only be shared with senior staff, and then only when there is clear justification. In the construction period and the initial operational period covered by loan covenants, the Dynagreen will report progress to the ADB, and this will include reporting complaints and their resolution.

31. Basic steps for resolving complaints are as follows and illustrated in Figure A.1.

iv. Step 1: For environmental and social problems during the construction stage, the affected persons (AP), including workers, can register their complaints directly with the contractors as well as the Dynagreen, ZPMO, or ZEPB. Contractors are required to set up a complaint hotline and anonymous drop-box and designate a person in charge of handling complaints, and to advertise the hotline number at the main entrance to each construction site. The contractors will maintain and update a Complaint Register to document all complaints. Unless the comment was received anonymously, the contractors are required to respond to the complainant in writing within 7 calendar days on their proposed solution and how it will be implemented. If the problem is resolved and the complainant is satisfied with the solution, the grievance handling ends here. The contractors are required to report all complaints received, handled, resolved and unresolved to ZPMO monthly.

v. Step 2: For environmental and social problems that could not be resolved at the contractor level, the affected person can take the grievance to the ZPMO and ZEPB. On receiving complaints by the ZPMO or ZEPB, the party receiving the complaints must notify the other party and document the complaint in writing in a Complaint Register. The ZPMO must immediately inform the ZPMO Environmental Specialist of a complaint and to agree on a course of action. The ZPMO and ZEPB must reply to each complain in writing within 14 calendar days on the proposed solution and how it will be implemented. If the problem is resolved and the complainant is satisfied with the solution, the ZPMO should document the complaint and resolution process in its Complaint Register, with quarterly reporting to Dynagreen and ZPMO.

vi. Step 3: If the affected person is not satisfied with the proposed solutions in Step 2, he/she can, upon receiving the reply, take the grievance to the Dynagreen and ZPMO (which will be received by the ZPMO Environment or Social Specialist). Upon receiving the complaint, ZPMO must deal with it within 14 calendar days. Once a complaint is documented and put on file, ZPMO through Dynagreen will immediately notify ADB. After discussing the complaint and potential solutions among ADB, ZPMO, the LIEC, the contractor, and the affected person, ZPMO must provide clear answers to the complainant within 14 calendar days from when the complaint is documented and put on file.

32. The tracking and documenting of grievance resolutions by ZPMO will include the following elements: (i) tracking forms and procedures for gathering information from project personnel and complainant(s); (ii) regular updating of the GRM database by the ZPMO Environment and/or Social Specialist; (iii) processes for informing stakeholders about the status of a case; and (iv) procedures to retrieve data for reporting purposes, including the periodic reports to the ADB.

33. At any time, an affected person may contact ADB (Private Sector Operations Department) directly, including the ADB Resident Mission in the PRC.

34. If the above steps are unsuccessful, people who are, or may in the future be, adversely affected by the project may submit complaints to ADB's Accountability Mechanism. The Accountability Mechanism provides an independent forum and process whereby people adversely affected by ADB-assisted projects can voice, and seek a resolution of their problems, as well as report alleged violations of ADB's operational policies and procedures. Before submitting a complaint to the Accountability Mechanism, affected people should make a good faith effort to solve their problems by working with the concerned ADB operations department. Only after doing that, and if they are still dissatisfied, should they approach the Accountability Mechanism.[9]

[9] See: http://compliance.adb.org/

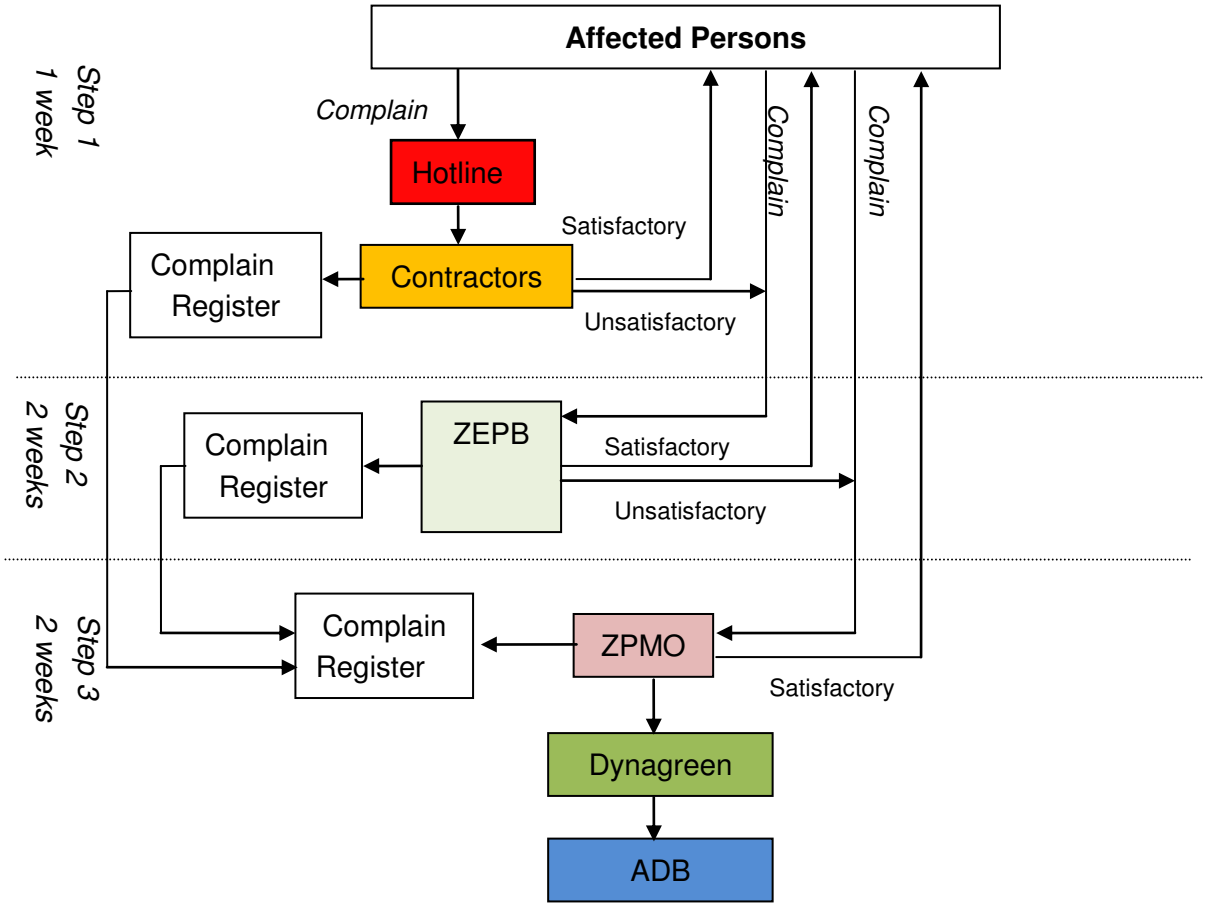


Figure A.1: Proposed Grievance Redress Mechanism

35. ZPMO will bear all internal environmental monitoring costs during the construction stage. The ZPMO will bear all internal monitoring costs during the operational stage. Contractors will bear the costs for all mitigation measures during construction, including those specified in the tender and contract documents as well as those to mitigate unforeseen impacts due to their construction activities. The ZPMO will bear the costs related to mitigation measures during operation. The ZPMO will bear the costs related to environmental supervision during construction and operation respectively. The project as a whole, through ZPMO, will bear the costs for training, the GRM, and the Loan Implementation Environment Consultants under contract to ZPMO.

H. Mechanisms for Feedback and Adjustment

36. The EMP is a living document. The need to update and adjust the EMP will be reviewed when there are design changes, changes in construction methods and program, unfavorable environmental monitoring results or inappropriate monitoring locations, and ineffective or inadequate mitigation measures. Based on environmental monitoring and reporting systems in place, ZPMO (with the support of the LIEC) shall

assess whether further mitigation measures are required as corrective action, or improvement in environmental management practices are required. ZPMO will inform ADB promptly on any changes to the project and needed adjustments to the EMP. The updated EMP will be submitted to ADB for review and approval, and will be disclosed on Dynagreen project website.

Attachments

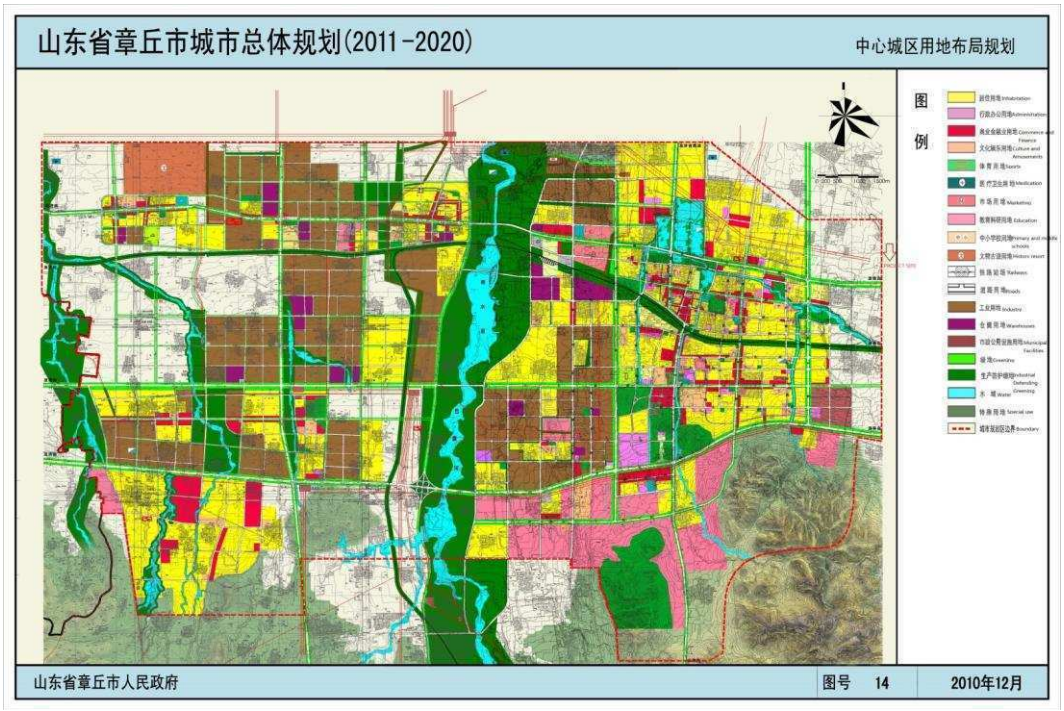
- Attachment 1:Zhangqiu City Master Plan (2011-2020)
- Attachment 2:Zhangqiu 12th five-years Key Pollutants Total Emission Amount Control Plan
- Attachment 3:Zhangqiu Environmental Function Zoning
- Attachment 4： Calculation of Dioxin generation from MSW incineration
- Attachment 5 : The power of attorney for EIA
- Attachment6 : The approval for the criteria application of EIA of Zhangqiu MSW incineration project (May 10th, 2012. Jinan Environmental Protection Bureau)
- Attachment 7 : The approval for Municipals Solid Waste incineration plant construction (October 10th, 2011, Zhangqiu city people's government)
- Attachment 8 : The Land pre-trial opinion of Municipals Solid Waste incineration plant (September 22th, 2011, Zhangqiu Municipal Bureau of Land and Resources)
- Attachment 9 : Theletter of opinions on site selection forZhangqiu MSW incineration project (September 21th,2011, Zhangqiu Urban Planning Bureau)
- Attachment 10 : The water supplies agreement for production and living, and fire water of Zhangqiu MSW incineration project (April 2012, Zhangqiu Water Supply Company)
- Attachment 11 : The certificate for MSW of Zhangqiu MSW incineration project (March 1th, 2013, Zhangqiu Urban Environmental Sanitation Center)
- Attachment 12 : The statement of Ground cover with mineral resources for Zhangqiu MSW incineration project (May 9th, 2011, Zhangqiu Municipal Bureau of Land and Resources)
- Attachment 13 : The reuse water supply agreement of Zhangqiu MSW incineration project (March 2013, Zhangqiu Wastewater Treatment Plant)
- Attachment 14 : The supply agreement for activated carbon (March 2013, Yantai activated carbon company)
- Attachment 15 : The proof of sewage receive (March 2013, Zhangqiu Wastewater Treatment Plant)
- Attachment 16 : The agreement for comprehensive utilization of slag (April 10th, 2012, ZhangqiuLiyuanxinxingbuilding materials factory)
- Attachment 17 : The agreement of accepting fly ash (March 1th, 2013, Zhangqiu Urban Environmental Sanitation Center)
- Attachment 18 : The agreement for the disposal of hazardous waste

(April 11th,2013, Qingdao Xintiandi Comprehensive Treatment of Solid Waste Company)

- Attachment 19 :The consulting contract of Dioxin Testing (May 4th, 2013, ResearchCenter for Environmental Analysis and Measurement of Zhejiang University)
- Attachment 20 : Ambient Air Quality Standards (GB 3095-2012)[to replace GB 3095-1996 on January 1, 2016] ;
- Attachment 21 :Hygienic Standard for the Design of Industries and Enterprises (TJ 36-79)
- Attachment 22 : Environmental Quality Standard for Noise (GB 3096-2008)
- Attachment 23 : Environmental Quality Standards for Surface Water (GB 3838-2002)
- Attachment 24 : Quality Standard for Ground Water (GB/T 14848-93)
- Attachment 25 :Emission Standard of Environmental Noise for Boundary of Construction Site (GB 12523-2011)
- Attachment 26 : Emission Standard for Industrial Enterprises Noise at Boundary (GB12348-2008)
- Attachment 27 : Pollution Control Standards for Pollutants from Municipal Solid Waste Incineration (GB18485-2001);
- Attachment 28 : Emission Standard for Odor Pollutants (GB14554-93);
- Attachment 29 :Shandong Integrated Atmospheric Particular Matters Emission Control Standard (DB37/1996-2011);
- Attachment 30 : Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB 18918-2002);
- Attachment 31 :Waste Water Quality Standard for Discharge into Sewer Network (CJ343-2010);
- Attachment 32 :Standard for Pollution Control on the Landfill Site of Municipal Solid Waste (GB37 16889－2008);
- Attachment 33 :Shangdong Integrated Pollutants Discharge Standards for Xiaoqing River Catchment (DB37/656-2006)
- Attachment 34 :Pollution Control Standard for Hazardous Waste Storage (GB18597-2001)
- Attachment 35： The Tentative Measures for Public Participation in Environmental Impact Assessments.
- Attachment 36: The Layout and map of the plant site
- Attachment 37:Solid Waste test report
- Attachment 38: Pollution control for LuoRiver
- Attachment 39:Air Dispersion Modeling (AERMOD)
- Attachment 40:Questionnaire for the Public Consultation

- Attachment 41: IFC EHS Guidelines for Waste Management Facilities(about Doxin emission standard)
- Attachment 42: The villages around the project site

Attachment 1:ZhangqiuCity Development Master Plan 2011-2020



Attachment 2: Zhangqiu 12th five-years Key Pollutants Total Emission Amount Control Plan

章丘市环境保护局文件

章环字〔2012〕12号

章丘市环境保护局
关于印发《“十二五”期间主要污染物排放总量控制计划》的通知

各科室、各责任单位：

现将《“十二五”期间主要污染物排放总量控制计划》印发给你们，望认真遵照执行。

二〇一二年七月十日

主题词：环保 减排 计划 印发 通知

章丘市环境保护局办公室 2012年7月10日印发

章丘市环境保护局
“十二五”期间主要污染物排放总量控制计划

为贯彻落实《章丘市人民政府关于印发章丘市“十二五”期间主要污染物排放总量控制实施方案的通知》（章政发【2012】21号），控制主要污染物排放总量，防治区域环境污染，改善环境质量，促进经济、社会和环境可持续发展，现制定我市“十二五”期间主要污染物排放总量控制计划。

一、基本原则

（一）总量指标分配范围为列入2010年污染源普查动态更新数据库的重点源，并以2010年污染源普查数据动态更新结果作为重点源“十二五”总量减排的排放基数。

（二）严格分配总量指标。结合我市区域环境容量，按照环境管理需要，基于污染物达标排放要求，又严于排放标准的原则测算总量分配指标。原则上不超过2010年的排放基数。

（三）统筹考虑已批复建设项目总量分配指标，并结合项目竣工验收监测报告、现行排放标准作适当加严。

（四）科学合理进行分配。除上述原则外，按照国家、省和济南市要求预留少部分烟粉尘总量指标，优先用于我市重点项目建设总量调剂。

二、分配方案

（一）COD、氨氮总量指标

1、工业及生活源

（1）工业源

按照国家有关工业 COD、氨氮削减率不低于整体水平的要求核算总量指标，重点工业源应分别达到济南市 COD、氨氮平均去除效率 94.6%、98.1%。原则上，2010 年去除效率已达到或超过上述平均水平的，其总量指标与基数持平；否则，按照 2010 年的污染物产生量和上述应达到的去除效率核算相应的总量指标。

但按照上述原则核算，对出现反推的污染物排放浓度超标或明显偏低的，统一按照 2010 年的废水排放量和"十二五"期间应达到的排放标准（COD、氨氮分别为 45mg/L、4.5mg/L），核算总量指标。

对于未纳入普查更新调查范围的新建项目，总量指标使用我局确认时的指标，已竣工验收时总量低于确认指标的按从严要求，分配指标。

非重点工业源不对应具体排污单位，COD、氨氮总量指标与其基数基本持平。

（2）生活源

按照 COD、氨氮分别削减 12.6%、15.9%测算，全市生活 COD、氨氮总量指标分别分配至乡镇污水处理站和社区污水处理站等。

2、农业源

农业源的 COD、氨氮净削减任务量分别为 2253 吨、106 吨，削减率分别为 13.8%、15.3%，在普查更新中，农业源包括畜禽养

殖业、种植业和水产养殖业3部分，按照目前国家、省和济南市工作安排，农业源的削减任务全部由畜禽养殖业承担，并相应分配总量指标。

（二）二氧化硫、氮氧化物指标

1、生活源。生活源不对应具体排污单位，二氧化硫、氮氧化物总量指标与其基数基本持平。

2、机动车。机动车氮氧化物削减8.7%的指标，将由济南市作为一个整体，统一安排并落实。

3、工业源。非重点工业源不对应具体排污单位，二氧化硫、氮氧化物总量指标与其基数持平。火电行业按照国家确定的发电、供热绩效值分机组核算分配指标并与2010年普查基数相衔接；钢铁、石化、水泥、集中供热等重点行业，按照2010年基数和“十二五”期间应达到的脱硫、脱硝或低氮燃烧效率核算分配指标。

四、有关说明

（一）待国家“十二五”总量分配指导意见明确后，我局将对本计划进行适当调整。

（二）根据国家、省和济南市要求，“十二五”期间，将实施过程总量控制，2013年，我局将根据有关要求进行落实。

附：1、“十二五”废气中主要污染物总量分配计划

2、“十二五”废水中主要污染物总量分配计划

3、“十二五”畜禽养殖业污染物总量分配计划

Attachment 3: Zhangqiu Environmental Function Zone

图 4-3-1 章丘市生态功能分区示意图

Attachment 4：Caculation of Dioxin generate from MSW incineration

1. 二恶英在炉内各区域的反应

现在普遍认为在垃圾焚烧中，二恶英相关的反应主要有 5 种情况，对应炉内的 5 个反应区域(图 1)。

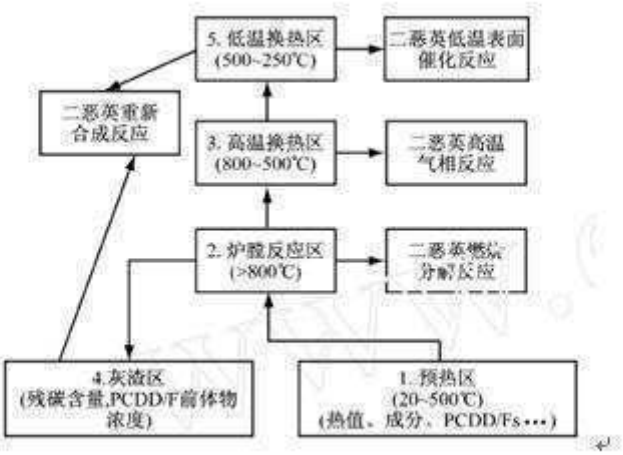


图 1 垃圾焚烧炉中二恶英生成区域图

其中，区域 1 是预热区，主要是垃圾中原本含有的二恶英在 20～500℃的温度区域内会释放出来；含有的前驱物会通过低温反应生成二恶英，这里释放和生成的二恶英会在炉膛内高温区得到分解，对尾部排放影响不大。区域 2 是炉膛反应区，在这个区域里，二恶英以及垃圾中的各种前驱物以高温分解为主，燃烧状况的好坏直接影响到了尾部二恶英的再生成。区域 3 主要为高温换热区，已有研究表明，在这个区域中二恶英反应以高温气相生成为主，生成的时间很短，并且生成量与区域 4、5 相比几乎可以忽略不计。区域 4 是灰渣区，主要以重新合成反应为主。区域 5 为低温换热区，反应以低温表面催化反应和重新合成反应为主。区域 4、5 是二恶英生成的主要区域，尤其是温度区间为 250～450℃的生成量占到了二恶英总生成量的 70%以上。由于预热区的二恶英生成对尾部二恶英排放影响不大，下面仅阐述后 4 个区域中二恶英生成的相关反应。

1.1 炉膛内与二恶英相关的反应

炉膛是高温(1000～800℃)反应集中的地方，垃圾中原有的二恶英或者其前体物在炉膛内高温焚烧时，发生与二恶英相

关的反应有氯酚聚合生成二恶英，二恶英、氯酚等有机物的高温分解和燃烧。

PRPCDD/Fs 2HCl (1)

PCDD/Fs+nO_2——mCO_2 +βHCl (2)

P+$n'O_2$——$m'CO_2$ +β'HCl (3)

其中 P 为氯酚等二恶英前体物。

1.2 高温换热区与二恶英相关的反应

在高温换热区(800～500℃)，二恶英的生成主要以高温气相反应为主，文献[4]提出二恶英在高温气相中主要有以下反应：

P——Pg+H (4)

P+OH——Pg+H2O (5)

Pg——Pr (6)

P+Pg——PD+Cl (7)

PD——D+HCl (8)

PD+OH——D+H2O (9)

Pg+R——P+Rg (10)

Pg+OH——Pr (11)

D——Pr (12)

D + OH——Pr (13)

Pg+O2——Pr (14)

R+OH——Rg+H2O (15)

R——Pr (16)

式中：P 为氯酚；Pg 为氯酚基团；Pr 为含酚基团化合物；D 为二恶英；Rg 为一般有机物；R 为一般有机物基团；PD 为多氯二联苯醚。

这些反应满足一阶动力学反应模型，如已知炉膛出口处前驱物浓度，可以计算出氯酚、氯酚基团、二恶英等浓度。

1.3 低温换热区与二恶英相关的反应

在低温换热区(500～250℃，省煤器与空气预热器区)，二恶英的反应主要以前体物的低温表面催化生成反应和重新合成反应为主。

低温表面催化反应过程示于图 2，主要包括二恶英的生成、解吸附、脱氯和分解 4 步反应。生成　　Ps+Pg——Ds (17)

解吸附　　Ds——Dg (18)

脱氯　　Ds——Pro (19)

分解　　Ds——DPro (20)

式中：Ps 为单位质量飞灰吸附的前体物浓度；Pg 为烟气中前体物浓度；Ds 为颗粒表面二恶英；Dg 为气相二恶英；Pro 为二恶英脱氯反应产物；DPro 为二恶英分解反应产物。

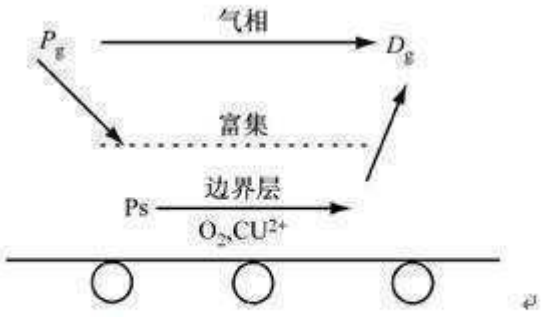


图 2 二恶英低温催化生成模型

重新合成反应主要受碳形态、催化剂、氧以及温度的影响，二恶英的生成主要可以分为以下几步：

(1) 气态氧被金属化学吸收 O2 + 2Cu——2CuO

(2) 碳被氧化 C_f +CuO——C_fO+Cu

(3) 碳结构的分解造成一些芳香烃，包括多氯联苯、五氯酚等，通过氧的配位，产生一部分二恶英。C_{gl} + aO2——bCO2 + cCO + dAr + ePCDD/F

(4) 在碳结构上的卤化和脱卤反应，会产生一些芳香烃和二恶英。

(5) 二恶英的分解转化。

1.4 灰渣里二恶英的生成

灰渣中二恶英的生成也主要以“denovo”合成反应为主。

2 垃圾焚烧炉中二恶英的生成计算

城市生活垃圾中含有二恶英为 5～50ngTEQ/kg。鉴于国内垃圾塑料和织物含量与国外垃圾相比稍多， 在本文中二恶英初始浓度取 n_0=35ngTEQ/kg。

2.1 炉内反应计算方程

炉内反应机理主要是高温分解为主，设二恶英分解率为 α，反应级数 n=1，则得到式(21)。

$$-\frac{d\alpha}{dt}=k(1+\alpha) \qquad (21)$$

在 800℃以上高温下，k=431×exp（-46600/RT)。因此，计算结果示于图 3。如图 3，在炉内时间为 2s，温度达到 800℃时，转化率为 99%，而 850℃则已达到 99.5%d以上，1000℃则在 1.5s时已几乎达到 100%，也就是说接近全部分解。

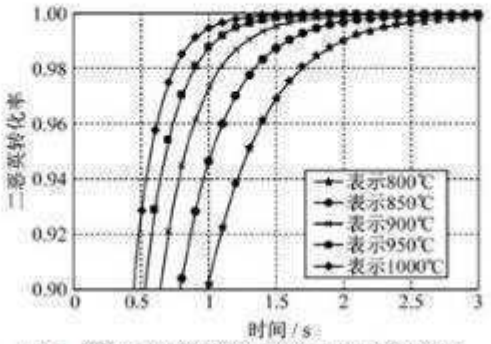


图 3 炉内二恶英转化率随时间温度变化图

2.2 高温气相反应计算方程

高温气相反应机理计算的困难点主要在于前体物浓度的确定，前体物浓度主要来源于未完全分解的和原有的。

高温气相反应由式(4)～式(16)组成。设 Ki 为反应 Ri 的反应速率常数，Cij 为基元反应

反应物的浓度。根据高温气相反应动力学得到以下式子，式中 $r_i=k_i\Pi C_{ij}$

$$d[P]/dt=-r_4-r_5-r_7+r_{10}$$

$$d[P\cdot]/dt=r_4+r_5-r_6-r_9-r_{10}-r_{11}-r_{14}$$

$$d[PD]/dt=r_7-r_8-r_9$$

$$d[D]/dt=r_8+r_9-r_{12}-r_{13}$$

$$d[R]/dt=-r_{10}-r_{15}-r_{16}$$

$$d[O_2]/dt=-r_{14}$$

在高温气相反应中，烟气中[OH]浓度与温度有关，OH=$10^{-1.7}$exp(-35000/RT)。根据以上方程式采用欧拉差分法可以计算求出二恶英以及各种前体物生成结果。高温气相生成二恶英的计算方程如式(22)。

$$d[D]/dt=5.0\times10^{4}\exp(-12150/T[P]ng/(m^3\cdot s)) \qquad (22)$$

假设高温反应中前驱物浓度为 10μg/m3 时，得到的计算结果示于图 4。

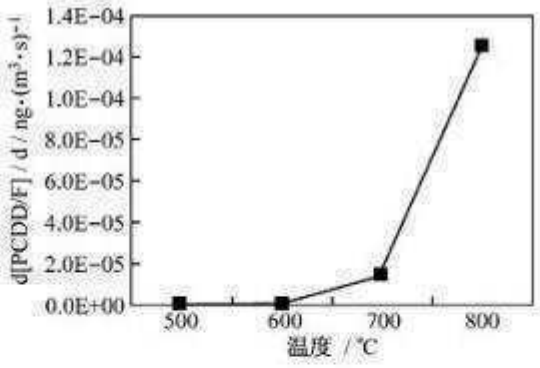


图 4 高温条件下二恶英生成计算结果

由图 4 可知，高温反应中二恶英的生成随温度降低而减少，同时二恶英生成速率与二恶英前体物浓度成正比。

2.3 低温表面催化反应计算方程

低温表面催化反应主要由式(17)~式(20)组成，它们分别表示二恶英的生成、解吸附、脱氯以及分解反应，分别以 Ker、Kdes、Kdechl 和 Kdeco 表示这 4 个反应的反应速度常数，由文献[7]得到：

$$K_{er} = 5\times10^{9}\sqrt{T}\exp\left[-20800/RT\right]$$

$$K_{des} = 5\times10^{13}\exp\left[-53400/RT\right]$$

$$K_{dechl} = 5\times10^{5}\exp\left[-15000/RT\right]$$

$$K_{deco} = 5\times10^{13}\exp\left[-37500/RT\right]$$

式中：Ki 为反应 Ri 的速率反应常数，Cij 为基元反应反应物的浓度。式中 ri = KiΠCij，则得到

$$d\left[D_s\right]/dt = r_{er} + r_{des} - r_{dechl} - r_{deco}$$

$$d\left[D_g\right]/dt = r_{des}$$

$$r_{er} = k_{er}P_sP_g$$

式中：Ps 指单位质量飞灰吸附的前体物分子数；Pg 指烟气中的前体物分子数；定义飞灰的表面覆盖率为 θ_s，θ_s 一般为 0.01~0.0001；$\theta_s = P_s/N_m$，N_m 为单位质量飞灰吸附空间的总数。根据计算过程发现低温催化生成二恶英主要和温降速率与飞灰覆盖率关系密切。由计算结果得到固相二恶英生成最多的温度段为 300-350℃，气相随温度降低生成量逐渐减少。增加烟气的温降速率和降低飞灰的前体物覆盖率可有效抑制二恶英的生成。

2.4 "Denovo"反应计算方程

"Denovo"反应的机理如式（17）~式（20）所述，碳结构的分解会造成芳香烃物质的产生，从而产生二恶英。

主要的反应方程如下：

$C_x + aO_2$——$bCO_2 + cCO + dAr + ePCDD/F$

Ds——Dg

Ds——其它产物

式中：K_1，K_2，K_3 为以上 3 式的反应速率常数，f 为碳气化反应生成二恶英的产率，文献[8]指出碳气化的反应级数为 0.54，本文采用 0.5，计算方程如下：

$$[D_s]=\frac{f[C]_0K_1[O_2]^{0.5}}{K_2+K_3-K_1[O_2]^{0.5}}\cdot\left[e^{-K_1[O_2]^{0.5}t}-e^{-(K_2+K_3)t}\right]$$

$$[D_g]=\frac{f[C]_0K_2}{K_2+K_3-K_1[O_2]^{0.5}}\cdot\frac{K_1[O_2]^{0.5}}{K_2+K_3}\left(1-e^{-(K_2+K_3)t}\right)$$

其中，$f=16\exp(3500/RT)$

$K1=5.1\times10^{8}\exp(-17000/RT)$

$K2=1.05\times10^{11}\exp(-35000/RT)$

$K3=8.5\times10^{14}\exp(-44250/RT)$

根据计算结果可知，烟气中残碳含量[C]和氧含量[O2]越高，最后生成的二恶英就越多。因此，控制飞灰中残碳含量、烟气中氧含量是控制重新合成二恶英的主要途径。

3. 结论

垃圾焚烧过程中二恶英的生成反应有其复杂性，需要全面考虑温度场和各组分浓度场的影响，本文提出了各个区域的计算方程和各区域主要影响二恶英生成的因素。计算结果表明，二恶英在炉内温度保持 850℃以上，停留时间保持 2s 则分解率可以达到 99.99%以上；减少高温气相二恶英前体物浓度可有效减少二恶英生成；增加烟气的温降速率和降低飞灰前体物覆盖率可有效抑制低温表面催化反应二恶英的生成；而控制飞灰中残炭含量、烟气中氧含量是控制重新合成反应生成二恶英的主要途径。由于垃圾焚烧过程中这种反应的复杂性，本文计算中众多参数如反应速度常数等应用了已有的试验结果，对一些求解条件也采用了近似方法，因此不能给出一个精确的垃圾焚烧炉产生二恶英数值，但是通过各计算方程中各变量对二恶英生成影响分析，对垃圾焚烧炉的设计具有一定的指导作用。

Attachment 5: The power of attorney for EIA

委 托 书

山东省环境保护科学研究设计院：

根据《中华人民共和国环境影响评价法》和《国家建设项目环境保护管理条例》的有关规定，特委托贵院承担章丘市生活垃圾焚烧发电项目的环境影响评价工作。请贵院接委托书后，抓紧编制《章丘市生活垃圾焚烧发电项目环境影响报告书》，以便开展下一步工作。

建设单位：章丘绿色动力再生能源有限公司

2012 年 3 月 30 日

Attachment 6: The approval for the criteria application of EIA of Zhangqiu MSWIncineration project (May 10th, 2012. Jinan Environmental Protection Bureau)

济南市环境保护局

济南市环保局关于章丘绿色动力再生能源有限公司章丘市生活垃圾焚烧发电厂 BOT 项目环境影响评价执行标准的批复

章丘绿色动力再生能源有限公司：

你单位《关于章丘市生活垃圾焚烧发电厂 BOT 项目环境影响评价执行标准的申请》（章绿〔2013〕02 号）收悉，经研究批复如下：

一、环境质量执行以下标准：

（一）《环境空气质量标准》（GB3095-2012）二级标准

（二）《地表水环境质量标准》（GB3838-2002）IV类

（三）《地下水质量标准》（GB/T14848-93）III类标准

（四）《声环境质量标准》（GB3096-2008）2 类标准

二、污染物排放执行以下标准：

（一）废水

《山东省小清河流域水污染物综合排放标准》（DB37/656-2006）重点保护区标准和《关于批准发布〈山东省南水北调沿线水污染物综合排放标准〉等 4 项标准修改单的通知》（鲁质监标发〔2011〕35 号）的有关要求（其中 COD、氨氮执行《济南市

人民政府办公厅关于提高部分排污企业水污染物排放执行标准的通知》（济政办字〔2011〕49号）的要求）。

（二）废气

1.《生活垃圾焚烧污染控制标准》（GB18485-2001）

2.《大气污染物综合排放标准》（GB16297-1996）二级标准

3.《恶臭污染物排放标准》(GB14554-93)二级标准

4.《山东省固定源大气颗粒物综合排放标准》（DB37/1996-2011）

（三）固体废物

1.《生活垃圾填埋场污染控制标准》（GB16889-2008）

2.《一般工业固体废物贮存、处置场污染控制标准》（GB18599-2001）

3.《危险废物贮存污染控制标准》(GB18597-2001)

（四）噪声

1.《工业企业厂界环境噪声排放标准》（GB12348-2008）2类标准

2.《建筑施工场界环境噪声排放标准》（GB12523-2008）

2013年5月22日

Attachment 7: The approval for Municipals Solid Waste incineration plant construction (October 10th, 2011, Zhangqiu city people's government)

章丘市人民政府

章政字［2011］65号

章丘市人民政府
关于同意建设生活垃圾焚烧发电项目的
批　复

市环卫管护中心：

你中心《关于建设生活垃圾焚烧发电项目的请示》收悉，经市政府研究，同意建设垃圾焚烧发电项目，采用BOT方式，通过竞争性谈判择优确定项目建设运营公司。

市环卫管护中心要按照垃圾焚烧发电项目的相关建设要求，抓紧办理各项手续，力争垃圾焚烧发电项目尽快开工建设，尽早发挥效益。

章丘市人民政府

二〇一一年十月十日

Attachment 8: The Land pre-trial opinion of Municipals Solid Waste incineration plant (September 22th, 2011, Zhangqiu Municipal Bureau of Land and Resources)

章丘市国土资源局

关于生活垃圾焚烧发电厂用地预审意见的函

章丘市环境卫生管护中心：

你单位《关于生活垃圾焚烧发电厂土地预审的申请报告》收悉。按照国土资源部《建设项目用地预审管理办法》，经审查，现函复如下：

一、该项目规划用地 7.5370 公顷，（其中耕地 3.1962 公顷，林地 4.0482 公顷，其他农用地 0.2926 公顷）。用地符合章丘市中心城区土地利用规划，符合国家供地政策，同意通过建设用地预审。

二、根据节约集约用地的原则，在项目设计阶段应进一步优化设计方案，从严控制建设用地规模。

三、根据国家有关规定，建设项目占用耕地应保证占补平衡，补充耕地的资金必须切实落实。

四、本预审意见不作为取得项目用地的批准文件，请按程序

和规定，依法取得国有土地使用权。

五、依据《建设项目用地预审管理办法》的规定，建设项目预审文件自批准之日起，有效期为两年。

二〇一一年九月二十二日

Attachment 9: Theletter of opinions on site selection for Zhangqiu MSW incineration project (September 21th,2011, Zhangqiu Urban Planning Bureau)

C № 0010932

中华人民共和国

建设项目选址意见书

选字第37 0181201100008 号

根据《中华人民共和国城乡规划法》第三十六条和国家有关规定，经审核，本建设项目符合城乡规划要求，颁发此书。

核发机关 章丘市规划局

日 期 二〇一一年九月二十一日

基本情况	建设项目名称	生活垃圾焚烧发电厂
	建设单位名称	章丘市环境卫生管护中心
	建设项目依据	项目建议书
	建设项目拟选位置	济钢明铝东矿区以北，规划东外环以东
	拟用地面积	约 75370 平方米（合 113 亩）以实际测量面积为准
	拟建设规模	25000 平方米
附图及附件名称		建设项目选址意见书申请表；现状地形图

遵守事项

一、建设项目基本情况一栏依据建设单位提供的有关材料填写。
二、本书是城乡规划主管部门依法审核建设项目选址的法定凭据。
三、未经核发机关审核同意，本书的各项内容不得随意变更。
四、本书所需附图与附件由核发机关依法确定，与本证具有同等法律效力。

Attachment 10: The water supplies agreement for production and living, and fire water of Zhangqiu MSW incineration project (April 2012, Zhangqiu Water Supply Company)

章丘市生活垃圾焚烧发电厂 BOT 项目

生产生活及消防用水供水协议

甲方：章丘市自来水公司

乙方：章丘绿色动力再生能源有限公司

鉴于章丘市经济发展的需要，垃圾环保处理的要求不断提高，为此，章丘绿色动力再生能源有限公司拟开展章丘市生活垃圾焚烧发电厂 BOT 项目。该项目拟选址在侯家村。项目生产生活及消防用水拟采用甲方提供的市政自来水。

经甲乙双方协商，达成如下合作意向：

一、 甲乙双方的权利和义务

1、 甲乙双方必须严格遵守国家法律、法规及济南地区相关规定。

2、 甲方有能力保障章丘市生活垃圾焚烧发电厂 BOT 项目生活及消防用水的需要。

3、 供用水设施（包括：供水管线、水泵、泵房、电力等）由章丘市相关主管单位负责建设。供用水设施之建设以乙方需要为准；甲方负责承担相应供水设施的维护。

4、 供水期限：自乙方正式取水之日起(以书面确认函为准)至章丘市生活垃圾焚烧发电 BOT 项目《特许经营权协议》履行完成之日止。

二、 供水量以水表计量为准，每月 25 日由甲乙双方共同抄表，作为结算依据。水价根据乙方与章丘环卫管护中心签订的章丘市生活垃圾焚烧发电 BOT 项目《特许经营权协议》的要求初步商定为 3 元/吨。

三、 付款方式为月结，如乙方延付甲方水费，乙方按照延付水费金额每日 0.3%比例向甲方支付违约金，但乙方承担违约金总额不超过上一年度水费总额的 10%。同时，甲方有权停止供水。

四、 甲乙双方如产生争议，争取双方友好协商解决。

五、 其他

1、 本协议经甲乙双方签字后生效；

2、 未尽事宜，甲乙双方另行协商；

3、 本协议一式二份，双方各执一份。

甲方（盖章）：

法人或授权代表：

日期：

乙方（盖章）：

法人或授权代表：

日期：

Attachment 11: The certificate for MSW of Zhangqiu MSW incineration project (March 1th, 2013, Zhangqiu Urban Environmental Sanitation Center)

关于章丘市生活垃圾焚烧发电厂

BOT 项目垃圾保障证明

根据章丘市环境卫生管护中心与章丘绿色动力再生能源有限公司签订的关于章丘市生活垃圾焚烧发电厂 BOT 项目的《特许经营权协议》中关于垃圾供应的相关条款要求，特证明如下：

1、甲方自项目开始运营日起至本协议有效期内，每一正常运营年度向乙方提供的垃圾数量为 16.65 至 23.3 万吨。其中正常运营期间月平均每日向乙方提供垃圾 500 至 700 吨。

2、甲方某年度的垃圾供应量多于 23.3 万吨+2%时且持续稳定达三个月以上（即平均每天的垃圾量连续三个月在 700 吨以上），由乙方提请建设二期工程，甲方审定确定后实施。

3、甲方对其供应的垃圾热值等质量不作承诺，但保证垃圾的正常收集后不人为剔出可燃部分，且尽一切合理努力，只运送可处理垃圾，不运送不可处理垃圾。根据章丘市环卫管护中心在章丘市生活垃圾焚烧发电厂 BOT 项目招标前委托相关单位针对章丘市生活垃圾进行检测鉴定，选取三个样品的湿基低位热值分表为 4237.1kJ/kg、3345.4 kJ/kg 、4630.5 kJ/kg，根据章丘市经济现状及未来发展趋势，人民生活水平不断提高带来的垃圾质量的提高、压缩中转站等垃圾收运系统工程的竣工投产以及生活垃圾在垃圾坑内经过 3 至 5 天的充分发酵沥水，生活垃圾热值因此而不断提升，能够保证提供给章丘市生活垃圾焚烧发电厂 BOT 项目的入炉垃圾平均湿基低位热值（LHV 值）在 5000 kJ/kg 以上。

（此页无正文）

章丘市环境卫生管护中心

2013 年 3 月 1 日

Attachment 12: The statement of Ground cover with mineral resources for Zhangqiu MSW incineration project (May 9th, 2011, Zhangqiu Municipal Bureau of Land and Resources)

山东省国土资源厅

鲁国土资字〔2013〕757号

关于山东省章丘市生活垃圾焚烧发电厂工程不压覆重要矿产资源的函

章丘市环境卫生管护中心：

你单位拟建的山东省章丘市生活垃圾焚烧发电厂工程，经山东省地矿工程集团有限公司现场核实，并向章丘市地质矿产局和济南市国土资源局查询，确定该建设项目保护范围内无重要矿产资源矿产地和采矿权设置。

附件：《山东省章丘市生活垃圾焚烧发电厂工程压覆矿产资源调查报告》审查意见书

山东省国土资源厅

2013年7月1日

附件：

《山东省章丘市生活垃圾焚烧发电厂工程压覆矿产资源调查报告》审查意见书

《山东省章丘市生活垃圾焚烧发电厂工程压覆矿产资源调查报告》（以下简称“报告”）是章丘市环境卫生管护中心委托山东省地矿工程集团有限公司于2012年9月编制完成。章丘市地质矿产局出具文件，对拟建工程压覆矿产资源情况进行了说明；济南市国土资源局对报告进行了初审。2012年10月27日，山东省国土资源厅聘请有关专家对报告进行了审查。报告编制单位按照专家组审查意见，对报告进行了修改、补充，于2013年5月15日提交修改稿。经审核基本符合要求，形成审查意见如下：

一、基本情况

1、拟建工程位于章丘市政府驻地东北约6.5km，明水街道办事处驻地东北约2.5km，侯家村南550m，官道店村西500m处，行政区划属于章丘市明水街道办事处。拟征地范围由24拐点坐标圈定，极值地理坐标：东经117° 34′ 02.838″ ~ 117° 34′ 23.334″，北纬36° 43′ 11.228″ ~ 36° 43′ 21.101″。拟征地总面积80814m²（约合121.221亩）。

调查区为拟征地范围边界外推 1000m 确定，调查区范围由 4 个拐点圈定，极值地理坐标：东经 117° 33′ 23″ ~117° 35′ 10″，北纬 36° 42′ 35″ ~36° 43′ 58″，面积 5.07km²。区内交通便利。

2、本区地处华北陆块（Ⅰ）、鲁西隆起（Ⅱ）、鲁中隆起区（Ⅲ）、泰山-沂山断隆（Ⅳ）、邹平-周村凹陷（Ⅴ）东南缘。调查区被第四纪和新近纪松散堆积物所覆盖，隐伏地层自下而上为石炭-二叠纪月门沟群太原组、山西组，二叠纪石盒子组。调查区内断裂主要有北东向的东石河、F1 和 F2 等 3 条断裂，F1、F2 两条断裂对粘土矿层有一定的破坏作用。调查区内有燕山晚期岩浆岩侵入，对煤层有一定的破坏作用，受其影响局部形成天然焦。

区域及调查区内查明的矿产主要为煤和耐火粘土矿。区域范围内的煤炭资源已开采枯竭，原有的煤矿矿山均已闭坑；耐火粘土矿由于开采多年，资源已近枯竭，仅在调查区东部剩余部分耐火粘土矿资源，区域内分布有官道店粘土矿、官道店第二粘土矿、池子头第四粘土矿、池子头村粘土矿、池子头第四粘土矿。调查区内分布有官道店粘土矿、官道店第二粘土矿、池子头第四粘土矿。

3、本次工作以搜集已有地质资料、政府查询和实地调查为主。经调查表明，调查区涉及章丘市明水镇官道店粘土矿、

章丘市明水镇官道店第二粘土矿和章丘市普集镇池子头第四粘土矿等 3 采矿权，官道店粘土矿、官道店第二粘土矿全部位于调查区范围内，拟建工程征地范围与采矿权不重叠，到采矿权边界的距离分别为 296m、467m；调查区与普集镇池子头第四粘土矿重叠面积为 0.1489km^2，拟建工程征地范围与采矿权不重叠，拟建工程征地范围边界到采矿权边界的最近距离约为 630m。调查区范围内无探矿权设置，除耐火粘土矿外无其他查明的矿产资源。在系统分析研究所搜集的调查区内地质、矿产资料的基础上，根据《山东省电力设施和电能保护条例》规定的电力设施保护范围，估算了拟建工程压覆的耐火粘土矿资源储量。

4、报告包括正文 1 本，附图 3 张，附表 3 个，附件 15 件。

二、主要成绩及优点

1、通过资料搜集、政府查询、实地调查及综合研究等工作，基本查清了调查区内矿业权设置及矿产资源情况。报告目的任务明确，调查方法正确。

2、报告中较详细地阐述了区域及调查区内地层、构造、岩浆岩等特征及矿产资源概况。调查区划分合理，论述清楚。

3、充分利用所搜集到的各类地质、矿产资料，对工程压覆耐火粘土矿资源储量进行了估算。经估算，最大压覆范围

由 5 个拐点圈定，拟建工程最大压覆面积 1.6Km²。官道店粘土矿、官道店第二粘土矿全部位于压覆范围内，其中：压覆官道店粘土矿范围由 4 个拐点圈定，压覆面积 0.0462Km²；压覆官道店第二粘土矿范围由 6 个拐点圈定，压覆面积 0.0134Km²。压覆范围拐点坐标分别见表 1、2、3。

表 1　拟建工程压覆范围拐点坐标一览表（1980 西安坐标系）

拐点编号	平面直角坐标		地理坐标	
	X	Y	东经	北纬
Y1	4066415.582	39550423.405	117° 33′ 52.09″	36° 43′ 38.83″
Y2	4066215.125	39551773.141	117° 34′ 46.43″	36° 43′ 32.07″
Y3	4065009.778	39551579.685	117° 34′ 38.35″	36° 42′ 53.01″
Y4	4065092.214	39550953.490	117° 34′ 13.14″	36° 42′ 55.80″
Y5	4065279.662	39550256.194	117° 33′ 45.08″	36° 43′ 02.02″

表 2　压覆官道店粘土矿范围拐点坐标表(1980 西安坐标系)

拐点	平面直角坐标		地理坐标	
	X	Y	东经	北纬
1	4065716.53	39551442.70	117° 34′ 33.00″	36° 43′
2	4065931.53	39551442.70	117° 34′ 33.05″	36° 43′
3	4065931.53	39551657.70	117° 34′ 41.71″	36° 43′
4	4065716.53	39551657.70	117° 34′ 41.66″	36° 43′

表 3　压覆官道店第二粘土矿范围拐点坐标表(1980 西安坐标系)

拐点	平面直角坐标		地理坐标	
	X	Y	东经	北纬
1	4065474.53	39551540.70	117° 34′ 39.08 "	36° 43′07.28 "
2	4065478.77	39551573.35	117° 34′ 40.39 "	36° 43′07.41 "

3	4065449.53	39551646.70	117° 34′ 43.34"	36° 43′06.45"
4	4065362.53	39551614.70	117° 34′ 42.03"	36° 43′03.63"
5	4065362.53	39551556.70	117° 34′ 39.69"	36° 43′03.32"
6	4065399.53	39551482.70	117° 34′ 36.72"	36° 43′04.86"

经估算，共压覆耐火土矿资源储量 42.8 万吨（正常块段 30.1 万吨，矿井保安矿柱 12.7 万 t），其中：

（111）14.0 万吨；

（122）7.5 万吨；

（111b）矿石量 20.2 万 t（正常块段）；

（122b）矿石量 9.9 万 t（正常块段）；

（331）矿石量 12.7 万 t（全部为矿井保安矿柱）。

其中：矿井保安矿柱既有压覆量：12.7 万 t；拟建工程新增压覆 30.1 万 t。

压覆总量中：

压覆官道店粘土矿资源储量 28.6 万 t，其中：

（111）7.3 万吨；

（122）7.5 万吨；

（111b）矿石量 9.7 万 t（正常块段）；

（122b）矿石量 9.9 万 t（正常块段）；

（331）矿石量 9.0 万 t（全部为保安矿柱）。

其中：矿井保安矿柱既有压覆 9.0 万 t；拟建工程新增压覆 19.6 万 t。

2.压覆官道店第二粘土矿资源储量 14.2 万 t，其中：

（111）6.7万吨;;

（111b）矿石量10.5万t（正常块段）;

（331）矿石量3.7万t（全部为矿井保安矿柱）;

其中：矿井保安矿柱既有压覆：3.7万t；拟建工程新增压覆10.5万t。

4、拟建工程压覆范围的确定和资源储量的估算方法选择基本合理，估算结果基本可靠。报告章节安排合理，文字较简练，附图、附表、附件较齐全，总体符合有关要求。

三、结论及建议

1、经调查表明，调查区涉及官道店粘土矿、官道店第二粘土矿和普集镇池子头第四粘土矿等3多采矿权。调查区范围内无其他矿业权设置，除耐火粘土矿资源外无其他查明的矿产资源，无查明的矿产地。

2、拟建工程压覆官道店粘土矿、官道店第二粘土矿两个采矿权，共压覆耐火土矿资源储量42.8万吨，其中矿井保安矿柱既有压覆9.0万t；拟建工程新增压覆19.6万t。压覆总量中，压覆官道店粘土矿资源储量28.6万t（矿井保安矿柱既有压覆9.0万t；拟建工程新增压覆19.6万t）；压覆官道店第二粘土矿资源储量14.2万t（矿井保安矿柱既有压覆：3.7万t；拟建工程新增压覆10.5万t）。建设单位均已与采矿权人签订协议，采矿权人同意压覆其耐火粘土矿资源，并

源，并承诺工程生产前办理完毕相关压覆矿产资源登记手续。拟建工程征地范围边界到采矿权边界的距离为 556m，不压覆普集镇池子头第四粘土矿采矿权。

3、同意报告通过审查并报省国土资源厅审批。

附：审查专家组名单

审查专家组

2013 年 5 月 16 日

《山东省章丘市生活垃圾焚烧发电厂
工程压覆矿产资源调查报告》
审查专家名单2012年10月27日

姓名	单 位	职称	签名	备注
王传才	山东省矿业协会	矿产资源储量评估师	王传才	主审
徐秉衡	山东省国土资源厅	教授级高工	徐秉衡	
赵凤江	山东省第一地质矿产勘查院	教授级高工	赵凤江	

抄送：济南市国土资源局

山东省国土资源厅办公室　　2013年7月1日印

Attachment 13: The reuse water supply agreement of Zhangqiu MSW incineration project (March 2013, Zhangqiu Wastewater Treatment Plant)

章丘市生活垃圾焚烧发电厂 BOT 项目

杏林水库水源供水协议

甲方：章丘市水务局

乙方：章丘绿色动力再生能源有限公司

鉴于章丘市经济发展的需要，垃圾环保处理的要求不断提高，为此，章丘绿色动力再生能源有限公司拟开展建设章丘市生活垃圾焚烧发电厂 BOT 项目。该项目拟选址在章丘市明水街道侯家村。项目部分生产用水及再生水的备用水源拟采用杏林水库地表水。

经甲乙双方协商，现就杏林水库取用水情况达成如下合作协议：

一、甲乙双方的权利和义务

1、根据国家规定，甲方同意将章丘市杏林水库的地表水提供给乙方作为部分生产用水及再生水的备用水源，年供水量能够满足章丘市生活垃圾焚烧发电厂 BOT 项目生产需要，甲方在乙方生产经营期限内，其他生产单位向甲方申请使用杏林水库的地表水时，甲方能够优先满足章丘市生活垃圾焚烧发电厂 BOT 项目生产需要。

2、乙方取水前必须按照规定办理用水许可证，安装合格的计量设施后方可取水。

3、乙方的退水水质和退水方式必须达到要求。

4、乙方必须按照规定及时缴纳水资源费，水资源费价格根据乙方与章丘环卫管护中心签订的章丘市生活垃圾焚烧发电 BOT 项目《特许经营权协议》的要求初步商定为 1.6 元/吨。

5、乙方必须按照有关法律法规的规定进行取用水，并接受甲方的监督检查，否则将按有关法律规定执行。

6、供用水设施（包括：供水管线、水泵、泵房、电力等设施）由章丘市水务局负责建设。供用水设施之建设应满足乙方需要，甲方负责承担相应供用水设施的维护。

二、其他

1、本协议经甲乙双方签字后生效；

2、未尽事宜，甲乙双方另行协商；

3、本协议一式二份，双方各执一份。

甲方（盖章）：

法人或授权代表：

日期：

乙方（盖章）：

法人或授权代表：

日期：

供 水 协 议

需方：章丘绿色动力再生能源有限公司

供方：章丘市污水处理厂

为保障章丘市垃圾焚烧发电 BOT 项目工程供水，经双方友好协商，本着精诚合作、平等互利的原则，达成以下共识：

一、 供水数量

供方自需方项目竣工之日起，每天向章丘绿色动力再生能源有限公司工程供水。供方每日供水不低于 2036 立方米，最大供水 2777 立方米，每年供水不少于 81.4 万立方米。

二、 供水质量

供水水质达到《污水综合排放标准》（GB18918-2002）规定的一级 A 标准，达到环保部门排放要求的合格水。

三、 合作期限

本协议自章丘绿色动力再生能源有限公司项目竣工之日开始长期合作。

四、 其他

1、本协议一式 2 份，供需双方各持 1 份；

2、供水管道和供水价格及本协议中未尽事宜，由双方协商解决，并另行签订补充协议。

3、本协议自盖章之日起生效。

需方：章丘绿色动力再生能源有限公司　　供方：章丘市污水处理厂

授权代表签字（盖章）　　授权代表签字（盖章）

签订时间：　年　月　日

Attachment 14: The supply agreement for activated carbon (March 2013, Yantai activated carbon company)

活性炭供货协议

合同编号：ZHQ-LS-CL-0203001
合同签署：章丘

供方：烟台通用活性炭有限公司
地址：山东省龙口市新嘉镇
法定代表人：马金策
电话：0535-8557676
传真：0535-8559958

需方：章丘绿色动力再生能源有限公司
地址：
法定代表人：侯志勇
电话：0531-83119995
传真：0531-83119995

一、合同标的名称：

活性炭

二、质量要求：

1 质量标准

序号	项　目	指　标	备　注
1	比表面积	>700m2/g	
2	碘吸附值	>700mg/g	
3	细度	220 目	过筛率大于 85%
4	亚蓝吸附值	>120mg/g	
5	水分	<10%	
6	总孔容积	0.85cm3/g	

2、供方所销售的合同标的之制造商为烟台通用活性炭有限公司，供方确认所销售给需方之合同标的，其质量符合上述规定。

3、供方保证所销售给需方的合同标的，在正常贮存(常温、常压)的前提条件下其品质保持稳定不变。

三、供方应保证需方免受任何因供方责任所造成的第三方索赔。

四、交货数量、地点、时间、方式及保险：

1、本合同下供方所需供应的的合同标的的数量以需方的书面通知为准

2、交货地点：需方指定供方交货的地点为需方位于章丘绿色动力再生能源有限公司垃圾焚烧发电厂的现场（以下称“现场”），供方应同时提供合同标的的产品质量检验单，供方负责卸车。

3、交货时间：由需方根据实际需要提前二（2）天向供方发出通知，供方在需方所指定的时间内，将指定数量的符合质量要求的合同标的送至现场交货。

4、本合同确认，由供方提供符合中国国家相应安全规范的运输工具，将需方所购之合同标的安全送达现场并卸入指定的储间，同时供方应随合同标的向需方提供合同标的清单。

5、保险及费用的负担：供方负责办理本合同下合同标的的运输保险并承担费用；供方还应为其派驻现场的人员购买人身安全保险并承担相关费用。

五、验收：

1、重量的验收：供方将合同标的送达现场后，按需方指定的衡器进行称重，供需双方派员监磅，称重码单应记载毛重、皮重、净重并且由双方监磅人员共同签字认可，该码单记载之净重即需方收到合同标的的实际数量（以下称“实际收到量”），为双方用于合同价格结算的数量。

2、质量的验收：

2.1. 供方应按批次向需方提供合同标的的品质检验报告。

2.2. 需方将对供方送达的合同标的及时进行取样检验，并将质量检验结果及时通知供方。该质量检验结果为合同价格结算的依据之一。

3、异议

3.1 如果供方对需方的质量检验结果持有异议并认为需要重新检验时，经双方协商同意后共同派员重新取样封存并送需方所在地技术监督部门的质检机构进行质量检验。双方同意最终以该质检机构的检验结果为合同价格结算依据，无论该检验结果是否与需方的检验结果相一致，送检费用均由供方承担。

3.2 供方对质量检验结果提出异议的期限为：需方质量检验结果告知供方的两（2）个工作日内。否则，逾期未提出的，视作无异议。

六、合同价格的结算及支付：

1、合同价格的结算：

1.1.供方所销售给需方之合同标的全部符合本合同规定的质量要求时，其合同价格为人民币 3525 元/吨（以下称“基准价”）。该基准价固定不变，不因任何原因而调整。

1.2 如果合同标的不符合本合同中规定之质量要求时，则属于供方违约，需方有权拒绝收货并无需支付合同价格，供方应按本合同的规定向需方承担违约责任。

1.3 本合同下合同价格 =基准价×实际收到量（净重）。该合同价格包括需方因供方履行本合同约定而应支付给供方的一切款项（包括运费、保险费、税费等）。

2、结算期限及支付：

2.1. 供方按需方的要求按月履行本合同规定之每月交货数量后，即可进行结算工作。

2.2. 供方必须向需方提供符合规范要求的销售增值税发票。

2.3. 在合同价格经结算确定且需方完成必要的内部手续并收到供方提供规范的销售增值税发票后的一（1）个月内，向供方支付合同价格。

七、其它约定事项：

1、供方必须具备经营、运输特殊化工产品的资格、资质，并向需方提供与之相关的一切资料。

2、鉴于合同标的的特殊性，供方承诺：在本合同履行过程中，所提供之合同标的运至现场并完全卸至需方储间、运输设备和需方储间分离及离开需方工厂过程中的一切安全责任均由供方承担，供方应与需方签订安全协议且作为本合同附件。

八、违约责任及合同的解除：

1、如一方违约，应向另一方支付合同价格 20%的违约金。如果供方提供的合同标的不符合本合同质量要求或少于本合同约定，需方有权要求更换或补足，由此而产生的费用由供方承担，同时，供方应按前述规定向需方支付违约金。 如果供方不能提供符合质量要求的合同标的，需方有权立即解除本合同，供方已收取的合同价格应立即退还需方，供方还应按前述规定向需方支付违约金。

2、在供方未出现违约情形的情况下，需方有权以提前三天发出书面通知的形式解除本合同，本合同自需方发出书面通知之日起三日后的次日视为到达供方，本

合同自动终止，需方无需对此承担任何责任。

九、争议的解决：

供、需双方因本合同而发生的争议，应友好协商解决，协商解决不成的，则任何一方有权向需方所在地人民法院提起诉讼。

需方（签章）：章丘绿色动力再生能源有限公司

法定代表人或授权代表：

日期：

供方（签章）：烟台通用活性炭有限公司

法定代表人或授权代表：

日期：

Attachment 15: The proof of sewage receive (March 2013, Zhangqiu Wastewater Treatment Plant)

污水接纳证明

我章丘市污水处理厂同意接纳章丘市生活垃圾焚烧发电厂 BOT 项目所产生的生活污水和生产污水。章丘绿色动力再生能源有限公司负责将场内污水（包括生产、生活废水）经过处理达标后，经市政管网排入章丘市污水处理厂处理，处理标准依据《生活垃圾填埋场污染物控制标准》(GB16889-2008)表 2 标准（指标应满足 COD≤100mg/L、BOD≤30mg/L、SS≤30mg/L、氨氮≤25 mg/L、色度≤40 倍（稀释倍数）技术要求）。

章丘绿色动力再生能源有限公司按要求规范废水排放口，经环保主管部门批复同意后按相关标准排放，安装废水在线监测设施，并与章丘市环保主管部门联网。

对于达标排放且能够通过市政管网排入污水处理厂的生产和生活污水，章丘市污水处理厂同意接纳处理。

特此证明。

章丘市污水处理厂

二零一三年三月一日

Attachment 16: The agreement for comprehensive utilization of slag (April 10th, 2012, Zhangqiu Liyuanxinxing building materials factory)

章丘绿色动力再生能源有限公司

炉渣处理承包合同

合同编号：

发 包 方： 章丘绿色动力再生能源有限公司

承 包 方： 章丘市栗园鑫兴建材厂

签订日期： 2013 年 3 月 20 日

签订地点： 章丘市

合同双方：

发包方：章丘绿色动力再生能源有限公司（以下简称甲方）

承包方：章丘市栗园鑫兴建材厂（以下简称乙方）

签订时间：2013年3月20日

签订地点：章丘市

鉴于：甲方将其焚烧炉焚烧后所产生的炉渣委托乙方进行综合利用处理，乙方保证已全面理解和掌握了甲方的要求，同意按照本合同的条款和条件签订该合同。为此，双方经充分友好协商，达成以下协议：

第一章 定义

本文件和附件中所用下列名词的含义在此予以定义。

1. “甲方”是指章丘绿色动力再生能源有限公司，包括该法人的继受主体。
2. “乙方”是指章丘市栗园鑫兴建材厂，包括该法人的继受主体。
3. “合同”是指本文件及其附件中的所有部分。
4. “转包”是指承包单位承包本项目后，未经甲方书面同意，将其承包内容的全部或部分工作转给他人或者将其承包的全部工作肢解以后以分包的名义分别转给其他单位承包的行为。
5. “分包”是指未经甲方同意认可，乙方将其承包的本合同承包内容任何部分交由其他单位完成的行为。

第二章 承包内容

1. 承包内容：甲方将焚烧炉焚烧后所产生的炉渣委托乙方进行综合利用处理，炉渣综合利用项目乙方全权负责，自主经营。

第三章 甲、乙双方的权利与义务

1、甲方的权利与义务

1) 甲方将所产生的所有合格的炉渣委托乙方进行处理，未经乙方同意，甲方不得擅自将炉渣委托其他第三方处理。

2) 负责炉渣上车抓取工作。

3) 由甲方原因终止该合同，甲方应无条件接受乙方的固定资产，承担相应损失。

2、乙方的权利与义务

1) 乙方应在合同签定生效后 90 天内将炉渣综合利用厂建设好并投入使用，保证甲方不外运炉渣，对炉渣综合利用后所产生的剩余物质进行安全处置。

2) 乙方自行派车到甲方渣坑拖取炉渣，保证渣坑炉渣量处于正常位置（渣坑最高储存量应在抽渣机下 500mm），不得影响甲方的生产，如乙方不能保证炉渣按时处理由此给甲方造成的损失由乙方负责。

3) 乙方对利用炉渣进行综合利用所带来的后续工作全面负责，尤其是其产品在环保方面达标的问题、该综合利用厂与周边居民协调问题等。

4) 该综合利用厂由乙方自主经营、自主管理，甲方不得干涉，但不影响甲方的正常生产。

5) 该综合利用厂的用工由乙方负责招聘和管理，与甲方无关，若发生劳动争议由乙方负责。

第四章　不可抗力

1. 不可抗力是指：严重的自然灾害和灾难（如台风、洪水、地震）、战争（不论是否宣战）、暴乱等等。合同双方中的任何一方，由于不可抗力事件而影响合同义务的执行时，则延迟履行合同义务的时间相当于不可抗力事件影响的时间，但是不能因为不可抗力的延迟而调整合同价格。

2. 受到不可抗力影响的一方应在不可抗力事件发生后，尽快将所发生的不可抗力事件的情况通知另一方，受影响的一方同时应尽最设法缩小这种影响和由此而引起的延误，一旦不可抗力的影响消除后，应将此情况立即通知对方。

第五章　合同价款的支付与结算

1. 乙方在签订合同后十日内向甲方支付首次炉渣处理费，以后每年 5 月 10 日前向甲方支付处理费，费用计算如下：

   乙方每年支付甲方的费用等于每年的垃圾量×30%×30 元/吨。

2. 除前款规定的乙方应支付的炉渣处理费外，乙方无须向甲方支付其他费用。

第六章　安全施工与保险

1. 乙方应按有关规定，采取严格的安全防护措施，承担由于自身安全措施不力造成事故的责任和因此发生的费用。因其它原因造成的伤亡事故，由责任方承担责任和有关费用。发生重大伤亡事故，乙方应按有关规定立即上报有关部门并通知甲方代表。同时按政府有关部门要求处理。甲方为抢救提供便利条件。发生的费用由事故责任方承担。

2. 不可抗力发生后，乙方应迅速采取措施，尽力减少损失，并在发生后 24 小时内向甲方代表通报受害情况，甲方应对灾害处理提供便利条件。

3. 乙方管理中发生的一切安全事故，均由乙方承担全部责任。并且应立即报告甲方和国家相关主管部门。乙方应为其参与执行本合同的现场工作人员办理人身意外伤害保险，并承担相应费用，由于乙方未办理保险而导致的相应损失概由乙方承担。乙方承诺：乙方在管理过程中对第三人造成的损害或者造成自身损害的，产生的相应责任与后果由乙方负责，即或是，受损第三方通过法律途径向甲方主张赔偿获赔后，甲方可要求乙方给予等额款项的补偿。

第七章　违约责任

1. 乙方应保证甲方的出渣系统正常运行，如由于其自身原因导致出渣系统影响甲方的生产所造成的损失由乙方全部负责。

2. 乙方未在合同签订生效后 90 天内将炉渣综合利用厂投入生产，则每迟延一天，支付违约金人民币 贰仟元，若迟延 30 天，甲方有权解除本合同，乙方应支付违约金人民币 陆万元 。

第八章　　纠纷解决办法

1. 本合同在履行过程中发生争议，由当事人双方应协商解决，如协商不成，由鉴证方协调解决，如仍达不成一致意见，可当地人民法院提起诉讼。在进行诉讼期间，除提交诉讼的事项外，合同仍应继续履行。

第九章　　合同的生效与终止及其他事项

1. 合同经双方法定代表人或委托代理人签字、加盖公章或合同专用章后生效。
2. 本合同签订后，双方如需要提出修改时，经协商一致后，可以签订补充协议，作为本合同补充合同。
3. 本合同一式 6 份，甲方执 2 份，乙方执 2 份，鉴证方执 2 份。
4. 该合同有效期为 2012 年 4 月 10 日至 2017 年 4 月 10 日。

甲方（签章）：

甲方代表：

乙方（签章）：

乙方代表：

签证方（签章）：

签证方代表：

Attachment 17: The agreement of accept flying ash (March 1th, 2013, Zhangqiu Urban Environmental Sanitation Center)

关于接纳章丘市生活垃圾焚烧发电厂

BOT 项目飞灰的证明

根据章丘市环境卫生管护中心与章丘绿色动力再生能源有限公司签订的关于章丘市生活垃圾焚烧发电厂 BOT 项目的《特许经营权协议》的规定，我填埋场同意在该项目特许经营期内，接纳章丘绿色动力再生能源有限公司因该项目产生的飞灰，飞灰必须经过章丘绿色动力再生能源有限公司稳定化处理并达到《生活垃圾填埋场污染物控制标准》（GB16689-2008）中进出毒性标准检测合格后的飞灰。

特此证明！

章丘市环境卫生管护中心

二零一三年三月一日

Attachment 18: The agreement for the disposal of hazardous waste (April 11th,2013, Qingdao Xintiandi Comprehensive Treatment of Solid Waste Company)

合同编号□□□□□□□□□□□□□□

危险废物委托处置合同

甲　　方：章丘绿色动力再生能源有限公司

乙　　方：青岛新天地固体废物综合处置有限公司

签 约 地 点：山东省青岛市崂山区

签 约 时 间：二o一三年四月十二日

危险废物委托处置合同

甲方：章丘绿色动力再生能源有限公司

法定代表人：

地址：济南章丘市双山大街

联 系 电 话：053180953650　　传真：053180953650

乙方：青岛新天地固体废物综合处置有限公司

法定代表人：韩清洁

联 系 电 话：0532-82868608　　传真：0532-82863908

为加强危险废物、固体废物污染防治，进一步改善环境质量，保障环境安全、人民健康。根据《中华人民共和国环境保护法》、《中华人民共和国固体废物污染环境防治法》、《山东省实施<中华人民共和国固体废物污染环境防治法>办法》中的法律规定：产生危险废物的单位，必须按照国家有关规定对废物进行安全处置，禁止擅自倾倒、堆放或擅自将危险废物提供或委托给无危险废物经营许可证的单位从事收集 、贮存、处置的经营活动。省内各地市也相继出台了《危险废物转移联单管理办法》及《危险废物经营许可证管理办法》等环保法规。

乙方经国家环境保护部(原国家环保总局)批准，成为中国首个静脉产业类国家生态工业园区。拥有山东省危险废物特许经营许可证、青岛市医疗废物特许经营许可证、中华人民共和国道路运输(危险废物)经营许可证、环境污染治理设施工业废水甲级资质、环境污染防治工程(废水、废气)设计乙级、ISO14001:2004环境管理体系认证。并提供除爆炸性、放射性和多氯联苯外的所有危险废物、医疗废物、一般工业废物处理、处置等环境服务。

经甲乙双方友好协商，就甲方委托乙方集中收集、贮存、运输、安全无害化处置等事宜达成一致，签订以下协议条款:

一、 合作分工

危险废物，固体废物集中处置工作是一项关联性极强的系统工程，需要废物产生单位，收集、运输及最终处置单位密切配合，协调一致才能保证彻底杜绝污染隐患。为此双方须明确各自应当承担的责任与义务，具体分工如下:

（一）甲方：作为危险废物产生源头，负责安全合理地收集本单位产生的危险废物。为乙方运输车辆提供方便，并负责危险废物的安全装车、过磅工作。

（二）乙方：作为危险废物的无害化处置单位，负责危险废物运输、贮存及安全无害化处置。

二、责任义务

（一）甲方责任

1 甲方负责分类、收集并暂时贮存本单位产生的危险废物，收集和

暂时贮存，装车过程中发生的污染事故及人身伤害由甲方负责。

2 甲方负责无泄露包装（要求符合国家环保部标准）并作好标识（标签由乙方提供），如因标识不清、包装破损所造成的后果及环境污染由甲方负责。

3 甲方向乙方提供本单位产生的危险废物的数量、种类、成分及含量等有效资料，如因危险废物成分不实、含量不符导致乙方在运输、存储、处置过程中造成事故以及环境污染的法律赔偿后果由甲方负责。

4 甲方按照《青岛市危险废物转移联单管理办法》文件及相关法规办理有关废物转移手续。

5 甲方根据生产需要指定具体运输处理时间，并提前48小时以上电告乙方，运输工作结束，甲方收到乙方出具的有效票据后，十日内以支票或银行转账形式付清乙方所有费用。乙方账户如下：

单位名称：青岛新天地固体废物综合处置有限公司

帐　　号：372005501018120088164

银行代码：301452000205

税　　号：370285763615070

开户银行：交通银行青岛分行营业部

（二）乙方责任

1 乙方凭甲方办理的危险废物转移联单及时进行固体废物的转移。

2 乙方进入甲方厂区应严格遵守甲方的有关规章制度。

3 乙方负责危险废物的运输工作，如因乙方原因造成的泄漏、污染

事故责任由乙方承担。

4 乙方负责危险废物进入处置中心后的卸车及清理工作。

5 乙方严格按照国家有关环保标准对甲方产生的危险废物进行无害化处置，如因处置不当所造成的污染责任事故由乙方负责。

三、危废名称、数量及处置价格

危废名称	代码	形态	预处置量/年	处置价格	运输价格	包装规格	合同总额
焚烧处置废油	HW18 802-002-18	固	1万吨	4700元/吨	1.5元/吨公里	袋装	

合同签定后，乙方预收处置费＿／＿元整，用于冲抵本合同期内处置费用，合同期满余款逾期不予退还。

1 收费依据：青价字[2004]18号文件。

2 处置物重量、合同标底总额按照实际过磅据实计算，由双方签字生效。

3 甲方距乙方处置中心（莱西姜山）距离 340 公里。

四、本合同有效期

本合同有效期 叁 年，自 2013 年 04 月 12 日至 2016 年 04 月 11 日。

五、违约责任

本合同有效期内，甲方不得将其产生的危险废物交付给第三方处置；如违反此条款，甲方承担违约责任，并向乙方按照合同标的额的20%缴纳违约金。

双方应严格遵守本协议，若一方违约，要赔偿对方经济损失，双方若有争议，按照《中华人民共和国合同法》有关规定协商解决，协

商无法解决，则由协议签定地人民法院诉讼解决。

五、 本协议自双方签字盖章之日起生效，一式叁份，具有同等法律效力。甲乙双方各执一份，青岛市环保局备案一份。

六、未尽事宜：_____

_____

_____

甲方：章丘绿色动力再生能源有限公司

授权代理人：

2013 年 4 月 12 日

乙方：青岛新天地固体废物综合处置有限公司

授权代理人：

2012 年 4 月 12 日

Attachment 19: The consulting contract of Dioxin Testing (May 4th, 2013, Research Center for Environmental Analysis and Measurement of Zhejiang University)

[illegible]合同

For

[illegible]有限公司

By

通标[illegible]青岛分公司

[illegible]服务部

编制	Prepared:	赵敏
审核	Reviewed:	Tina Zhang
日期	Updated:	2013.07.11

1. 合约双方：

委托方（甲方）：章丘绿色动力再生能源有限公司

联系人：	张绍军
电话：	0531-80953650
传真：	0531-80953650
手机：	13793176500
电子邮件：	zhangshaojun30@163.com
通讯地址：	山东省章丘市明水街道荷花路1号

受托方（乙方）：通标标准技术服务有限公司青岛分公司

联系人：	赵敏
电话：	0531-86992276
传真：	0531-86992206
手机：	13864187781
电子邮件：	mindy.zhao@sgs.com
通讯地址：	济南市解放路112号历东商务大厦305室

2. 合约内容：

甲方委托乙方进行 环境二噁英，土壤二噁英专项技术服务，并支付相应的报酬。双方经过平等协商，在真实、充分地表达各自意愿的基础上，根据《中华人民共和国合同法》的规定，达成如下协议，并由双方共同恪守。

第一、甲方按照合同约定为乙方提供样品、材料或工作条件。乙方如发现甲方提供样品、材料或者工作条件不符合合同约定，应当收到样品和采样说明后 2 个工作日内通知甲方补充、修改或者更换。

第二、乙方在合同约定的保证期限内，发现服务质量有缺陷的，应当负责返工或者采取补救措施。如果因为甲方提供工作条件不符合合同约定，而且乙方在收到采样方案后 2 个工作日内已通知甲方补充、修改或者更换，否则引起的服务质量缺陷问题乙方不需承担责任。

第三、甲方发现乙方的工作成果不符合约定时，应当及时通知乙方，要求其改进或者返工。乙方保证所有监测数据必须是客观、真实的，不会根据甲方的主观需要进行任何修改。

第四、乙方按期完成合同约定的服务项目，并保证工作质量。乙方应按照双方商定的质量控制要求和国家实验室质量认可要求，进行实验数据的质量控制和保证，并向甲方提供具有相应国家检测资质的，通过质量控制与保证的数据。

第五、乙方应对检测数据的真实性和可靠性负责，提供的报告应有审核人员签字。

第六、甲方未按照合同约定提供样品、材料，工作条件以致影响工作质量和进度，或者不接受乙方工作成果的，甲方须支付一定的经济赔偿。乙方未按照合同约定提供服务的，乙方须支付一定的经济赔偿。具体金额双方依具体情况议定处理。

第七、甲方应明确告知相关工作环境以及安全注意事项，并确保采样人员的安全采样条件；乙方已明确了解甲方所告知执行本项目相关之工作环境、危害因素等事项，并承诺将确实遵守安全卫生管理办法和法令之相关规定，且会采取相关措施以维护工作环境之安全卫生事项。

第八、本合同附件报价单为含税价格。在采样实施前 5 个工作日内向乙方支付 100%检测费（RMB60, 420）。

第九、乙方检测费收到后，方可实施采样工作。

第十、甲方应按双方商定的服务合同价格向乙方支付检测费。乙方收款帐户如下：

公司名称:	通标标准技术服务有限公司青岛分公司
银行帐号:	380302710920014084O
开户银行:	中国工商银行 青岛高科技工业园支行

第十一、 本合同书共 贰 份，双方各执 壹 份，具有同等法律效力。

第十二、 本合同遵循上述条款以及 SGS 通用条款和条件。经双方签字盖章后生效。

甲方：_____（盖章）

法定代表人 / 委托代理人：_____（签名）

_____ 月 _____ 日

乙方：通标标准技术服务有限公司青岛分公司（盖章）

法定代表人 / 委托代理人：_____（签名）

_____ 年 _____ 月 _____ 日

附件一：

QUOTATION

报价单

Client/[illegible]

Attention/收件人：[illegible]

Customer Phone/客户电话：0531-83119995

Customer Fax/客户传真：0531-83119995

Customer E-mail/客户邮箱：zhangshaojun30@163.com

[illegible]SGS[illegible]

Contact/联系人：[illegible]

Mobile/手机：13864187781

Tel/电话：0531-86558216

Fax/传真：0531-86892206

Item/编号	Description/服务项目	[illegible]	Qty/数量	单价（RMB）	金额（RMB）
1	土壤 检测	USEPA /ISO/EN	2	¥8,000.00	¥16,000.00
2	环境空气 检测	USEPA /ISO/EN	2	¥15,000.00	¥30,000.00
3	人工费、交通、差旅、报告费打包价	/	1	¥16,000.00	¥16,000.00
				合计	¥62,000.00
				优惠至	¥57,000.00
				6%税率	¥3,420.00
				Total Amount/总金额	¥60,420.00

1、[illegible]

2、[illegible]

Attachment 20 : Ambient Air Quality Standards (GB 3095-2012)[to replace GB 3095-1996 on January 1, 2016]

表 1：各项污染物的浓度限值

污染物名称	取值时间	浓度限值			浓度单位
		一级标准	二级标准	三级标准	
二氧化硫 SO_2	年平均	0.02	0.06	0.10	毫克/立方米（标准状态）
	日平均	0.05	0.15	0.25	
	1 小时平均	0.15	0.50	0.70	
总悬浮颗粒物 TSP	年平均	0.08	0.20	0.30	
	日平均	0.12	0.30	0.30	
可吸入颗粒物 PM_{10}	年平均	0.04	0.10	0.15	
	日平均	0.05	0.15	0.25	
氮氧化物 NOx	年平均	0.05	0.05	0.10	
	日平均	0.10	0.10	0.15	
	1 小时平均	0.15	0.15	0.30	
二氧化氮 NO_2	年平均	0.04	0.04	0.08	
	日平均	0.08	0.08	0.12	
	1 小时平均	0.12	0.12	0.24	
一氧化碳 CO	日平均	4.00	4.00	6.00	
	1 小时平均	10.00	10.00	20.00	
臭氧 O_3	1 小时平均	0.12	0.16	0.20	
铅 Pb	季平均		1.50		微克/立方米（标准状态）
	年平均		1.00		
苯并[a]芘（B[a]P）	日平均		0.01		
氟化物 F	日平均		7①		
	1 小时平均		20①		
	月平均	1.8②	3.0③		微克/（平方分米·日）
	植物生长季平均	1.2②	2.0③		

注：
①适用于城市地区；
②适用于牧业区和以牧业为主的半农半牧区，蚕桑区；
③适用于农业和林业区

Attachment 21：Hygienic standards for the Design of Industrial Enterprises(TJ 36-79)

车间空气中有害物质的最高容许浓度　表 4

编 号	物质名称	最高容许浓度（毫克 / 立方米）
	（一）有毒物质	
1	一氧化碳	30
2	一甲胺	5
3	乙醚	500
4	乙腈	3
5	二甲胺	10
6	二甲苯	100
7	二甲基甲酰胺（皮）	10
8	二甲基二氯硅烷	2
9	二氧化硫	15
10	二氧化硒	0.1

12	二硫化碳（皮）	10
13	二异氰酸甲苯酯	0.2
14	丁烯	100
15	丁二烯	100
16	丁醛	10
17	三乙基氯化锡（皮）	0.01
18	三氧化二砷及五氧化二砷	0.3
19	三氧化铬、铬酸盐、重铬酸盐（换算成Ｃｒ０３）	0.05
20	三氯氢硅	3
21	乙内酰胺	10
22	五氧化二磷	1
23	五氯酚及其钠盐	0.3

24	六六六	0.1
25	丙体六六六	0.05
26	丙酮	400
27	丙烯腈（皮）	2
28	丙烯醛	0.3
29	丙烯醇（皮）	2
30	甲苯	100
31	甲醛	3
32	光气	0.5
	有机磷化合物：	
33	内吸磷（E 509）（皮）	0.02
34	对硫磷（E 605）（皮）	0.05
35	甲拌磷（3911）（皮）	0.01
36	马拉硫磷（4049）（皮）	2
37	甲基内吸磷（甲基 E059）（皮）	0.2
38	甲基对硫磷（甲基 E605）（皮）	0.1
39	乐戈（乐果）（皮）	1
40	敌百虫（皮）	1
41	敌敌畏（皮）	0.3
42	吡啶	4
	汞及其化合物	

表 1 车间内工作地点的夏季空气温度规定

夏季通风室外计算温度(℃)	22 及以下	23	24	25	26	27	28	29～32	33 及以上
工作地点与室外温差(℃)	10	9	8	7	6	5	4	3	2

表 2 空气调节厂房内不同湿度下的温度要求

相对湿度(%)	50	60	70	80
温度(℃)	30	29	28	27

表 3 冬季工作地点的采暖温度

劳动强度(分级)	采暖温度(℃)
Ⅰ	18～21
Ⅱ	16～18
Ⅲ	14～16
Ⅳ	12～14

表 4 冬季辅助用室的温度

辅助用室名称	气温(℃)
厕所、盥洗室	12
食堂	18
办公室、休息室	18～20
技术资料室	20～22
存衣室	18
淋浴室	25～27
更衣室	25

表 5 工作地点噪声声级的卫生限值

日接触噪声时间(h)	卫生限值[dB(A)]
8	85
4	88
2	91
1	94
1/2	97

1/4	100
1/8	103
最高不得超过 115[dB(A)]	

表 6 非噪声工作地点噪声声级的卫生限值

地点名称	卫生限值 dB(A)	工效限值 dB(A)
噪声车间办公室	75	不得超过 55
非噪声车间办公室	60	
会议室	60	
计算机室、精密加工室	70	

表 7 工作地点脉冲噪声声级的卫生限值

工作日接触脉冲次数	峰值(dB)
100	140
1000	130
10000	120

表 8 局部振动强度卫生限值

日接振时间(h)	卫生限值(m/s^2)
2～4	6
～2	8
～1	12

表 9 全身振动强度卫生限值

工作日接触时间(h)	卫生限值	
	dB(A)	m/s^2
8	116	0.62
4	120.8	1.1
2.5	123	1.4
1.0	127.6	2.4
0.5	131.1	3.6

表 11 工作地点微波辐射强度卫生限值

波　型		平均功率密度（μw/cm²）	日总计量（μw/cm²）
连续波		50	400
脉冲波	固定辐射	25	200
	非固定辐射	500	4000

表 12 高频辐射强度卫生限值

波型	日接触时间(h)	功率密度	
		mw/cm²	v/m
连续波	8	0.05	14
	4	0.10	19
脉冲波	8	0.025	10
	4	0.05	14

表 13　辐射强度卫生限值

频率(MHz)	电场强度(v/m)	磁场强度(A/m)
0.1～3.0	50	5
3.0～30	25	不规定

Attachment 22: Environmental Quality Standard for Noise (GB 3096-2008)

表1 环境噪声限值

单位：dB（A）

时段 / 声环境功能区类别		昼间	夜间
0类		50	40
1类		55	45
2类		60	50
3类		65	55
4类	4a类	70	55
	4b类	70	60

Attachment 23: Environmental Quality Standards for Surface Water (GB 3838-2002)

《地表水环境质量标准基本项目标准限值》（GB3838-2002） 单位：mg/L

编号	项　目	分类标准值				
		Ⅰ类	Ⅱ类	Ⅲ类	Ⅳ类	Ⅴ类
1	PH 值（无量纲）	6～9				
2	溶解氧 ≥	饱和率 90%(或 7.5)	6	5	3	2
3	高锰酸盐指数 ≤	2	4	6	10	15
4	化学需氧量（COD）≤	15	15	20	30	40
5	五日生化需氧量（BOD5） ≤	3	3	4	6	10
6	氨氮(NH3-N) ≤	0.15	0.5	1.0	1.5	2.0
7	总磷(以 P 计) ≤	0.02 (湖、库 0.01)	0.1 (湖、库 0.025)	0.2 (湖、库 0.05)	0.3 (湖、库 0.1)	0.4 (湖、库 0.2)
8	铜 ≤	0.01	1.0	1.0	1.0	1.0
9	锌 ≤	0.05	1.0	1.0	2.0	2.0
10	氟化物（以 F-计）≤	1.0	1.0	1.0	1.5	1.5
11	砷 ≤	0.05	0.05	0.05	0.1	0.1
12	汞 ≤	0.00005	0.00005	0.0001	0.001	0.001
13	镉 ≤	0.001	0.005	0.005	0.005	0.01
14	铬(六价) ≤	0.01	0.05	0.05	0.05	0.1
15	铅 ≤	0.01	0.01	0.05	0.05	0.1
16	氰化物 ≤	0.005	0.05	0.2	0.2	0.2
17	挥发酚 ≤	0.002	0.002	0.005	0.01	0.1
18	石油类 ≤	0.05	0.05	0.05	0.5	1.0

注：除 PH 外，其余项目标准值单位均为 mg/L

水质评价标准说明：

Ⅰ类：主要适用于源头水、国家自然保护区。

Ⅱ类：主要适用于集中式生活饮用水地表水源地一级保护区、珍稀水生

生物栖息地、鱼虾类产卵场、仔稚幼鱼的索饵场等。

Ⅲ类：主要适用于集中式生活饮用水地表水源地二级保护区、鱼虾类越冬场、洄游通道、水产养殖区等渔业水域及游泳区。

Ⅳ类：主要适用于一般工业用水区及人体非直接接触的娱乐用水区。

Ⅴ类：主要适用于农业用水区及一般景观要求水域。

Attachment24: Quality Standard for Ground Water (GB/T 14848-93)

4 地下水质量分类及质量分类指标

4.1 地下水质量分类

依据我国地下水水质现状、人体健康基准值及地下水质量保护目标，并参照了生活饮用水、工业、农业用水水质最高要求，将地下水质量划分为五类。

Ⅰ类 主要反映地下水化学组分的天然低背景含量。适用于各种用途。

Ⅱ类 主要反映地下水化学组分的天然背景含量。适用于各种用途。

Ⅲ类 以人体健康基准值为依据。主要适用于集中式生活饮用水水源及工、农业用水。

Ⅳ类 以农业和工业用水要求为依据。除适用于农业和部分工业用水外，适当处理后可作生活饮用水。

Ⅴ类 不宜饮用，其他用水可根据使用目的选用。

表 1 地下水质量分类指标

The characteristic of underground water

项目序号	类别 标准值 项目	Ⅰ类	Ⅱ类	Ⅲ类	Ⅳ类	Ⅴ类
1	色(度)	≤5	≤5	≤15	≤25	>25

2	嗅和味	无	无	无	无	有
3	浑浊度(度)	≤3	≤3	≤3	≤10	>10
4	肉眼可见物	无	无	无	无	有
5	pH		6.5～8.5		5.5～6.5 8.5～9	<5.5，>9
6	总硬度(以CzCO3,计)(mg/L)	≤150	≤300	≤450	≤550	>550
7	溶解性总固体(mg/L)	≤300	≤500	≤1000	≤2000	>2000
8	硫酸盐(mg/L)	≤50	≤150	≤250	≤350	>350
9	氯化物(mg/L)	≤50	≤150	≤250	≤350	>350
10	铁(Fe)(mg/L)	≤0.1	≤0.2	≤0.3	≤1.5	>1.5
11	锰(Mn)(mg/L)	≤0.05	≤0.05	≤0.1	≤1.0	>1.0
12	铜(Cu)(mg/L)	≤0.01	≤0.05	≤1.0	≤1.5	>1.5
13	锌(Zn)(mg/L)	≤0.05	≤0.5	≤1.0	≤5.0	>5.0
1	钼(Mo)(mg/L)	≤0.001	≤0.01	≤0.1	≤0.5	>0.5

4						
15	钴(Co)(mg/L)	≤0.005	≤0.05	≤0.05	≤1.0	>1.0
16	挥发性酚类(以苯酚计)(mg/L)	≤0.001	≤0.001	≤0.002	≤0.01	>0.01
17	阴离子合成洗涤剂(mg/L)	不得检出	≤0.1	≤0.3	≤0.3	>0.3
18	高锰酸盐指数(mg/L)	≤1.0	≤2.0	≤3.0	≤10	>10
19	硝酸盐(以N计)(mg/L)	≤2.0	≤5.0	≤20	≤30	>30
20	亚硝酸盐(以N计)(mg/L)	≤0.001	≤0.01	≤0.02	≤0.1	>0.1
21	氨氮(NH4)(mg/L)	≤0.02	≤0.02	≤0.2	≤0.5	>0.5
22	氟化物(mg/L)	≤1.0	≤1.0	≤1.0	≤2.0	>2.0
23	碘化物(mg/L)	≤0.1	≤0.1	≤0.2	≤1.0	>1.0
24	氰化物(mg/L)	≤0.001	≤0.01	≤0.05	≤0.1	>0.1
25	汞(Hg)(mg/L)	≤0.00005	≤0.0005	≤0.001	≤0.001	>0.001

26	砷(As)(mg/L)	≤0.005	≤0.01	≤0.05	≤0.05	>0.05
27	硒(Se)(mg/L)	≤0.01	≤0.01	≤0.01	≤0.1	>0.1
28	镉(Cd)(mg/L)	≤0.0001	≤0.001	≤0.01	≤0.01	>0.01
29	铬(六价)(Cr6+)(mg/L)	≤0.005	≤0.01	≤0.05	≤0.1	>0.1
30	铅(Pb)(mg/L)	≤0.005	≤0.01	≤0.05	≤0.1	>0.1
31	铍(Be)(mg/L)	≤0.00002	≤0.0001	≤0.0002	≤0.001	>0.001
32	钡(Ba)(mg/L)	≤0.01	≤0.1	≤1.0	≤4.0	>4.0
33	镍(Ni)(mg/L)	≤0.005	≤0.05	≤0.05	≤0.1	>0.1
34	滴滴滴(μg/L)	不得检出	≤0.005	≤1.0	≤1.0	>1.0
35	六六六(μg/L)	≤0.005	≤0.05	≤5.0	≤5.0	>5.0
36	总大肠菌群(个/L)	≤3.0	≤3.0	≤3.0	≤100	>100

37	细菌总数(个/L)	≤100	≤100	≤100	≤1000	>1000
38	总 σ 放射性 (Bq/L)	≤0.1	≤0.1	≤0.1	>0.1	>0.1
39	总 β 放射性 (Bq/L)	≤0.1	≤1.0	≤1.0	>1.0	>1.0

根据地下水各指标含量特征，分为五类，它是地下水质量评价的基础。以地下水为水源的各类专门用水，在地下水质量分类管理基础上，可按有关专门用水标准进行管理。

Attachment 25: Emission Standard of Environmental Noise for Boundary of Construction Site (GB 12523-2011)

昼　　间	夜　　间
70	55

4.2 夜间噪声最大声级超过限值的幅度不得高于 15 dB（A）。

4.3 当场界距噪声敏感建筑物较近，其室外不满足测量条件时，可在噪声敏感建筑物室内测量，

Attachment 26: Emission Standard for Industrial Enterprises Noise at Boundary (GB12348-2008)

表 1　工业企业厂界环境噪声排放限值

单位：dB（A）

厂界外声环境功能区类别 \ 时段	昼　间	夜　间
0	50	40
1	55	45
2	60	50
3	65	55
4	70	55

4.1.2 夜间频发噪声的最大声级超过限值的幅度不得高于 10 dB（A）。

4.1.3 夜间偶发噪声的最大声级超过限值的幅度不得高于 15 dB（A）。

表 2　结构传播固定设备室内噪声排放限值（等效声级）

单位：dB（A）

噪声敏感建筑物所处声环境功能区类别 \ 房间类型 \ 时段	A类房间		B类房间	
	昼　间	夜　间	昼　间	夜　间
0	40	30	40	30
1	40	30	45	35
2、3、4	45	35	50	40

说明：A 类房间是指以睡眠为主要目的，需要保证夜间安静的房间，包括住宅卧室、医院病房、宾馆客房等。

B 类房间是指主要在昼间使用，需要保证思考与精神集中、正常讲话不被干扰的房间，包括学校教室、

会议室、办公室、住宅中卧室以外的其他房间等。

表 3　结构传播固定设备室内噪声排放限值（倍频带声压级）

单位：dB

噪声敏感建筑所处声环境功能区类别	时段	倍频程 / 中心频率，Hz / 房间类型	室内噪声倍频带声压级限值				
			31.5	63	125	250	500
0	昼间	A、B 类房间	76	59	48	39	34
	夜间	A、B 类房间	69	51	39	30	24
1	昼间	A 类房间	76	59	48	39	34
		B 类房间	79	63	52	44	38
	夜间	A 类房间	69	51	39	30	24
		B 类房间	72	55	43	35	29
2、3、4	昼间	A 类房间	79	63	52	44	38
		B 类房间	82	67	56	49	43
	夜间	A 类房间	72	55	43	35	29
		B 类房间	76	59	48	39	34

Attachment 27: Pollution Control Standards for Pollutants from Municipal Solid Waste Incineration (GB18485-2001)

表 1 焚烧炉技术性能指标

项目	烟气出口温度℃	烟气停留时间 S	焚烧炉渣热灼减率%	焚烧炉出口烟气中氧含量%
指标	≥850	≥2	≤5	6-12
	≥1000	≥1		

表 2 焚烧炉烟囱高度要求

处理量 t/d	烟囱最低允许高度 m
＜100	25
100-300	40
＞300	60

表 3 焚烧炉大气污染物排放限值

序号	项目	单位	数值含义	限值
1	烟尘	mg/m3	测定均值	80
2	烟气黑度	林格曼黑度，级	测定值 2)	1
3	一氧化碳	mg/m3	小时均值	150
4	氮氧化物	mg/m3	小时均值	400
5	二氧化硫	mg/m3	小时均值	260
6	氯化氢	mg/m3	小时均值	75
7	汞	mg/m3	测定均值	0.2
8	镉	mg/m3	测定均值	0.1
9	铅	mg/m3	测定均值	1.6
10	二噁英类	ng TEQ/m3	测定均值	1.0

Attachment 28: Emission Standard for Odor Pollutants (GB14554-93)

表 1 恶臭污染物厂界标准值

序号	控制项目	单位	一级	二级		三级	
				新扩改建	现有	新扩改建	现有
1	氨	mg/m3	1.0	1.5	2.0	4.0	5.0
2	三甲胺	mg/m3	0.05	0.08	0.15	0.45	0.80
3	硫化氢	mg/m3	0.03	0.06	0.10	0.32	0.60
4	甲硫醇	mg/m3	0.004	0.007	0.010	0.020	0.035
5	甲硫醚	mg/m3	0.03	0.07	0.15	0.55	1.10
6	二甲二硫	mg/m3	0.03	0.06	0.13	0.42	0.71
7	二硫化碳	mg/m3	2.0	3.0	5.0	8.0	10
8	苯乙烯	mg/m3	3.0	5.0	7.0	14	19
9	臭气浓度	无量纲	10	20	30	60	70

4.2.2 恶臭污染物排放标准值，见表 2

表 2 恶臭污染物排放标准值

序号	控制项目	排气筒高度，m	排放量，kg/h
1	硫化氢	15 20 25 30 35 40 60 80 100 120	0.33 0.58 0.90 1.3 1.8 2.3 5.2 9.3 14 21
2	甲硫醇	15 20 25 30 35 40 60	0.04 0.08 0.12 0.17 0.24 0.31 0.69
3	甲硫	15	0.33

	醚	20 25 30 35 40 60	0.58 0.90 1.3 1.8 2.3 5.2
4	二甲二硫醚	15 20 25 30 35 40 60	0.43 0.77 1.2 1.7 2.4 3.1 7.0
5	二硫化碳	15 20 25 30 35 40 60 80 100 120	1.5 2.7 4.2 6.1 8.3 11 24 43 68 97
6	氨	15 20 25 30 35 40 60	4.9 8.7 14 20 27 35 75
7	三甲胺	15 20 25 30 35 40 60 80 100	0.54 0.97 1.5 2.2 3.0 3.9 8.7 15 24

		120	35
8	苯乙烯	15 20 25 30 35 40 60	6.5 12 18 26 35 46 104
9	臭气浓度	排气筒高度,m	标准值（无量纲）
		15 25 35 40 50 ≥60	2000 6000 15000 20000 40000 60000

Attachment 29: Shandong Integrated Atmospheric Particular Matters Emission Control Standard (DB37/1996-2011)

表 1　现有企业大气颗粒物最高允许排放浓度限值

序号	行业及工段			最高允许排放浓度（mg/Nm^3）
1	火电厂锅炉	燃煤锅炉、燃油锅炉、煤粉锅炉、燃气轮机组		50
2		以煤矸石及以树皮、秸秆等生物质为主要燃料的资源综合利用锅炉		100
3	其它锅炉	燃煤锅炉、生物质锅炉、水煤浆锅炉	≥7MW(10t/h)的锅炉及<0.7MW(1t/h)的自然通风锅炉	120（80a）
4			<7MW(10t/h)锅炉	150（80a）
5		燃油锅炉		80（50a）
6		燃气锅炉		30
7	水泥工业	水泥窑及窑磨一体机、烘干机、烘干磨、煤磨及冷却机		50
8		其它尘源		30
9	陶瓷工业	喷雾干燥塔、辊道	以水煤浆为燃料烧制	50
10			以油气为燃料烧制	30

		窑、隧道窑、梭式窑		
11	钢铁工业	烧结	烧结、球团设备	50
12			其它尘源	30
13		炼铁	热风炉	20
14			其它尘源	30
15		炼钢转炉（一次烟气），铁合金精炼炉、矿热炉、回转窑		80
16		其它尘源		20
17	焦化工业	装煤、推焦、干法熄焦、硫铵结晶干燥		100
18		其它尘源		50
19	煤炭工业	原煤筛分、破碎、转载点等设备		80
20		煤炭风选设备通风管道、筛面、转载点等除尘设备		80
21	铝工业	氧化铝厂	氧化铝贮运	30
22		电解铝厂	电解槽烟气净化	20
23			氧化铝、氟化盐贮运、电解质破碎	30
24		铝用碳素厂	石油焦煅烧窑	100
25			阳极焙烧炉	30

26		其它尘源	50
注：括号中数据是指自然保护区、风景名胜区和其它需要特殊保护的地区的锅炉应执行的限值。			

表 1（续）现有企业大气颗粒物最高允许排放浓度限值

序号	行业及工段		最高允许排放浓度（mg/Nm3）
27	玻璃工业	玻璃窑炉	100
28		其它尘源	50
29	石棉纤维或粉尘		10 mg/m3 或 1 根纤维/cm3
30	炭黑尘、染料尘		15
31	其它工业	工业窑炉	80
32		其它尘源	50

表 2　新建企业大气颗粒物最高允许排放浓度限值

序号	行业及工段			最高允许排放浓度（mg/Nm3）
1	火电厂锅炉	天然气锅炉及燃气轮机组		5
2		其它气体燃料锅炉及燃气轮机组		10
3		其它火电厂锅炉		30
4	其它锅炉	燃煤锅炉、生物质锅炉、水煤浆锅炉	≥7MW(10t/h)锅炉	50
5			<7MW(10t/h)锅炉	80
6		燃油锅炉		50
7		燃气锅炉		30
8	水泥工业			30
9	陶瓷工业			30
10	钢铁工业	烧结	烧结、球团设备	50
11			其它尘源	30
12		炼铁	热风炉	20
13			其它尘源	30
14		炼钢转炉（一次烟气）、矿热炉（封闭）		80
15		铁合金精炼炉、矿热炉（半封闭炉、敞口炉）、回转窑		50

16		其它尘源	20
17	焦化工业	干法熄焦	50
18		其它尘源	30
19	煤炭工业	原煤筛分、破碎、转载点等设备	50
20		煤炭风选设备通风管道、筛面、转载点等除尘设备	50

表 2（续）新建企业大气颗粒物最高允许排放浓度限值

序号	行业及工段			最高允许排放浓度（mg/Nm3）
21	铝工业	氧化铝厂	氢氧化铝焙烧炉	50
22		电解铝厂	电解槽	20
23		铝用碳素厂	石油焦煅烧窑	80
24		其它尘源		30
25	玻璃工业	玻璃窑炉		50
26		其它尘源		30
27	石棉纤维或粉尘			10 mg/Nm3 或 1 根纤维/cm3
28	炭黑尘、染料尘			15

29	其它工业	工业窑炉	50
30		其它尘源	30

表 3　现有及新建企业边界大气污染物浓度限值

序号	颗粒物性质	最高允许排放浓度或要求（mg/Nm3）
1	石棉纤维或粉尘	生产设备不得有明显的无组织排放
2	炭黑尘、染料尘、颜料尘	肉眼不可见
3	其它颗粒物	1.0

Attachment 30: Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB 18918-2002)

基本控制项目最高允许排放浓度（日均值）单位 mg/L 表 1

序号	基本控制项目		一级标准		二级标准	三级标准
			A 标准	B 标准		
1	化学需氧量（COD）		50	60	100	120①
2	生化需氧量（BOD_5）		10	20	30	60①
3	悬浮物（SS）		10	20	30	50
4	动植物油		1	3	5	20
5	石油类		1	3	5	15
6	阴离子表面活性剂		0.5	1	2	5
7	总氮（以 N 计）		15	20	—	—
8	氨氮（以 N 计）②		5（8）	8（15）	25（30）	—
9	总磷（以 P 计）	2005 年 12 月 31 日前建设的	1	1.5	3	5
		2006 年 1 月 1 日起建设的	0.5	1	3	5

10	色度（稀释倍数）	30	30	40	50
11	pH	6－9			
12	粪大肠菌群数（个/L）	10^3	10^4	10^4	—

注：①下列情况下按去除率指标执行：当进水 COD 大于 350mg/L 时，去除率应大于 60%； BOD 大于 160mg/L 时，去除率应大于 50%。

②括号外数值为水温>120℃ 时的控制指标，括号内数值为水温≤120℃时的控制指标。

部分一类污染物最高允许排放浓度（日均值）单位 mg/L 表 2

序号	项目	标准值
1	总汞	0.001
2	烷基汞	不得检出
3	总镉	0.01
4	总铬	0.1
5	六价铬	0.05
6	总砷	0.1
7	总铅	0.1

4.1.3.2 选择控制项目按表 3 的规定执行。

选择控制项目最高允许排放浓度（日均值）单位 mg/L

序号	选择控制项目	标准值	序号	选择控制项目	标准值
1	总镍	0.05	23	三氯乙烯	0.3
2	总铍	0.002	24	四氯乙稀	0.1
3	总银	0.1	25	苯	0.1
4	总铜	0.5	26	甲苯	0.1
5	总锌	1.0	27	邻—二甲苯	0.4
6	总锰	2.0	28	对—二甲苯	0.4
7	总硒	0.1	29	间—二甲苯	0.4
8	苯并(a)芘	0.00003	30	乙苯	0.4
9	挥发酚	0.5	31	氯苯	0.3
10	总氰化物	0.5	32	1,4-二氯苯	0.4
11	硫化物	1.0	33	1,2-二氯苯	1.0
12	甲醛	1.0	34	对硝基氯苯	0.5
13	苯胺类	0.5	35	2,4-二硝基氯苯	0.5
14	总硝基化合物	2.0	36	苯酚	0.3

15	有机磷农药（以 P 计）	0.5	37	间-甲酚	0.1
16	马拉硫磷	1.0	38	2,4-二氯酚	0.6
17	乐果	0.5	39	2,4,6 －三氯酚	0.6
18	对硫磷	0.05	40	邻苯二甲酸二丁酯	0.1
19	甲基对硫磷	0.2	41	邻苯二甲酸二辛酯	0.1
20	五氯酚	0.5	42	丙烯腈	2.0
21	三氯甲烷	0.3	43	可吸附有机卤化物（AOX 以 CL 计）	1.0
22	四氯化碳	0.03			

4.2.2　标准值

城镇污水处理厂废气的排放标准值按表 4 的规定执行。

厂界（防护带边缘）废气排放最高允许浓度单位 mg/m^3 表 4

序号	控制项目	一级标准	二级标	三级标

			准	准
1	氨	1.0	1.5	4.0
2	硫化氢	0.03	0.06	0.32
3	臭气浓度（无量纲）	10	20	60
4	甲烷（厂区最高体积浓度%）	0.5	1	1

污泥稳定化控制指标

稳定化方法	控制项目	控制指标
厌氧消化	有机物降解率（%）	>40
好氧消化	有机物降解率（%）	>40
好氧堆肥	含水率（%）	<65
	有机物降解率（%）	>50
	蠕虫卵死亡率（%）	>95
	粪大肠菌群菌值	>0.01

污泥农用时污染物控制标准限值

序	控制项目	最高允许含量（mg/kg 干污泥）

号		在酸性土壤上（pH<6.5）	在中性和碱性土壤上(pH>=6.5)
1	总镉	5	20
2	总汞	5	15
3	总铅	300	1000
4	总铬	600	1000
5	总砷	75	75
6	总镍	100	200
7	总锌	2000	3000
8	总铜	800	1500
9	硼	150	150
10	石油类	3000	3000
11	苯并(a)芘	3	3
12	多氯代二苯并二恶英/多氯代二苯并呋喃（PCDD/PCDF 单	100	100

	位:ng 毒性单位/kg 干污泥)		
13	可吸附有机卤化物（AOX）（以 Cl 计）	500	500
14	多氯联苯（PCB）	0.2	0.2

Attachment 31: Waste Water Quality Standard for Discharge into Sewer Network (CJ343-2010)

基本控制项目最高允许排放浓度（现有及 2005 年 12 月 31 日之前建成（包括新建、扩建和改建）的城镇污水处理厂）

单位 mg/L

序号	基本控制项目		一级标准	二级标准	三级标准	四级标准（或达到括号内去除率要求，%）
1	COD	>5 万 m^3/d	60	80	120	150(60)
		1-5 万 m^3/d	60	100	120	150(60)
		<1 万 m^3/d	80	120	120	150(60)
2	BOD	>5 万 m^3/d	10	20	30	80(50)
		1-5 万 m^3/d	15	30	40	80(50)
		<1 万 m^3/d	15	30	40	80(50)
3	SS		15	20	30	60(70)
4	动植物油		1	3	5	20
5	石油类		1	3	5	15

6	LAS	0.5	1	2	5
7	总氮	15	20	-	-
8	NH_3-N	5	5	25	40
9	总 P（以 P 计）	1	1	3	5
10	色度(稀释倍数)	30	30	30	50
11	PH	6-9	6-9	6-9	6-9
12	粪大肠菌群数*（个/L）	10^3	10^4	10^4	-

*：粪大肠菌群为夏季（或根据当地肠道传染病流行季节）控制指标

表 2 基本控制项目最高允许排放量（2006 年 1 月 1 日以后建成（包括新建、扩建和改建）的城镇污水处理厂）单位 mg/L

序号	基本控制项目		一级标准	二级标准	三级标准
1	COD	>5 万 m^3/d	50	80	100
		1-5 万 m^3/d	50	80	100
		<1 万 m^3/d	60	80	100
2	BOD	>5 万 m^3/d	10	2	30

		1-5 万 m^3/d	10	02	30
		<1 万 m^3/d	15	020	30
3	SS		15	20	30
4	动植物油		1	3	5
5	石油类		1	3	5
6	LAS		0.5	1	2
7	总氮		15	20	-
8	NH_3-N		5	5	25
9	总 P（以 P 计）		0.5	0.5	3
10	色度（稀释倍数）		30	30	30
11	PH		6-9	6-9	6-9
12	粪大肠菌群数*（个/L）		10^3	10^4	10^4

*：粪大肠菌群数为夏季（或根据当地肠道传染病流行季节）控制指标

表 3 选择控制项目最高允许排放浓度（以日均值计） 单位 mg/L

序号	选择控制项目	标准值	序号	选择控制项目	标准值

1	总汞	0.01	26	甲基对硫磷	1.0
2	烷基汞	不得检出	27	五氯酚	5.0
3	总镉	0.05	28	三氯甲烷	0.3
4	总铬	1.5	29	四氯化碳	0.03
5	六价铬	0.5	30	三氯乙烯	0.3
6	总砷	0.5	31	四氯乙烯	0.1
7	总铅	0.5	32	苯	0.1
8	总镍	0.5	33	甲苯	
9	总铍	0.001	34	邻一二甲苯	0.4
10	总银	0.1	35	对一二甲苯	0.4
11	总铜	0.5	36	间二甲苯	0.4
12	总锌	2.0	37	乙苯	0.4
13	总锰	2.0	38	氯苯	0.2
14	总硒	0.1	39	对一二氯苯	0.4
15	苯并（a）芘	0.00003	40	邻一二氯苯	0.4
16	挥发酚	0.5	41	对硝基氯苯	0.5
17	总氰化物	0.5	42	2,4一二硝基氯苯	0.5
18	硫化物	1.0	43	苯酚	0.3

19	甲醛	1.0	44	间－甲酚	0.1
20	苯胺类	1.0	45	2,4－二氯酚	0.6
21	硝基苯类	2.0	46	2,4，6－三氯酚	0.6
22	有机磷农药	0.5	47	邻苯二甲酸二丁酯	0.2
23	马拉硫磷	5.0	48	邻苯二甲酸二辛酯	0.3
24	乐果	1.0	49	丙烯腈	2.0
25	对硫磷	1.0	50	可吸附有机卤化物	1.0

表 4 废气排放量最高允许浓度

序号	基本控制项目	一级标准	二级标准
1	氨	1.5	4.0
2	硫化氢	0.06	0.32
3	甲硫醇	0.007	0.02
4	甲硫醚	0.07	0.55
5	臭气浓度	20	60

6	甲烷气（厂区最高浓度%）	1	1
7	氯气	0.4	0.6

表 5 污泥堆肥控制标准

序号	控制项目	标准值
1	含水率（%）	25~65
2	有机质（%）	>10
3	蠕虫卵死亡率（%）	>95
4	粪大肠菌值	10-1~10-2

表 6 污泥农用时污染物控制标准值

序号	控制项目	最高允许含量（mg/kg 干污泥）	
		在酸性土壤上（ph<6.5）	在中性和碱性土壤上（pH>=6.5）
1	总镉	5	20

2	总汞	5	15
3	总铅	300	1000
4	总铬	600	1000
5	总砷	75	75
6	硼	150	150
7	矿物油	3000	3000
8	苯并（a）芘	3	3
9	总铜	250	500
10	总锌	500	1000
11	总镍	100	200
12	聚氯二恶英/聚氯呋喃（PCDD/PCDF 单位：ng 毒性单位/kg 干污泥）	100	100
13	AOX	500	500
14	PCB	0.2	0.2

Attachment 32: Standard for Pollution Control on the Landfill Site of Municipal Solid Waste (GB37 16889－2008)

附 1 新旧标准渗滤液处理后出水水质标准比较

污染物	GB16889-2008	GB16889-1997		
		一级标准	二级标准	三级标准
BOD_5(mg/l)	30	30	150	600
COD(mg/l)	100	100	300	1000
氨氮(mg/l)	25	15	25	——
悬浮物(mg/l)	30	70	200	400
总氮(mg/l)	40			
总磷(mg/l)	3			
色度（稀释倍数）	40			

表 1 浸出液污染物浓度限值

序号	污染物项目	浓度限值（mg/L）
1	汞	0.05
2	铜	40
3	锌	100
4	铅	0.25
5	镉	0.15
6	铍	0.02
7	钡	25
8	镍	0.5
9	砷	0.3
10	总铬	4.5
11	六价铬	1.5
12	硒	0.1

表 2 现有和新建生活垃圾填埋场水污染物排放浓度限值

序号	控制污染物	排放浓度限值	污染物排放监控位置
1	色度（稀释倍数）	40	常规污水处理设施排放口
2	化学需氧量（COD_{Cr}）（mg/L）	100	常规污水处理设施排放口
3	生化需氧量（BOD_5）（mg/L）	30	常规污水处理设施排放口
4	悬浮物（mg/L）	30	常规污水处理设施排放口
5	总氮（mg/L）	40	常规污水处理设施排放口
6	氨氮（mg/L）	25	常规污水处理设施排放口
7	总磷（mg/L）	3	常规污水处理设施排放口
8	粪大肠菌群数（个/L）	10000	常规污水处理设施排放口
9	总汞（mg/L）	0.001	常规污水处理设施排放口
10	总镉（mg/L）	0.01	常规污水处理设施排放口
11	总铬（mg/L）	0.1	常规污水处理设施排放口
12	六价铬（mg/L）	0.05	常规污水处理设施排放口
13	总砷（mg/L）	0.1	常规污水处理设施排放口
14	总铅（mg/L）	0.1	常规污水处理设施排放口

表 3 现有和新建生活垃圾填埋场水污染物特别排放限值

序号	控制污染物	排放浓度限值	污染物排放监控位置
1	色度（稀释倍数）	30	常规污水处理设施排放口
2	化学需氧量（COD_{Cr}）（mg/L）	60	常规污水处理设施排放口
3	生化需氧量（BOD_5）（mg/L）	20	常规污水处理设施排放口
4	悬浮物（mg/L）	30	常规污水处理设施排放口
5	总氮（mg/L）	20	常规污水处理设施排放口
6	氨氮（mg/L）	8	常规污水处理设施排放口
7	总磷（mg/L）	1.5	常规污水处理设施排放口
8	粪大肠菌群数（个/L）	1000	常规污水处理设施排放口
9	总汞（mg/L）	0.001	常规污水处理设施排放口
10	总镉（mg/L）	0.01	常规污水处理设施排放口
11	总铬（mg/L）	0.1	常规污水处理设施排放口
12	六价铬（mg/L）	0.05	常规污水处理设施排放口
13	总砷（mg/L）	0.1	常规污水处理设施排放口
14	总铅（mg/L）	0.1	常规污水处理设施排放口

Attachment 33: Integrated Pollutants Discharge Standards for Xiaoqing River Catchment (DB37/656-2006)

第一类污染物最高允许排放浓度标准不分时段。山东省小清河流域内除城镇污水处理厂外所有向该区域直接排放污水的单位自 2007 年 4 月 1 日起执行表 1 标准。

第二类污染物最高允许排放浓度标准分为三个时段。流域内除城镇污水处理厂外所有向该区域直接排放污水的单位，于 2007 年 4 月 1 日起执行表 2 时段的标准，2008 年 7 月 1 日起执行表 3 时段的标准，2009 年 7 月 1 日起执行表 4 时段的标准。

表 1 第一类污染物最高允许排放浓度 单位为毫克每升

序号	污 染 物	重点保护区域	一般保护区域
1	总汞	0.005	0.05
2	烷基汞	不得检出	不得检出
3	总镉	0.1	0.1
4	总铬	0.5	1.5
5	六价铬	0.2	0.5
6	总砷	0.2	0.5
7	总铅	0.5	1.0
8	总镍	1.0	1.0

9	苯并（a）芘	0.00003	0.00003
10	总铍（按 Be 计）	0.005	0.005
11	总银（按 Ag 计）	0.5	0.5
12	总 α 放射性	1Bq/L	1Bq/L
13	总 β 放射性	10Bq/L	10Bq/L

表 2 第二类污染物最高允许排放浓度（2007 年 4 月 1 日起至 2008 年 6 月 30 日执行标准）单位为毫克每升（pH、粪大肠菌群除外）

序号	污 染 物			重点保护区域	一般保护区域
1	pH			6-9	6-9
2	色度（稀释倍数）			50	50
3	悬浮物(SS)			70	100
4	五日生化需氧量(BOD_5)	造纸工业	制浆、制浆造纸	40	40
			造纸	30	30
		畜禽养殖业		60	100
		其他排污单位		20	30
5	化学需氧量(CODcr)	焦化、合成脂肪酸、湿法纤维板、染料、洗毛、有机磷农药、		100	200

		医药原料药、生物制药、酒精、皮革、化纤浆粕工业			
		造纸工业	木浆	100	150
			草浆	200	300
			其他	100	100
		其他排污单位		100	120
6	石油类			5.0	8.0
7	动植物油			10	15
8	挥发酚			0.5	0.5
9	总氰化物（按 CN^- 计）			0.5	0.5
10	硫化物			1.0	1.0
11	氨氮	合成氨工业		60	60
		味精工业		60	60
		其他排污单位		15	15
12	氟化物			10	10
13	磷酸盐(以 P 计)			0.5	1.0
14	甲醛			1.0	1.0
15	苯胺类			1.0	1.5
	16	硝基苯类		2.0	2.0
	17	阴离子表面活性剂(LAS)		5.0	10

	18	总铜			0.5	0.5
	19	总锌			2.0	4.0
	20	总锰			2.0	2.0
	21	彩色显影剂			1.0	2.0
	22	显影剂及氧化物总量			3.0	3.0
	23	元素磷			0.1	0.1
	24	有机磷农药(以 P 计)			不得检出	0.1
	25	乐果			不得检出	0.2
	26	对硫磷			不得检出	0.2
	27	甲基对硫磷			不得检出	0.2
	28	马拉硫磷			不得检出	1.0
	29	五氯酚及五氯酚钠(以五氯酚计)			5.0	8.0
	30	可吸附有机卤化物(AOX)（以 C1 计）	制浆、制浆造纸[a]	木浆（漂白）	6.0	12
				非木浆（漂白）	5.0	9.0
			其他排污单位		1.0	5.0

	31	三氯甲烷	0.3	0.6
	32	四氯化碳	0.03	0.06
	33	三氯乙烯	0.3	0.6
	34	四氯乙烯	0.1	0.2
	35	苯	0.1	0.2
	36	甲苯	0.1	0.2
	37	乙苯	0.4	0.6
	38	邻二甲苯	0.4	0.6
	39	对二甲苯	0.4	0.6
	40	间二甲苯	0.4	0.6
	41	氯苯	0.2	0.4
	42	邻二氯苯	0.4	0.6
	43	对二氯苯	0.4	0.6
	44	对硝基氯苯	0.5	1.0
	45	2,4-二硝基氯苯	0.5	1.0
	46	苯酚	0.3	0.4
	47	间-甲酚	0.1	0.2
	48	2,4-二氯酚	0.6	0.8
	49	2,4,6-三氯酚	0.6	0.8
	50	邻苯二甲酸二丁酯	0.2	0.4

	51	邻苯二甲酸二辛酯	0.3	0.6
	52	丙烯腈	2.0	5.0
	53	总硒	0.1	0.2
	54	粪大肠菌群数（医疗污水，单位 MPN/L）	100	100
	55	总余氯[b]（采用氯化消毒的医疗污水）	0.5	0.5
	56	总有机碳(TOC)	20	30
	[a] 单纯制浆或浆纸产量平衡的生产。 [b] 加氯消毒后需进行脱氯处理，达到本标准规定。			

表 3 第二类污染物最高允许排放浓度

（2008 年 7 月 1 日起至 2009 年 6 月 30 日执行标准）

序号	污 染 物		重点保护区域	一般保护区域
1	pH		6-9	6-9
2	色度（稀释倍数）		50	50
3	悬浮物(SS)		70	70
4	五日生化需氧量(BOD_5)	造纸工业	30	30
		畜禽养殖业	30	60
		其他排污单位	20	20

5	化学需氧量(CODcr)	焦化、合成脂肪酸、湿法纤维板、染料、洗毛、有机磷农药、医药原料药、生物制药、酒精、皮革、化纤浆粕工业		100	150
		造纸工业	木浆	80	120
			草浆	150	200
			其他	80	100
		其他排污单位		80	1000
6	石油类			5.0	8.0
7	动植物油			10	15
8	挥发酚			0.5	0.5
9	总氰化物（按 CN^- 计）			0.5	0.5
10	硫化物			1.0	1.0
11	氨氮	合成氨工业		25	40
		味精工业		25	40
		其他排污单位		15	15
12	氟化物			10	10
13	磷酸盐(以 P 计)			0.5	1.0

14	甲醛	0.8	1.0
15	苯胺类	0.8	1.2
16	硝基苯类	1.5	2.0
17	阴离子表面活性剂(LAS)	5.0	10
18	总铜	0.5	0.5
19	总锌	2.0	2.0
20	总锰	2.0	2.0
21	彩色显影剂	1.0	2.0
22	显影剂及氧化物总量	3.0	3.0
23	元素磷	0.1	0.1
24	有机磷农药(以 P 计)	不得检出	不得检出
25	乐果	不得检出	不得检出
26	对硫磷	不得检出	不得检出
27	甲基对硫磷	不得检出	不得检出
28	马拉硫磷	不得检出	不得检出
29	五氯酚及五氯酚钠(以五氯酚计)	5.0	6.0

30	可吸附有机卤化物(AOX)（以C1计）	制浆、制浆造纸[a]	木浆（漂白）	3.0	8.0
			非木浆（漂白）	3.0	8.0
		其他排污单位		1.0	5.0
31	三氯甲烷			0.3	0.6
32	四氯化碳			0.03	0.06
33	三氯乙烯			0.3	0.6
34	四氯乙烯			0.1	0.2
35	苯			0.1	0.2
36	甲苯			0.1	0.2
37	乙苯			0.4	0.6
38	邻二甲苯			0.4	0.6
39	对二甲苯			0.4	0.6
40	间二甲苯			0.4	0.6
41	氯苯			0.2	0.4
42	邻二氯苯			0.4	0.6
43	对二氯苯			0.4	0.6
44	对硝基氯苯			0.5	1.0
45	2,4-二硝基氯苯			0.5	1.0

46	苯酚	0.3	0.3
47	间-甲酚	0.1	0.2
48	2,4-二氯酚	0.6	0.8
49	2,4,6-三氯酚	0.6	0.8
50	邻苯二甲酸二丁酯	0.2	0.4
51	邻苯二甲酸二辛酯	0.3	0.6
52	丙烯腈	2.0	5.0
53	总硒	0.1	0.2
54	粪大肠菌群数（医疗污水，单位 MPN/L）	100	100
55	总余氯[b]（采用氯化消毒的医疗污水）	0.5	0.5
56	总有机碳(TOC)	20	30
[a] 单纯制浆或浆纸产量平衡的生产。 [b] 加氯消毒后需进行脱氯处理，达到本标准规定。			

表 4 第二类污染物最高允许排放浓度（2009 年 7 月 1 日起执行）

序号	污 染 物	重点保护区域	一般保护区域
1	pH	6-9	6-9
2	色度(稀释倍数)	40	50
3	悬浮物(SS)	70	70

4	五日生化需氧量(BOD_5)	20	20
5	化学需氧量(CODcr)	60	100
6	石油类	4.0	5.0
7	动植物油	10	10
8	挥发酚	0.3	0.5
9	总氰化物(按 CN^-计)	0.2	0.5
10	硫化物	0.8	1.0
11	氨氮	10	15
12	氟化物	8.0	10
13	磷酸盐(以 P 计)	0.5	0.5
14	甲醛	0.5	1.0
15	苯胺类	0.5	1.0
16	硝基苯类	1.0	2.0
17	阴离子表面活性剂(LAS)	5.0	8.0
18	总铜	0.5	0.5
19	总锌	2.0	2.0
20	总锰	2.0	2.0
21	彩色显影剂	1.0	1.0
22	显影剂及氧化物总量	3.0	3.0

23	元素磷	0.1	0.1
24	有机磷农药(以 P 计)	不得检出	不得检出
25	乐果	不得检出	不得检出
26	对硫磷	不得检出	不得检出
27	甲基对硫磷	不得检出	不得检出
28	马拉硫磷	不得检出	不得检出
29	五氯酚及五氯酚钠(以五氯酚计)	3.0	5.0
30	可吸附有机卤化物(AOX) (以 C1 计)	1.0	5.0
31	三氯甲烷	0.3	0.3
32	四氯化碳	0.03	0.03
33	三氯乙烯	0.3	0.3
34	四氯乙烯	0.1	0.1
35	苯	0.1	0.1
36	甲苯	0.1	0.1
37	乙苯	0.4	0.4
38	邻二甲苯	0.4	0.4

39	对二甲苯	0.4	0.4
40	间二甲苯	0.4	0.4
41	氯苯	0.2	0.2
42	邻二氯苯	0.4	0.4
43	对二氯苯	0.4	0.4
44	对硝基氯苯	0.5	0.5
45	2,4-二硝基氯苯	0.5	0.5
46	苯酚	0.3	0.3
47	间-甲酚	0.1	0.1
48	2,4-二氯酚	0.6	0.6
49	2,4,6-三氯酚	0.6	0.6
50	邻苯二甲酸二丁酯	0.2	0.2
51	邻苯二甲酸二辛酯	0.3	0.3
52	丙烯腈	2.0	2.0
53	总硒	0.1	0.1
54	粪大肠菌群数（医疗污水，单位MPN/L）	100	100
55	总余氯[b]（采用氯化消毒的医疗污水）	0.5	0.5
56	总有机碳(TOC)	20	20

[b] 加氯消毒后需进行脱氯处理，达到本标准规定。

Attachment 34: Pollution Control Standard for Hazardous Waste Storage (GB18597-2001)

1 一般要求

1.1 所有危险废物产生者和危险废物经营者应建造专用的危险废物贮存设施，也可利用原有构筑物改建成危险废物贮存设施。

1.2 在常温常压下易爆、易燃及排出有毒气体的危险废物必须进行预处理，使之稳定后贮存，否则，按易爆、易燃危险品贮存。

1.3 在常温常压下不水解、不挥发的固体危险废物可在贮存设施内分别堆放。

1.4 除 4.3 规定外，必须将危险废物装入容器内。

1.5 禁止将不相容（相互反应）的危险废物在同一容器内混装。

1.6 无法装入常用容器的危险废物可用防漏胶袋等盛装。

1.7 装载液体、半固体危险废物的容器内须留足够空间，容器顶部与液体表面之间保留 100 mm 以上的空间。

1.8 医院产生的临床废物，必须当日消毒，消毒后装入容器。常温下贮存期不得超过 1d，于 5℃以下冷藏的，不得超过 7d。

1.9 盛装危险废物的容器上必须粘贴符合本标准附录 A 所示的标签。

1.10 危险废物贮存设施在施工前应做环境影响评价。

2 危险废物贮存容器

2.1 应当使用符合标准的容器盛装危险废物。

2.2 装载危险废物的容器及材质要满足相应的强度要求。

2.3 装载危险废物的容器必须完好无损。

2.4 盛装危险废物的容器材质和衬里要与危险废物相容（不相互反应）。

2.5 液体危险废物可注入开孔直径不超过 70 mm 并有放气孔的桶中。

3 危险废物贮存设施的选址与设计原则

3.1 危险废物集中贮存设施的选址

3.1.1 地质结构稳定，地震烈度不超过 7 度的区域内。

3.1.2 设施底部必须高于地下水最高水位。

3.1.3 场界应位于居民区 800 m 以外，地表水域 150 m 以外。

3.1.4 应避免建在溶洞区或易遭受严重自然灾害如洪水、滑坡，泥石流、潮汐等影响的地区。

3.1.5 应建在易燃、易爆等危险品仓库、高压输电线路防护区域以外。

3.1.6 应位于居民中心区常年最大风频的下风向。

3.1.7 集中贮存的废物堆选址除满足以上要求外，还应满足 6.3.1 款要求。

3.2 危险废物贮存设施（仓库式）的设计原则

3.2.1 地面与裙脚要用坚固、防渗的材料建造，建筑材料必须与危险废物相容。

3.2.2 必须有泄漏液体收集装置、气体导出口及气体净化装置。

3.2.3 设施内要有安全照明设施和观察窗口。

3.2.4 用以存放装载液体、半固体危险废物容器的地方，必须有耐腐蚀的硬化地面，且表面无裂隙。

3.2.5 应设计堵截泄漏的裙脚，地面与裙脚所围建的容积不低于堵截最大容

器的最大储量或总储量的 1/5。

3.2.6 不相容的危险废物必须分开存放，并设有隔离间隔断。

3.3 危险废物的堆放

3.3.1 基础必须防渗，防渗层为至少 1 m 厚黏土层（渗透系数≤10^{-7} cm/s），或 2 mm 厚高密度聚乙烯，或至少 2 mm 厚的其他人工材料，渗透系数≤10^{-10} cm/s。

3.3.2 堆放危险废物的高度应根据地面承载能力确定。

3.3.3 衬里放在一个基础或底座上。

3.3.4 衬里要能够覆盖危险废物或其溶出物可能涉及到的范围。

3.3.5 衬里材料与堆放危险废物相容。

3.3.6 在衬里上设计、建造浸出液收集清除系统。

3.3.7 应设计建造径流疏导系统，保证能防止 25a 一遇的暴雨不会流到危险废物堆里。

3.3.8 危险废物堆内设计雨水收集池，并能收集 25a 一遇的暴雨 24 h 降水量。

3.3.9 危险废物堆要防风、防雨、防晒。

3.3.10 产生量大的危险废物可以散装方式堆放贮存在按上述要求设计的废物堆里。

3.3.11 不相容的危险废物不能堆放在一起。

3.3.12 总贮存量不超过 300 kg（L）的危险废物要放入符合标准的容器内，加上标签，容器放入坚固的柜或箱中，柜或箱应设多个直径不少于 30 mm 的排气孔。不相容危险废物要分别存放或存放在不渗透间隔分开的区域内，

每个部分都应有防漏裙脚或储漏盘，防漏裙脚或储漏盘的材料要与危险废物相容。

4 危险废物贮存设施的运行与管理

4.1 从事危险废物贮存的单位，必须得到有资质单位出具的该危险废物样品物理和化学性质的分析报告，认定可以贮存后，方可接收。

4.2 危险废物贮存前应进行检验，确保同预定接收的危险废物一致，并登记注册。

4.3 不得接收未粘贴符合 4.9 规定的标签或标签没按规定填写的危险废物。

4.4 盛装在容器内的同类危险废物可以堆叠存放。

4.5 每个堆间应留有搬运通道。

4.6 不得将不相容的废物混合或合并存放。

4.7 危险废物产生者和危险废物贮存设施经营者均须作好危险废物情况的记录，记录上须注明危险废物的名称、来源、数量、特性和包装容器的类别、入库日期、存放库位、废物出库日期及接收单位名称。

危险废物的记录和货单在危险废物回取后应继续保留 3a。

4.8 必须定期对所贮存的危险废物包装容器及贮存设施进行检查，发现破损，应及时采取措施清理更换。

4.9 泄漏液、清洗液、浸出液必须符合 GB 8978 的要求方可排放，气体导出口排出的气体经处理后，应满足 GB 16297 和 GB 14554 的要求。

5 危险废物贮存设施的安全防护与监测

5.1 安全防护

5.1.1 危险废物贮存设施都必须按 GB 15562.2 的规定设置警示标志。

5.1.2 危险废物贮存设施周围应设置围墙或其他防护栅栏。

5.3 危险废物贮存设施应配备通讯设备、照明设施、安全防护服装及工具，并设有应急防护设施。

5.1.4 危险废物贮存设施内清理出来的泄漏物，一律按危险废物处理。

5.2 按国家污染源管理要求对危险废物贮存设施进行监测。

6 危险废物贮存设施的关闭

6.1 危险废物贮存设施经营者在关闭贮存设施前应提交关闭计划书，经批准后方可执行。

6.2 危险废物贮存设施经营者必须采取措施消除污染。

6.3 无法消除污染的设备、土壤、墙体等按危险废物处理，并运至正在营运的危险废物处理处置场或其他贮存设施中。

6.4 监测部门的监测结果表明已不存在污染时，方可摘下警示标志，撤离留守人员。

Attachment 35：The Tentative Measures for Public Participation in Environmental Impact Assessments.

公众参与的一般要求

第一节 公开环境信息

第七条 建设单位或者其委托的环境影响评价机构、环境保护行政主管部门应当按照本办法的规定，采用便于公众知悉的方式，向公众公开有关环境影响评价的信息。

第八条 在《建设项目环境分类管理名录》规定的环境敏感区建设的需要编制环境影响报告书的项目，建设单位应当在确定了承担环境影响评价工作的环境影响评价机构后 7 日内，向公众公告下列信息：

（一）建设项目的名称及概要；

（二）建设项目的建设单位的名称和联系方式；

（三）承担评价工作的环境影响评价机构的名称和联系方式；

（四）环境影响评价的工作程序和主要工作内容；

（五）征求公众意见的主要事项；

（六）公众提出意见的主要方式。

第九条 建设单位或者其委托的环境影响评价机构在编制环境影响报告书的过程中，应当在报送环境保护行政主管部门审批或者重新审核前，向公众公告如下内容：

（一）建设项目情况简述；

（二）建设项目对环境可能造成影响的概述；

（三）预防或者减轻不良环境影响的对策和措施的要点；

（四）环境影响报告书提出的环境影响评价结论的要点；

（五）公众查阅环境影响报告书简本的方式和期限，以及公众认为必要时向建设单位或者其委托的环境影响评价机构索取补充信息的方式和期限；

（六）征求公众意见的范围和主要事项；

（七）征求公众意见的具体形式；

（八）公众提出意见的起止时间。

第十条 建设单位或者其委托的环境影响评价机构，可以采取以下一种或者多种方式发布信息公告：

（一）在建设项目所在地的公共媒体上发布公告；

（二）公开免费发放包含有关公告信息的印刷品；

（三）其他便利公众知情的信息公告方式。

第十一条 建设单位或其委托的环境影响评价机构，可以采取以下一种或者多种方式，公开便于公众理解的环境影响评价报告书的简本：

（一）在特定场所提供环境影响报告书的简本；

（二）制作包含环境影响报告书的简本的专题网页；

（三）在公共网站或者专题网站上设置环境影响报告书的简本的链接；

（四）其他便于公众获取环境影响报告书的简本的方式。

第二节 征求公众意见

第十二条 建设单位或者其委托的环境影响评价机构应当在发布信息公告、公开环境影响报告书的简本后，采取调查公众意见、咨询专家意见、座谈会、论证会、听证会等形式，公开征求公众意见。

建设单位或者其委托的环境影响评价机构征求公众意见的期限不得少于10日，并确保其公开的有关信息在整个征求公众意见的期限之内均处于公开状态。

环境影响报告书报送环境保护行政主管部门审批或者重新审核前，建设单

位或者其委托的环境影响评价机构可以通过适当方式，向提出意见的公众反馈意见处理情况。

第十三条 环境保护行政主管部门应当在受理建设项目环境影响报告书后，在其政府网站或者采用其他便利公众知悉的方式，公告环境影响报告书受理的有关信息。

环境保护行政主管部门公告的期限不得少于 10 日，并确保其公开的有关信息在整个审批期限之内均处于公开状态。

环境保护行政主管部门根据本条第一款规定的方式公开征求意见后，对公众意见较大的建设项目，可以采取调查公众意见、咨询专家意见、座谈会、论证会、听证会等形式再次公开征求公众意见。

环境保护行政主管部门在作出审批或者重新审核决定后，应当在政府网站公告审批或者审核结果。

第十四条 公众可以在有关信息公开后，以信函、传真、电子邮件或者按照有关公告要求的其他方式，向建设单位或者其委托的环境影响评价机构、负责审批或者重新审核环境影响报告书的环境保护行政主管部门，提交书面意见。

第十五条 建设单位或者其委托的环境影响评价机构、环境保护行政主管部门，应当综合考虑地域、职业、专业知识背景、表达能力、受影响程度等因素，合理选择被征求意见的公民、法人或者其他组织。

被征求意见的公众必须包括受建设项目影响的公民、法人或者其他组织的代表。

第十六条 建设单位或者其委托的环境影响评价机构、环境保护行政主管部门应当将所回收的反馈意见的原始资料存档备查。

第十七条 建设单位或者其委托的环境影响评价机构，应当认真考虑公众意见，并在环境影响报告书中附具对公众意见采纳或者不采纳的说明。

环境保护行政主管部门可以组织专家咨询委员会，由其对环境影响报告书中有关公众意见采纳情况的说明进行审议，判断其合理性并提出处理建议。

环境保护行政主管部门在作出审批决定时，应当认真考虑专家咨询委员会的处理建议。

第十八条 公众认为建设单位或者其委托的环境影响评价机构对公众意见未采纳且未附具说明的，或者对公众意见未采纳的理由说明不成立的，可以向负责审批或者重新审核的环境保护行政主管部门反映，并附具明确具体的书面意见。

负责审批或者重新审核的环境保护行政主管部门认为必要时，可以对公众意见进行核实。

第三章 公众参与的组织形式

第一节 调查公众意见和咨询专家意见

第十九条 建设单位或者其委托的环境影响评价机构调查公众意见可以采取问卷调查等方式，并应当在环境影响报告书的编制过程中完成。

采取问卷调查方式征求公众意见的，调查内容的设计应当简单、通俗、明确、易懂，避免设计可能对公众产生明显诱导的问题。

问卷的发放范围应当与建设项目的影响范围相一致。

问卷的发放数量应当根据建设项目的具体情况，综合考虑环境影响的范围和程度、社会关注程度、组织公众参与所需要的人力和物力资源以及其他相关因素确定。

第二十条 建设单位或者其委托的环境影响评价机构咨询专家意见可以采用书面或者其他形式。

咨询专家意见包括向有关专家进行个人咨询或者向有关单位的专家进行集体咨询。

接受咨询的专家个人和单位应当对咨询事项提出明确意见，并以书面形式回复。对书面回复意见，个人应当签署姓名，单位应当加盖公章。

集体咨询专家时，有不同意见的，接受咨询的单位应当在咨询回复中载明。

第二节 座谈会和论证会

第二十一条 建设单位或者其委托的环境影响评价机构决定以座谈会或者

论证会的方式征求公众意见的，应当根据环境影响的范围和程度、环境因素和评价因子等相关情况，合理确定座谈会或者论证会的主要议题。

第二十二条 建设单位或者其委托的环境影响评价机构应当在座谈会或者论证会召开 7 日前，将座谈会或者论证会的时间、地点、主要议题等事项，书面通知有关单位和个人。

第二十三条 建设单位或者其委托的环境影响评价机构应当在座谈会或者论证会结束后 5 日内，根据现场会议记录整理制作座谈会议纪要或者论证结论，并存档备查。

会议纪要或者论证结论应当如实记载不同意见。

第三节听证会

第二十四条 建设单位或者其委托的环境影响评价机构（以下简称“听证会组织者”）决定举行听证会征求公众意见的，应当在举行听证会的 10 日前，在该建设项目可能影响范围内的公共媒体或者采用其他公众可知悉的方式，公告听证会的时间、地点、听证事项和报名办法。

第二十五条 希望参加听证会的公民、法人或者其他组织，应当按照听证会公告的要求和方式提出申请，并同时提出自己所持意见的要点。

听证会组织者应当按本办法第十五条的规定，在申请人中遴选参会代表，

并在举行听证会的 5 日前通知已选定的参会代表。

听证会组织者选定的参加听证会的代表人数一般不得少于 15 人。

第二十六条 听证会组织者举行听证会，设听证主持人 1 名、记录员 1 名。

被选定参加听证会的组织的代表参加听证会时，应当出具该组织的证明，个人代表应当出具身份证明。

被选定参加听证会的代表因故不能如期参加听证会的，可以向听证会组织者提交经本人签名的书面意见。

第二十七条 参加听证会的人员应当如实反映对建设项目环境影响的意见，遵守听证会纪律，并保守有关技术秘密和业务秘密。

第二十八条 听证会必须公开举行。

个人或者组织可以凭有效证件按第二十四条所指公告的规定，向听证会组织者申请旁听公开举行的听证会。

准予旁听听证会的人数及人选由听证会组织者根据报名人数和报名顺序确定。准予旁听听证会的人数一般不得少于 15 人。

旁听人应当遵守听证会纪律。旁听者不享有听证会发言权，但可以在听证会结束后，向听证会主持人或者有关单位提交书面意见。

第二十九条 新闻单位采访听证会，应当事先向听证会组织者申请。

第三十条 听证会按下列程序进行：

（一）听证会主持人宣布听证事项和听证会纪律，介绍听证会参加人；

（二）建设单位的代表对建设项目概况作介绍和说明；

（三）环境影响评价机构的代表对建设项目环境影响报告书做说明；

（四）听证会公众代表对建设项目环境影响报告书提出问题和意见；

（五）建设单位或者其委托的环境影响评价机构的代表对公众代表提出的问题和意见进行解释和说明；

（六）听证会公众代表和建设单位或者其委托的环境影响评价机构的代表进行辩论；

（七）听证会公众代表做最后陈述；

（八）主持人宣布听证结束。

第三十一条 听证会组织者对听证会应当制作笔录。

听证笔录应当载明下列事项：

（一）听证会主要议题；

（二）听证主持人和记录人员的姓名、职务；

（三）听证参加人的基本情况；

（四）听证时间、地点；

（五）建设单位或者其委托的环境影响评价机构的代表对环境影响报告书所作的概要说明；

（六）听证会公众代表对建设项目环境影响报告书提出的问题和意见；

（七）建设单位或者其委托的环境影响评价机构代表对听证会公众代表就环境影响报告书提出问题和意见所作的解释和说明；

（八）听证主持人对听证活动中有关事项的处理情况；

（九）听证主持人认为应笔录的其他事项。

听证结束后，听证笔录应当交参加听证会的代表审核并签字。无正当理由拒绝签字的，应当记入听证笔录。

第三十二条 审批或者重新审核环境影响报告书的环境保护行政主管部门决定举行听证会的，适用《环境保护行政许可听证暂行办法》的规定。《环境保护行政许可听证暂行办法》未作规定的，适用本办法有关听证会的规定。

第四章 公众参与规划环境影响评价的规定

第三十三条 根据《环境影响评价法》第八条和第十一条的规定，工业、农业、畜牧业、林业、能源、水利、交通、城市建设、旅游、自然资源开发的有关专项规划（以下简称“专项规划”）的编制机关，对可能造成不良环境影响并直接涉及公众环境权益的规划，应当在该规划草案报送审批前，举行论证会、听证会，或者采取其他形式，征求有关单位、专家和公众对环境影响报告书草案的意见。

第三十四条 专项规划的编制机关应当认真考虑有关单位、专家和公众对环境影响报告书草案的意见，并应当在报送审查的环境影响报告书中附具对意见采纳或者不采纳的说明。

第三十五条 环境保护行政主管部门根据《环境影响评价法》第十一条和《国务院关于落实科学发展观加强环境保护的决定》的规定，在召集有关部门专家和代表对开发建设规划的环境影响报告书中有关公众参与的内容进行审查时，应当重点审查以下内容：

（一）专项规划的编制机关在该规划草案报送审批前，是否依法举行了论证会、听证会，或者采取其他形式，征求了有关单位、专家和公众对环境影响报告书草案的意见；

（二）专项规划的编制机关是否认真考虑了有关单位、专家和公众对环境影响报告书草案的意见，并在报送审查的环境影响报告书中附具了对意见采纳或者不采纳的说明。

第三十六条 环境保护行政主管部门组织对开发建设规划的环境影响报告

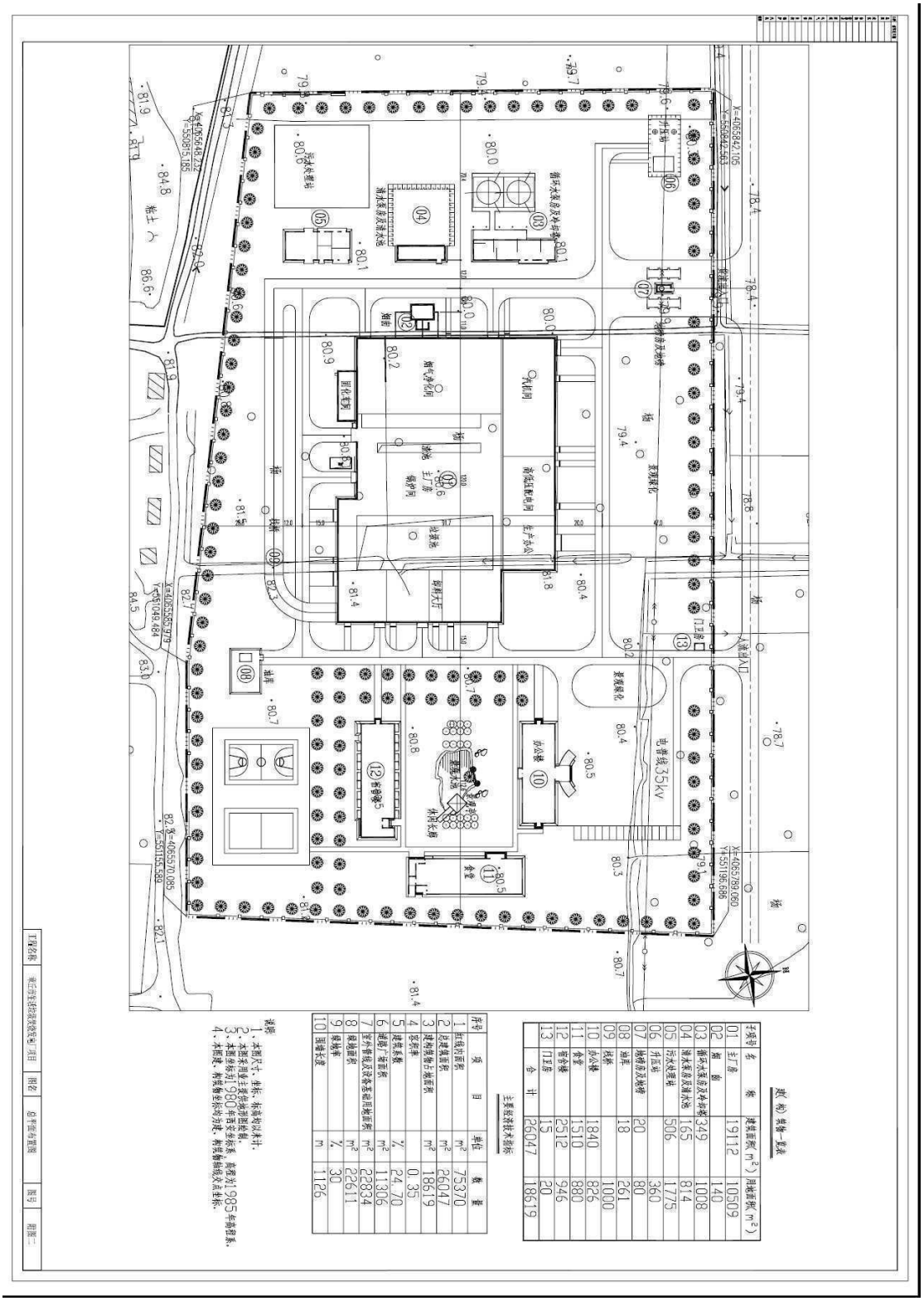
书提出审查意见时，应当就公众参与内容的审查结果提出处理建议，报送审批机关。

审批机关在审批中应当充分考虑公众意见以及前款所指审查意见中关于公众参与内容审查结果的处理建议；未采纳审查意见中关于公众参与内容的处理建议的，应当作出说明，并存档备查。

第三十七条 土地利用的有关规划、区域、流域、海域的建设、开发利用规划的编制机关，应当根据《环境影响评价法》第七条和《国务院关于落实科学发展观加强环境保护的决定》的有关规定，在规划编制过程中组织进行环境影响评价，编写该规划有关环境影响的篇章或者说明。

土地利用的有关规划、区域、流域、海域的建设、开发利用规划的编制机关，在组织进行规划环境影响评价的过程中，可以参照本办法征求公众意见。

Attachment 36: The Layout and the map of the plant site



Attachment 37:Solid Waste Test Report

检 测 报 告

委托单位：章丘市环境卫生管护中心

检测单位（盖章）：建设部环境卫生工程技术研究中心

报告发出日期：2011 年 11 月 22 日

说　　明

1、　委托单位在委托检测前应说明检测目的，凡是污染事故调查、环保验收检验、仲裁及鉴定检测需在委托书中说明，并由我单位按规定采样、检测，否则不能作为执法依据。由委托单位自行采样送检的样品，本报告只对送检样品负责。

2、　本报告未经同意请勿复印，涂改无效。

3、　本报告不作为产品鉴定使用，不得用于各类广告宣传。

4、　本报告无压缝章无效。

5、　对本报告若有异议，应在报告发出之日起十五日内提出，逾期不予受理。

地址：北京市西城区德胜门外大街 36 号

邮编：100120

电话：010-57365279；010-57365280

传真：010-57365208

建设部环境卫生工程技术研究中心
（联合国工业发展组织技术支撑）　　实 验 室

检 测 数 据 报 告 单

受检单位：　章丘市环境卫生管护中心　　采样地点：章丘市生活垃圾填埋场
采样日期：　2011 年 10 月 24 日　　分析日期：2011 年 10 月 25 日至
检测目的：　物理成分、热值和元素　　2011 年 11 月 22 日
样品类别：　原生固体垃圾 01 号

	名称		湿重百分含量%	干重百分含量%
样品分类	有机物	动物	0.87	1.31
		植物	38.19	28.08
	无机物	灰土	0.00	0.00
		砖瓦/陶瓷	7.92	12.84
	可回收物	纸类	17.83	15.69
		塑料、橡胶	13.15	15.40
		纺织物	14.32	14.99
		玻璃	2.06	4.78
		金属	0.00	0.00
		木　竹	0.66	0.84
	其它		5.00	6.06
	混合物		—	—

	水分	灰分	C	H	N	O	S
干基组分（%）	—	33.12	35.92	5.37	1.93	16.31	0.39
湿基组分（%）	59.91	13.28	14.40	2.15	0.77	6.54	0.15

干基高位热值	15392.6kJ/kg	湿基低位热值	4237.1kJ/kg
检测依据	CJ/T313-2009		
主要检测仪器	元素分析仪和氧弹热量计		
备　注			

分析人：尹然 袁松 史丽君　　审查签发：

校　核：屈志云 黄文雄　　盖　章：

地　　址：北京市西城区德胜门外大街 36 号　　邮编：100120
联系电话：（010）57365279 57365280　　传真：（010）57365208

建设部环境卫生工程技术研究中心
（联合国工业发展组织技术支撑）　实验室

检测数据报告单

受检单位：章丘市环境卫生管护中心　　采样地点：章丘市生活垃圾填埋场
采样日期：2011年10月24日　　分析日期：2011年10月25日至
检测目的：物理成分、热值和元素　　2011年11月22日
样品类别：原生固体垃圾02号

	名称		湿重百分含量%	干重百分含量%
样品分类	有机物	动物	2.21	3.43
		植物	43.72	32.43
	无机物	灰土	0.42	0.62
		砖瓦/陶瓷	1.11	2.21
	可回收物	纸类	5.49	4.63
		塑料、橡胶	16.43	19.22
		纺织物	0.87	1.06
		玻璃	0.51	1.15
		金属	0.18	0.37
		木　竹	0.00	0.00
	其它		29.05	34.88
	混合物		--	--

	水分	灰分	C	H	N	O	S
干基组分（%）	—	35.28	32.77	4.43	0.85	22.17	0.37
湿基组分（%）	56.16	15.46	14.36	1.94	0.37	9.72	0.16

干基高位热值	11729.6kJ/kg	湿基低位热值	3345.4kJ/kg
检测依据	CJ/T313-2009		
主要检测仪器	元素分析仪和氧弹热量计		
备　注			

分析人：尹然 袁松 史丽君　　审查签发：

校　核：屈志云 黄文雄　　盖　章：

地　址：北京市西城区德胜门外大街36号　　邮编：100120
联系电话：（010）57365279 57365280　　传真：（010）57365208

建设部环境卫生工程技术研究中心
（联合国工业发展组织技术支撑）　实 验 室

检 测 数 据 报 告 单

受检单位：章丘市环境卫生管护中心　　采样地点：章丘市生活垃圾填埋场
采样日期：2011 年 10 月 24 日　　分析日期：2011 年 10 月 25 日至
检测目的：物理成分、热值和元素　　2011 年 11 月 22 日
样品类别：原生固体垃圾 03 号

	名称		湿重百分含量%	干重百分含量%
样品分类	有机物	动物	1.68	2.57
		植物	60.43	51.50
	无机物	灰土	0.00	0.00
		砖瓦/陶瓷	0.00	0.00
	可回收物	纸类	23.71	24.88
		塑料、橡胶	13.41	19.15
		纺织物	0.00	0.00
		玻璃	0.30	0.70
		金属	0.48	1.19
		木　竹	0.00	0.00
	其它		0.00	0.00
	混合物		--	--

	水分	灰分	C	H	N	O	S
干基组分（%）	—	24.05	43.40	6.34	0.91	24.69	0.40
湿基组分（%）	59.71	9.69	17.49	2.56	0.37	9.95	0.16
干基高位热值	16502.0kJ/kg			湿基低位热值		4630.5kJ/kg	
检测依据	CJ/T313-2009						
主要检测仪器	元素分析仪和氧弹热量计						
备　注							

分析人：尹然 袁松 史丽君　　审查签发：

校　核：屈志云 黄文雄　　盖　章：

地　址：北京市西城区德胜门外大街 36 号　　邮编：100120
联系电话：（010）57365279 57365280　　传真：（010）57365208

建设部环境卫生工程技术研究中心
（联合国工业发展组织技术支撑）　实 验 室

检 测 数 据 报 告 单

受检单位：章丘市环境卫生管护中心　　采样地点：章丘市生活垃圾填埋场
采样日期：2011 年 10 月 24 日　　分析日期：2011 年 10 月 25 日至
检测目的：物理成分、热值和元素　　2011 年 11 月 22 日
样品类别：01 02 03 号算术平均值

	名称		湿重百分含量%	干重百分含量%
样品分类	有机物	动物	1.59	2.44
		植物	47.45	37.34
	无机物	灰土	0.14	0.21
		砖瓦/陶瓷	3.01	5.02
	可回收物	纸类	15.68	15.07
		塑料、橡胶	14.33	17.93
		纺织物	5.07	5.35
		玻璃	0.96	2.21
		金属	0.22	0.52
		木　竹	0.22	0.28
	其它		11.35	13.65
	混合物		—	—

	水分	灰分	C	H	N	O	S
干基组分（%）	—	30.82	37.36	5.38	1.23	21.06	0.39
湿基组分（%）	58.59	15.42	15.42	2.22	0.50	8.73	0.16

干基高位热值	14541.4kJ/kg	湿基低位热值	4071.0kJ/kg
检测依据	CJ/T313-2009		
主要检测仪器	元素分析仪和氧弹热量计		
备　注			

分析人：尹然 袁松 史丽君　　审查签发：

校　核：屈志云 黄文雄　　盖　章：

地　址：北京市西城区德胜门外大街 36 号　　邮编：100120
联系电话：（010）57365279 57365280　　传真：（010）57365208

备　　注

现场采样、热值和元素分析情况说明：

本分析报告只是对本次采集的样品的各项特性进行了分析，单次样品含水率、物理成分、以及测试的热值和元素含量很难代表全年整个区域平均值。所以建议全年生活垃圾热值和元素设计取值应参考此报告，并作适当修正。

Attachment 38: Pollution control for Luohe River

我市加强水污染治理管理工作

【大中小】编辑：市政务信息中心　时间：2012-8-14 10:45:29 浏览 227 人次

记者在日前召开的全市环保重点工作推进会上了解到，我市将进一步突出重点，加大力度，多措并举，扎实有效地推进水污染防治工作，确保我市水环境质量根本改善。

实施重点河流"河长"责任制。市政府决定实行重点河流"河长"责任制，县（区）长任各自辖区内主要河流的"河长"，分管副县（区）长、县（区）环保局局长为副"河长".河流水质连续两周不达标的，所在县（区）政府主要负责人在市政府常务会议上说明情况，并实行建设项目"区域限批".对未完成河流责任目标任务的县区政府实施"一票否决"，扣缴所在县区责任断面生态补偿金。

全面开展流域综合整治。市政府要求各县区在对辖区内重点河流流域内排污单位进行拉网式排查的基础上，逐河制订流域综合整治方案，实行"一河一策"、"一河一档".环保部门将加强对重点流域、重点区域、重点行业的污染整治，并将加大执法力度，严厉打击各种损害群众环境权益的违法行为；加强河流水质监测监控，对直接排污入河的单位、达不到市定排放标准的排污企业坚决实施停产整治或限产限排。

加快污染减排重点项目建设。经济技术开发区污水处理厂、源汇区马沟

污水处理厂、郾城区淞江产业集聚区污水处理厂、临颍县产业集聚区污水处理厂年底前建成投运。年底前完不成建设任务的，要在市政府常务会议上作检讨，同时，对其实行环保"一票否决"和"区域限批"。

加快实施建成区产业"退二进三"搬迁步伐。在石武高速铁路以东、龙江路以南、南环路以北、中山路以西范围内不含各产业集聚区的建成区区域内，对排放污染物超过国家和地方排放标准或总量控制指标，严重污染环境，群众反映强烈，经限期治理仍达不到要求的企业限期搬迁改造。对未按规定时限搬迁的，政府依法责令其停业、关闭。

加大"引沙入黑"、"引沙入颍"生态调水力度。在保障现有"引沙入黑"每日 8 万吨调水工程正常运行.

基础上，实施"引沙入黑"扩容改造工程，11 月底前建成投运；实施黑河清淤工程，11 月底前完成清淤工作。同时，加大协调力度，保障"引沙入颍"工程每日 26 万吨生态水进入颍河。

严格落实环保"一票否决"和奖罚制度。对完不成水污染防治目标任务的县区、单位和企业，一律不能参加评优评先活动；完不成减排治理目标任务的县（区）主要负责人和分管领导不予提拔重用，并视情况给予党、政纪处分；完不成减排治理任务或存在环保违法行为的企业主要负责人，不能推荐为各级党代表、人大代表和政协委员。对完成减排治理任务好，为全市减排治理工作作出突出贡献的县区、单位和企业要给予表彰奖励。（来源：漯河名城

网）

Attachment 39: Air Dispersion Modeling (AERMOD)

大气预测软件系统 AERMOD

简要用户使用手册

1. 手册说明

本手册基于 AERMOD Version 04300 with PRIME 用户手册编写，模型系统下载地址：http://www.lem.org.cn/support/aermod_dl.html 。

2. AERMOD 模式系统简介

AERMOD 由美国国家环保局联合美国气象学会组建法规模式改善委员会（AERMIC）开发，AERMIC 的目标是开发一个能完全替代 ISC3 的法规模型，新的法规模型将采用 ISC3 的输入与输出结构、应用最新的扩散理论和计算机技术更新 ISC3 计算机程序、必须保证能够模拟目前 ISC3 能模拟的大气过程与排放源。20 世纪 90 年代中后期，法规模式改善委员会在美国国家环保局的财政支持下，成功开发出 AERMOD 扩散模型，目前版本为 2004 年 8 月推出的 ***Version 04300 with PRIME*** 版。

该系统以扩散统计理论为出发点，假设污染物的浓度分布在一定程度上服从高斯分布。模式系统可用于多种排放源（包括点源、面源和体源）的排放，也适用于乡村环境和城市环境、平坦地形和复杂地形、地面源和高架源等多种排放扩散情形的模拟和预测。AERMOD 具有下述特点：

- 以行星边界层（PBL）湍流结构及理论为基础。按空气湍流结构和尺度概念，湍流扩散由参数化方程给出，稳定度用连续参数表示；
- 中等浮力通量对流条件采用非正态的 PDF 模式；
- 考虑了对流条件下浮力烟羽和混合层顶的相互作用；
- 对简单地形和复杂地形进行了一体化的处理；
- 包括处理夜间城市边界层的算法。

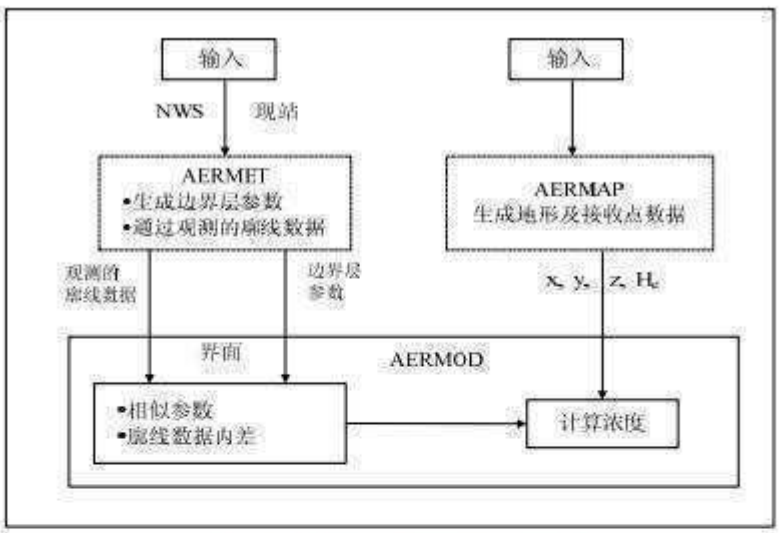


图 2-1 AERMOD 模式系统数据流程框图

2.1. AERMOD 运行流程

AERMOD 系统包括 AERMOD 扩散模式、AERMET 气象预处理和 AERMAP 地形预处理模块。AERMOD 模式运行流程如图 2-2 所示。AERMET 的边界层参数数据和廓线数据可以由输入的现场观测数据确定，或由输入的国家气象局常规气象资料（地面数据、探空数据）生成。

将地面反射率、表面粗糙度等地面特征数据，以及风速、风向、温度、云量等气象观测数据输入到 AERMET 中，在 AERMET 计算出行星边界层参数：摩擦速度 u^*、Monin-Obukhov 长度 L、对流速度尺度 w^*、温度尺度 θ^*、混合层高度 z 和地面热通量 H。得到的这些参数同气象观测数据一同传递给 AERMOD 中的 Interface，在 Interface 里通过相似关系求得风速 u、水平方向和垂直方向的湍流强度 σ_v 和 σ_w，位温梯度 $d\theta/dz$，位温 θ 和水平拉格朗日时间尺度 T_L 等变量垂直分布。

AERMET 廓线数据和边界层廓线数据经过 AERMOD 中的控制文件引用进入 AERMOD 系统，计算出相似参数，并对边界层廓线数据进行内插。AERMOD 将平均风速、水平向及垂向湍流量脉动、温度梯度、位温、水平拉格朗日时间尺度等输

AERMAP 是简化并标准化 AERMOD 地形输入数据的地形预处理器，它将输入的各网格点的位置参数(x,y,z)及其地形高度参数(x_t,y_t,z_t)经过计算转化成 AERMOD 数据处理的地形数据，包括有各个网格点位置参数（x,y,z）及其有效高度值 z_{ef}。这些数据用于障碍物周围大气扩散的计算，并结合风速 u 等参数的分布，从而可以进行污染物浓度的分布计算。

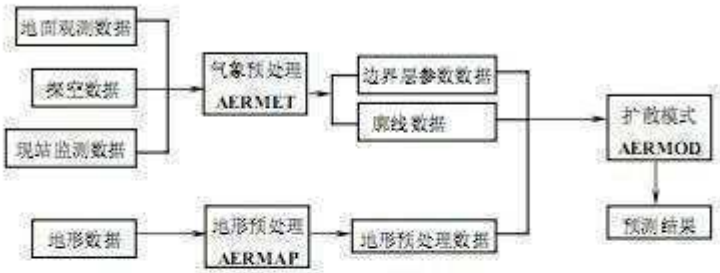


图 2-2 AERMOD 模式系统流程

2.2. 模型运行所需基本数据

2.2.1. AERMOD 基本数据要求

运行 AERMOD 扩散计算模块，至少需要建立一个文本格式的控制流文件，该控制流文件中提供了模型运行的一些程序控制选项、污染源位置及参数、预测点位置、气象数据的引用以及输出参数。若考虑建筑物下洗，控制流文件中还需要建筑物几何参数数据。

此外，AERMOD 运行还需要两个基本的气象数据文件：地面气象数据文件 ***(surface meteorological data file)***及探空廓线数据文件***(profile meteorological data file)***，这两个文件由气象预处理程序 AERMET 生成。如需考虑地形的影响，还需在控制流文件中加入地形数据文件的引用，地形预处理文件需要由地形预处理模块 AERMAP 生成。

此外还需要的场地数据包含：源所在地的经纬度、地面湿度、地面粗糙度、反射率。污染源数据包括源的编码、源的几何参数、排放率等；AERMOD 可以处理点源、线源、面源、体源。预测点数据包括预测点的地理位置和高程。AERMOD

可以处理网格预测点和任意离散的预测点。所有元数据存储在 AERMOD.INP 文件中。在运行扩散模型时，AERMOD 将对输入的数据格式进行有效性检查。

2.2.2. 污染源参数要求

AERMOD 处理的污染源包括：点源、面源、体源。

1、点源源强参数：点源排放率(g/s)；烟气温度(K)；烟囱高度(m)；烟囱出口烟气排放速度(m/s)；烟囱出口内径(m)。

2、面源源强参数：

规则形状面源：面源排放率(g/(sm^2))；高度(m)；长度(m)(东西方向)；宽度(m)(南北方向)；方向角；

不规则形状面源：面源排放率(g/(sm^2))；高度(m)；面源多边型顶点数；烟羽初始高度（m）；面源多边型顶点的坐标；

3、体源源强参数：体源排放率(g/s)；高度(m)；体源初始长度(m)；体源初始宽度(m)；

4、建筑物的下洗几何参数：

当烟囱的几何高度小于建筑物高度的 2.5 倍时，需考虑建筑物下洗作用。建筑物的几何参数：建筑物高度、宽度与方位角。

5、AERMOD 清洗作用：

AERMOD 对污染物的清洗机制包括干、湿沉降作用，需要输入分子阻抗系数、沉降速度等相关参数。

2.2.3. AERMET 气象预处理输入数据

AERMET 可以接受以下数据：1）国家气象局的标准时数据；2）来自最近的探空站的风、温度、露点探空数据；3）现场观测到的风、温度、湍流、压力、太阳辐射测量。运行 AERMOD 模型系统所需的最少测量或衍生的气象数据如下：

（1）气象数据：

时间（年、月、日、时）；风速；风向；云量（低云/总云）；降雨量、环境温度；每日两次早晨低空探空测量数据。

（2）风向与季节变化的地表特征：

需要为 AERMET 指出 12 个风向上随季节变化的中午反射率、湿度和粗糙度。反射率是被地面反射的那一部分太阳辐射；粗糙度是地面以上水平风速为 0 处的高度。该类参数可根据地表状况查表得到。

（3）其它须输入的数据：

项目所在地纬度；经度；时区（北京时间为东八区 GMT +8，对于 Version 04300 版本 Aermet，由于程序应用限制，应注意设置项目所在地时差与经度，将项目位置转换至西半球位置，详见后文 Aermet 设置部分）；风速仪的阈值；风速仪高度。

（4）可以选择输入的数据：

太阳辐射；净辐射；垂向湍流廓线；横向湍流廓线。

（5）气象数据输入格式：

常规地面气象数据：风速、风向、云量（低云/总云）、气温（干球/湿球温度）、降雨量；

探空数据：位势高度、气压、气温/露点、风速、风向；

现场观测：测风高度、风速、风向、水平风速标准差、垂直风速标准差。

（6）经 AERMET 处理生成的边界层参数：

AERMET 生成的边界层参数包括两个文件：地面气象数据文件（*.SFC）、探空廓线数据文件（*.PFL）。地面气象数据文件包括：Monin-Obuhov 长度、表面摩擦速度、表面灵敏热流、混合层高度、温度、对流速度尺度、风速、风向、位温梯度等边界层参数。探空廓线数据文件包括：位势高度、温度、风向、风速、水平向及垂直向湍流脉动量等参数。若有观测的边界层参数，可直接将观测的数据输入 AERMET 生成的边界层参数文件中。

2.2.4. AERMAP 地形预处理输入数据

AERMAP 地形预处理模块使用网格化地形数据计算预测点的地形高度尺度。AERMAP 输入的参数包括：评价区域网格点或任意点的地理坐标；评价区地形高程数据文件。其中，地形高程数据包含的地理范围不得小于评价区域的范围，以保证所有的计算点都能从地形数据文件中获取各自的地形高程值。以上参数经 AERMAP 模块运行后，生成 AERMOD 模块所需的网格点或任意点的高度尺度、地形高程。另外，AERMAP 输入的地形高程数据的空间分辨率可以低于评价区域网格点的空间分辨率，在此情况下，AERMAP 采用线性插值方法，计算出网格点的高度尺度。地形数据是 DEM 数字高程数据格式，可以在 USGS（WWW.USGS.COM）

2.3. 扩散计算

在编辑好 AERMOD 控制流文件后（系统默认为 aermod.inp），运行 aermod.exe，程序将执行浓度扩散计算。扩散模块可以计算出给定污染物的小时、日均或年平均浓度分布及烟羽抬升高度、干湿沉降。控制流中设定的"最大浓度"指令可以从各种时段平均浓度数据中挑选出任意指定数量的最大浓度（最大、次最大等）。用户需要设置单位时间中输出多少个最大值，以及最大浓度的阈值。计算结果以文本格式储存在用户设定的文件中。

2.4. 计算结果处理

AERMOD 输出的结果是以数据文件的格式存储在磁盘上，经处理生成相应格式文件，使用 ArcGIS8 及 Surfur8 进行后期作图，可生成不同污染源点位分布图、叠加背景图层后不同污染物浓度等值线图等。

2.5. AERMOD 系统对计算机硬件的要求

硬件要求：Pentium4 的 CPU,256MB 或更大的内存,1000MB 以上的磁盘空间，安装 Windows 系统的 PC 机。

实际运行发现,如果若干个点源、线源、面源和体源同时参与计算时，则该系统对计算机资源的要求相当高，建议使用的磁盘空间不低于 5GB。

2.6. AERMOD 程序执行

在 DOS 提示符下键入命令：aermod.exe　aermod.inp

或在 windows 资源管理器窗口中直接点击 aermod.exe。

Attachment 40: Questionnaire

Project name	
Name	
Age	
Gender	
Occupation	
Degree of education	
Tel	
Home Address	

Question	Answer	Population	Ratio (%)	Advantage of options
1、Have you heard of the project?	Yes	100	100	√
	No	0	0	
2、What do you think the effect to air quality after the construction of the project?	Good	26	26	
	General pollution	33	33	√
	Slight pollution	17	17	
	Serious pollution	24	24	
3、What do you think the effect to surface water quality after the construction of the project?	Good	19	19	
	General pollution	53	53	√
	Slight pollution	26	26	
	Serious pollution	2	2	
4、What do you think the effect to underground water quality after the construction of the	Good	22	22	
	General pollution	56	56	√
	Slight	19	19	

project?	pollution			
	Serious pollution	3	3	
5、What do you think the effect to noise quality after the construction of the project?	Good	34	34	
	General	38	38	√
	Bad	11	11	
	Terrible bad	17	17	
6、What do you think will be the major environmental pollution issues during construction?	Noise	28	28	
	Dust	67	67	√
	Water and soil erosion	6	6	
	Construction waste	11	11	
7、What major environmental pollution issues you concern most?	Air pollution	73	73	√
	Surface water pollution	20	20	
	Underground water pollution	18	18	
	Noise	6	6	
	Others	1	1	
8、Do you satisfy with the solutions for resolving the environmental pollution?	Satisfied	59	59	√
	No idea	41	41	
	Unsatisfied	0	0	
9、Do you think the project will promote the development of economic?	Yes	73	73	√
	No	5	5	
	No idea	22	22	
10、Will you be affected by the project construction?	Beneficial effect	65	65	√
	Adverse effect	0	0	
	No effect	35	35	
11、Will you accept the project if the environmental pollution control work well?	Yes	79	79	√
	Conditional acceptance	16	16	
	No matter	5	5	
	No	0	0	
12、Do you agree with the construction of the project and site selection?	Yes	93	93	√
	No	0	0	
	No answer	7	7	

basic information	Total	Ratio(%)	Advantage of

Gender	Male	89	89	√
	Female	11	11	
Age	＜20	1	1	
	20～45	47	47	
	＞46	52	52	√
Degree of education	Primary school	10	10	
	junior high school	40	40	√
	High school	30	30	
	University and above	20	20	
Occupation	Farmer	68	68	√
	Worker	7	7	
	Teacher	1	1	
	Cadre	23	23	
	Student	1	1	
You are represent	Personal	100	100	√
	Company unit	0	0	
	Social group	0	0	
	Other	0	0	

Impact Assessment •

Attachment 41: IFC EHS Guidelines for Waste Management Facilities（about doxin emission standard）

2.2 Occupational Health and Safety Performance

Occupational Health and Safety Guidelines

Occupational health and safety performance should be evaluated against internationally published exposure guidelines, of which examples include the Threshold Limit Value (TLV®) occupational exposure guidelines and Biological Exposure Indices (BEIs®) published by American Conference of Governmental Industrial Hygienists (ACGIH), the United States National Institute for Occupational Health and Safety (NIOSH), Permissible Exposure Limits (PELs) published by the Occupational Safety and Health Administration of the United States (OSHA), Indicative Occupational Exposure Limit Values published by European Union member states, or other similar sources.

Accident and Fatality Rates

Projects should try to reduce the number of accidents among project workers (whether directly employed or subcontracted) to a rate of zero, especially accidents that could result in lost work time, different levels of disability, or even fatalities. Facility rates may be benchmarked against the performance of facilities in this sector in developed countries through consultation with published sources (e.g. US Bureau of Labor Statistics and UK Health and Safety Executive).

Occupational Health and Safety Monitoring

The working environment should be monitored for occupational hazards relevant to the specific project. Monitoring should be designed and implemented by credentialed professionals as part of an occupational health and safety monitoring program. Facilities should also maintain a record of occupational accidents and diseases and dangerous occurrences and accidents. Additional guidance on occupational health and safety monitoring programs is provided in the **General EHS Guidelines**

Table 1. Air Emission Standards for MSW Incinerators in the EU and US

Parameter	EU	USA[a]
Total Suspended Particulates	10 mg/m3 (24-hr average)	20 mg/dscm
Sulfur Dioxide (SO_2)	50 mg/m3 (24-hr average)	30 ppmv (or 80% reduction)[b]
Oxides of Nitrogen (NO_x)	200 – 400 mg/m3 (24-hr average)	150 ppmv (24-hr average)
Opacity	n/a	10%
Hydrochloric Acid (HCl)	10 mg/m3	25 ppmv (or 95% reduction)[b]
Dioxins and Furans	0.1 ng TEQ/m3 [6 – 8 hr average]	13 ng/dscm (total mass)
Cadmium	0.05 – 0.1 mg/m3 [0.5 – 8 hr average]	0.010 mg/dscm
Carbon Monoxide (CO)	50 – 150 mg/m3	50 – 150 ppmv[c]
Lead (Pb)	(See Total Metals below)	0.140 mg/dscm
Mercury (Hg)	0.05 – 0.1 mg/m3 [0.5 – 8 hr average]	0.050 mg/dscm (or 85% reduction)[b]
Total Metals	0.5 – 1 mg/m3 [0.5 – 8 hr average]	n/a
Hydrogen fluoride (HF)	1 mg/m3	n/a

Sources:
- EU Directive 2000/76/EC (applicable to MSW and Hazardous Waste Incinerators)
- US EPA Standards of Performance for Large Municipal Waste Combustors, 40 CFR Part 60 Subpart Eb.

Notes:
a All values corrected to 7% oxygen
b Whichever is less stringent
c Depending on the type of unit: modular starved air, and modular excess air—50 ppm (4-hr average); mass burn waterwall, mass burn refractory, and circulating fluidized bed combustor—100 ppm (4-hr average); mass burn rotary waterwall—100 ppm (24-hr average); pulverized coal/refuse-derived fuel mixed fuel-fired combustor—150 ppm (4-hr average); refuse-derived fuel stoker, and spreader stoker coal/refuse -derived fuel mixed fuel-fired combustor—150 ppm (24-hr average).
mg/m3 = milligrams per cubic meter; mg/dscm = milligrams per dry standard cubic meter; ppmv = parts per million by volume; TEQ = Toxicity Equivalent Units;

Attachment 42: The villages around the project site