Henan Junma Chemical Industry Co., Ltd

Technological Transformation Project on Route of Synthetic Ammonia Raw Materials

Environmental Impact Statement

(Draft for Approval)

Henan Environmental Protection Research Institute

May, 2006

Henan Junma Chemical Industry Co., Ltd

Technological Transformation Project on Route of Synthetic Ammonia Raw Materials

Environmental Impact Statement

(Draft for Approval)

Name of Enterprise	**Henan Environmental Protection Research Institute**
Head of Institute	**Shi Wei**
Director and Assistant Chief Engineer	**Zhong Chonglin (Environmental Assessment Qualification Certificate, No. A25020002)**
Manager of Environmental Impact Assessment Center	**Lu Dongxia (Environmental Assessment Qualification Certificate, No. A25020005)**
Project Leader	**Zhang Mingying (Environmental Assessment Qualification Certificate, No. A25020007)**
Checked by	**Gao Hewen (Environmental Assessment Qualification Certificate, A25020008)**
Approved by	**Zhong Chonglin**

Henan Environmental Protection Research Institute

May, 2006

Main Persons Involved

Name	Title	Certificate No.	Division of Work	Signature
Zhang Mingying	Engineer	(Environmental Assessment Qualification Certificate, No. A25020007)	Compilation basis, project analysis, technical and economical feasibility analysis on environmental protection measures, assessment conclusions and suggestions	
Li Xianghua	Engineer	(Environmental Assessment Qualification Certificate, No. A25020022)	Technical and economical feasibility analysis on environmental protection measures, cleaning production and environmental risk assessment	
Zhao Shipei	Engineer	(Environmental Assessment Qualification Certificate, No. A25020031)	Environmental impact prediction and assessment	
Dingna	Engineer	(Environmental Assessment Qualification Certificate, No. A25020009)	Analysis on Rationalization ofsite selection of a factory, environmental feasibility and general layout	
Wangting	Assistant	(Environmental Assessment Qualification Certificate, No. A25020023)	Gross control, environmental economy cost-benefit analysis	
Lvyan Zhao Shixing Liu Junfu	Senior Engineer Engineer Senior Engineer	No. B25100005 No. B25100006 No. B25100002	Environmental condition, monitoring, assessment, management and public participation in affected areas of proposed project	
Gao Hewen	Engineer	(Environmental Assessment Qualification Certificate, No. A25020007)	Approval	
Zhong Chonglin	Senior Engineer	(Environmental Assessment Qualification Certificate, No. A25020007)	Approval	

Attached photo

Fig.

I. Project location map in Henan province

II. Location of a factory site and monitoring points

III. General layout of present factory area

IV. General layout of technological transformed factory

V. Drainage system map of factory

VI. Cross section map of the surface water monitoring

VII. General plan of Zhumadian city

VIII. Sketch map of surrounding environment in the present factory area and technological transformed factory

IX. Sketch map of drainage ditch route

Attachment:

1. Notice on distributing the *Notice of National Development and Reform Commission about Implementation of Fund Application for Pilot Project of Raw Material and Power Structure Adjustment in Nitrogenous Fertilizer Industry* (No. 1665 [2004] of Henan Development and Reform Commission, industry), of a document by Henan Development and Reform Commission

2. *Requesting Instructions of Henan Development and Reform Commission on Presenting Fund Application Report of 300,000 tons/Year Technological Transformation Project on Route of Synthetic Ammonia Raw Materials of Henan Junma Chemical Industry Co., Ltd* (No. 1988 [2004] of Henan Development and Reform Commission, industry), of a document by Henan Development and Reform Commission.

3. *Analysis Report for Coal Properties* (raw coal)

4. Raw Coal Supply Agreement for Technological Transformation Project

5. *Requesting Instructions of on Removal Problems of Residents and Relevant Units within Health protection distance for 300,000 tons/Year Technological Transformation Project on Route of Synthetic Ammonia Raw Materials* (No. 12 [2005] of Henan Junma Chemical Industry Co., Ltd) **, of a document by** Henan Junma Chemical Industry Co., Ltd**.**

6. *Reply of Zhumadian Municipal People's Government on the Issues Concerning Removal Problems of Residents and Relevant Units within Health protection distance for 300,000 tons/Year Technological Transformation Project on Route of Synthetic Ammonia Raw Materials of Henan Junma Chemical Industry Co., Ltd* (No. 147 document [2005] of Zhumadian Municipal People's Government)

7. *Letter of Environmental Protection Bureau of Zhumadian City of Henan Province on Executive Standard of Environmental Impact Assessment for 300,000 tons/Year Technological Transformation Project on Route of Synthetic Ammonia Raw Materials of Henan Junma Chemical Industry Co., Ltd*

(No. 6 letter [2005] of Henan Municipal Environmental Protection Bureau)

8. *Notice of Bureau of Environmental Protection of Yicheng District of Zhumadian City on Distributing the Control Plan for Total Amount of Pollutants of Area Major Polluting Sources in 2004* (No. 9 [2004] of Bureau of Environmental Protection of Yicheng District of Zhumadian City)

9. Recycling Agreement of Spent Catalyst

10. Comprehensive Utilization Agreement of Csectioner

11. *Reply of Henan Municipal Bureau of Environmental Protection on Environmental Impact Report of 30,000 tons/Year Melamine Project of Henan Junma Chemical Industry Co., Ltd* (No. 133 report [2003] of Henan Municipal Environmental Protection Bureau)

12. *Reply of Henan Municipal Bureau of Environmental Protection on Environmental Impact Report of 20,000 tons/Year Methylamine and 20,000 tons/Year DMF (Dimethylformamide) Project of Henan Junma Chemical Industry Co., Ltd* (No. 9 report [2004] of Henan Municipal Environmental Protection Bureau)

13. *Reply of Henan Municipal Bureau of Environmental Protection on Environmental Impact Report of Urea Transformation and 600,000 tons/Year High Concentration NPK Compound Fertilizer Project of Henan Junma Chemical Industry Co., Ltd* (No. 18 report [2001] of Henan Municipal Environmental Protection Bureau)

14. Planning Permit of Construction Site

15. *Preliminary Views of Department of Land Resources of Henan Province on land location of Technological Transformation Project on Route of Synthetic Ammonia Raw Materials by Henan Junma Chemical Industry Co., Ltd* (No. 520 letter [2004] of Department of Land Resources of Henan Province)

16. *Report of Henan Junma Chemical Industry Co., Ltd on Never Using Orignal Normal Pressure Fixed Bed Intermittent Gasifier Again after Completion of Technological Transformation Project on Route of Synthetic Ammonia Raw Materials* (No. 24 report [2005] of Department of Henan Junma Chemical Industry Co., Ltd)

17. Promise of Department of Henan Junma Chemical Industry Co., Ltd on Current Equipment Dismantling of Technological Transformation Project on Route of Synthetic Ammonia Raw Materials;

18. Acceptance letter of Sewage Treatment Station of Zhumadian City on waste water receiving of Henan Junma Chemical Industry Co., Ltd

19. Representation of Henan Junma Chemical Industry Co., Ltd on removal plan within health protection distance and financial sources of Technological Transformation Project on Route of Synthetic Ammonia Raw Materials

20. Certification of Bureau of Urban Planning of Zhumadian City on never approving construction again within health protection distance again around current technological transformed factory

21. Letter of attorney of environmental impact assessment

Attachment: registration form onenvironmental protection approval of construction project

Contents

Attached photo

Fig.

I. Project location map in Henan province

II. Locations of a factory site and monitoring points

III. General layout of current present factory area

IV. General layout of technological transformed factory

V. Drainage system map of factory

VI. Cross section map of the surface water monitoring

VII. General plan of Zhumadian

VIII. Sketch map of Surrounding environment in the present factory area and technological transformed factory

IX. Sketch map of drainage ditch route

Attachment:

1. Notice on distributing the *Notice of National Development and Reform Commission about Implementation of Fund Application for Pilot Project of Raw Material and Power Structure Adjustment in Nitrogenous Fertilizer Industry* (No. 1665 [2004] of Henan Development and Reform Commission, industry), of a document by Henan Development and Reform Commission

2. *Requesting Instructions of Henan Development and Reform Commission on Presenting Fund Application Report of 300,000 tons/Year Technological Transformation Project on Route of Synthetic Ammonia Raw Materials of Henan Junma Chemical Industry Co., Ltd* (No. 1988 [2004] of Henan Development and Reform Commission, industry), of a document by Henan Development and Reform Commission.

3. *Analysis Report for Coal Properties* (raw coal)

4. Raw coal Supply Agreement for Technological Transformation Project

5. *Requesting Instructions of on Removal Problems of Residents and Relevant Units within Health protection distance for 300,000 tons/Year Technological Transformation Project on Route of Synthetic Ammonia Raw Materials* (No. 12 [2005] of Henan Junma Chemical Industry Co., Ltd) **, of a document by** Henan Junma Chemical Industry Co., Ltd**.**

6. *Reply of Zhumadian Municipal People's Government on the Issues Concerning Removal Problems of Residents and Relevant Units within Health protection distance for 300,000 tons/Year Technological Transformation Project on Route of Synthetic Ammonia Raw Materials of Henan Junma Chemical Industry Co., Ltd* (No. 147 document [2005] of Zhumadian Municipal People's Government)

7. *Letter of Environmental Protection Bureau of Zhumadian City of Henan Province on Executive Standard of Environmental Impact Assessment for 300,000 tons/Year Technological Transformation Project on Route of Synthetic Ammonia Raw Materials of Henan Junma Chemical Industry Co., Ltd* (No. 6 letter [2005] of Henan Municipal Environmental Protection Bureau)

8. *Notice of Bureau of Environmental Protection of Yicheng District of Zhumadian City on Distributing the Control Plan for Total Amount of Pollutants of Area Major Polluting Sources in 2004* (No. 9 [2004] of Bureau of Environmental Protection of Yicheng District of Zhumadian City)

9. Recycling Agreement of Spent Catalyst

10. Comprehensive Utilization Agreement of Csectioner

11. *Reply of Henan Municipal Bureau of Environmental Protection on Environmental Impact Report of 30,000 tons/Year Melamine Project of Henan Junma Chemical Industry Co., Ltd* (No. 133 report [2003] of Henan Municipal Environmental Protection Bureau)

12. *Reply of Henan Municipal Bureau of Environmental Protection on Environmental Impact Report of 20,000 tons/Year Methylamine and 20,000 tons/Year DMF (Dimethylformamide) Project of Henan Junma Chemical Industry Co., Ltd* (No. 9 report [2004] of Henan Municipal Environmental Protection Bureau)

13. *Reply of Henan Municipal Bureau of Environmental Protection on Environmental Impact Report of Urea Transformation and 600,000 tons/Year High Concentration NPK Compound Fertilizer Project of Henan Junma Chemical Industry Co., Ltd* (No. 18 report [2001] of Henan Municipal Environmental Protection Bureau)

14. Planning Permit of Construction Site

15. Preliminary Views of Department of Land Resources of Henan Province on land location of Technological Transformation Project on Route of Synthetic Ammonia Raw Materials of Henan Junma Chemical Industry Co., Ltd (No. 520 letter [2004] of Department of Land Resources of Henan Province)

16. Report of Henan Junma Chemical Industry Co., Ltd on Never Using Orignal Normal Pressure Fixed Bed Intermittent Gasifier Again after Technological Transformation Project on Route of Synthetic Ammonia Raw Materials (No. 24 report [2005] of Department of Henan Junma Chemical Industry Co., Ltd)

17. Promise of Department of Henan Junma Chemical Industry Co., Ltd on Current Equipment Dismantling of Technological Transformation Project on Route of Synthetic Ammonia Raw Materials;

18. Acceptance letter of Sewage Treatment Station of Zhumadian City on waste water receiving of Henan Junma Chemical Industry Co., Ltd

19. Representation of Henan Junma Chemical Industry Co., Ltd on removal plan within health protection distance and financial sources of Technological Transformation Project on Route of Synthetic Ammonia Raw Materials

20. Certification of Bureau of Urban Planning of Zhumadian City on never approving construction again within health protection distance again around technological transformed factory

21. Letter of attorney of environmental impact assessment

Attachment: registration form on environmental protection approval of construction project

Introduction

Henan Junma Chemical Industry Co., Ltd (hereinafter referred to as Junma Company) is one of top 500 enterprises in chemical industry of China. With total assets of RMB 860 million, asset-liability ratio of 58% and bank credit rank of AAA, the honorary titles it has received cover " national pioneer enterprise for producing fertilizer", "clean and civilized factory", "leak free factory", "civilized enterprise at provincial level", etc. The company has 1450 staffs currently, which includes 485 professional technicians, and has the annual production capacity of 500,000 tons synthetic ammonia, 550,000 tons urea, 400,000 tons high concentration compound fertilizer and 100,000 methanol. The leading product of urea is regarded as the national inspection-free product. In 2003, the sales revenue was RMB 560.17 million with profit of RMB 60.57 million and all economic and technical norms were among the best compared with the same industry in the nation. In the same year, the company's total assets were RMB 300 million, total debts were RMB 166 million and asset-liability ratio was 55%; the sales revenue of current year was RMB 125 million with profit of RMB 20.55 million.

Due to the limitation of gas-producing process, only the coal from Jincheng city, Shanxi Province can be adopted at present. The coal price can be up to RMB 520 per tons and the highest was RMB 670 per tons. The high price of raw materials makes the production cost of enterprise rising year by year, which directly affects the economic benefit of enterprise, but the contradiction between low efficiency during coal utilization and environmental pollution is becoming increasingly conspicuous. In order to localize raw coal supply, lower production cost, stabilize production and improve benefits, Henan Junma Chemical Industry Co., Ltd plans to construct the Technological Transformation Project on Route of Synthetic Ammonia Raw Materials. This project belongs to technological transformation type. The proposed site locates about 1km in the southeast of the existing factory. Texaco gasification process is planned to substitute current fixed bed intermittent gasification process. Meantime, current synthetic ammonia devices will be improved, production devices for air separation, gasification, conversion, desulfurization and decarbonization, methanolizing and methanation, synthesization and compression of synthetic gas are planned to be constructed and corresponding devices of existing project will be dismounted. Current methanol distillation and urea systems won't be transformed. The production capacity and production plan of enterprise won't change after technological transformation . The raw material route technological transformation involves with gas-producing and synthetic sections. At present, the *Feasibility Study Report* is compiled by East China Project Technology Co., Ltd. The total investment of project is RMB 981.26 million (includes 17.91 million US dollars) and fund resources are bank loan of RMB 679.52 million and self-financing of RMB 301.74 million. The project has good economical and environmental benefits and conforms to industry policies and environmental protection polices of the national. It has listed by the nation as selective trial project of raw material and power structural adjustment in nitrogenous fertilizer industry in the year 2004 and 2005. The fund application report has already been submitted to National Development and Reform Committee by Henan Development and Reform Commission with the report number of [2004]1988.

Entrusted by the owner, Henan Environmental Protection Research Institute is responsible for environmental impact assessment. The environmental impact report needs to be prepared according to *Classified Management Catalog of Construction Project* and it has been compiled based on *Guidelines for Environmental Impact Assessment*.

On March 2, 2006, Henan Environmental Impact Accessment Center held the technical review meeting of the report in Zhumadian city and made certain modification according to the minutes of meeting, through which the *Environmental Impact Report of Technological Transformation Project on Route of Synthetic Ammonia Raw Materials of Henan Junma Chemical Industry Co., Ltd* is formed (draft).

1. General Considerations

1.1 Name, scale and the basic composition of project

See table 1.1-1 for name, scale and composition of project

Table 1.1-1　Composition of project

Project Name			Technological Transformation Project on Route of Synthetic Ammonia Raw Materials of Henan Junma Chemical Industry Co., Ltd
Construction unit			Henan Junma Chemical Industry Co., Ltd
Project Type			Technological transformation
Location			East of Yicheng avenue, south of Lianjiang road, about 1km from current factory
Scale	Existing project	Synthetic ammonia	Design production capacity of current synthetic ammonia is 160,000 tons/a, actual capacity is 220,000 tons/a.
		Urea	Design production capacity of current urea is 160,000 tons/a, actual capacity is 220,000 tons/a.
	Project under construction	Methanol	Annual production capacity of methanol is 150,000 tons/a.
		Melamine	Annual production capacity of melamine is 30,000 tons/a.
		Methylamine and DMF	Methylamine is 20,000 tons/a, DMF is 20,000 tons/a
		Compound fertilizer	Annual production capacity of Compound fertilizer is 600,000 tons/a.
	Technological Transformation Project		Technological Transformation Project only relates with current gasification process and synthetic ammonia devices. Production scale and other procedure routes keep current status.
Project investment		Total investment	RMB 981.26 million
		Environmental protection investments	RMB 41.40 million

1.2 Compilation basis

1.2.1 Laws, regulations, programs and stipulations

(1) *Law of Environmental Protection of the People's Republic of China* (December 26, 1989)

(2) *Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution* (September 1, 2000)

(3) *Law of the People's Republic of China on the Prevention and Control of Water Pollution* (May 15, 1996)

(4) *Law of the People's Republic of China on Prevention and Control of Pollution From Environmental Noise* (March 1, 1997)

(5) *Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste* (April 1, 1996)

(6) *Cleaner Production Promotion Law of the People's Republic of China* (January 1,

2003)

(7) *Law of the People's Republic of China on Environmental Impact Assessment* (September 1, 2000)

(8) *Regulations on the Administration of Construction Project Environmental Protection* (November 29, 1998)

(9) *The Decision of the State Council on Several Issues Related to Environmental Protection* (No. 31 [1996] of State Council)

(10) *Notice of State Environmental Protection Administration of China on risk assessment of Serious Potential Accidents due to Environmental Pollution* (No.057 of State Environmental Protection Administration of China)

(11) *Notice of State Environmental Protection Administration of China on Strengthening of Enviromental Impact Assessment Management and Environmental Risk Prevention* (No.152of State Environmental Protection Administration of China)

(12) *Stipulation for Environmental Protection Design of Construction Project*

(13) *Guiding Principles for the Development of Chemical Industry*

(14*) Tenth Five Year Plan for Chemical Industry*

(15) *Regulations on the Control over Safety of Dangerous Chemicals*

(16) *Safety Regulations on Dangerous Chemical Goods*

(17) *National Tenth Five Year Plan for Environmental Protection*

(18) *Water Pollution Control in the Huaihe River Basin*

(19) *Tenth Five Year Plan for Water Pollution Control in the Huaihe River Basin (Zhumadian City)*

(20) *Henan Tenth Five Year Plan for Environmental Protection*

(21) *Zhumadian Tenth Five Year Plan for Environmental Protection*

1.2.2 Files and documents of project

(1) *Feasibility Study Report of Technological Transformation Project on Route of Synthetic Ammonia Raw Materials of Henan Junma Chemical Industry Co., Ltd;*

(2) Notice of Henan Development and Reform Commission on distributing the *Notice of National Development and Reform Commission about Implementation of Fund Application for Pilot Project of Raw Material and Power Structure Adjustment in Nitrogenous Fertilizer Industry* (No. 1665 [2004] of Henan Development and Reform Commission, industry);

(3) *Requesting Instructions of Henan Development and Reform Commission on Presenting Fund Application Report of 300,000 tons/Year Technological Transformation Project on Route of Synthetic Ammonia Raw Materials of Henan Junma Chemical Industry Co., Ltd* (No. 1988 [2004] of Henan Development and Reform Commission, industry)

(4) *Letter of Environmental Protection Bureau of Zhumadian City of Henan Province on Executive Standard of Environmental Impact Assessment for 300,000 tons/Year Technological Transformation Project on Route of Synthetic Ammonia Raw Materials of Henan Junma Chemical Industry Co., Ltd* (No. 6 letter [2005] of Henan Municipal Environmental Protection Bureau);

(5) *Notice of Bureau of Environmental Protection of Yicheng District of Zhumadian City on Distributing the Control Plan for Total Amount of Pollutants of Area Major Polluting Sources in 2004* (No. 9 [2004] of Bureau of Environmental Protection of Yicheng District

of Zhumadian City)

(6) *Reply of Zhumadian Municipal People's Government on the Issues Concerning Removal Problems of Residents and Relevant Units within Health protection distance for 300,000 tons/Year Technological Transformation Project on Route of Synthetic Ammonia Raw Materials of Henan Junma Chemical Industry Co., Ltd* (No. 147 document [2005] of Zhumadian Municipal People's Government);

(7) *Preliminary Views of Department of Land Resources of Henan Province on land location of Technological Transformation Project on Route of Synthetic Ammonia Raw Materials of Henan Junma Chemical Industry Co., Ltd* (No. 520 letter [2004] of Department of Land Resources of Henan Province);

(8) Permission notes for location;

(9) Letter of attorney of environmental impact assessment

1.2.3 Technological specification

(1) *Guidelines for Environmental Impact Assessment (HJ/T2.1~2.3-9.3)*;

(2) *Guidelines for Environmental Impact Assessment (Sound Environment)(HJ/T2.1~2.3-9.3);*

(3) *Guidelines for Environmental Impact Assessment of Construction Project* (HJ/T169-2004);

(4) *Technological Principle and Methods for Enactment of Local Water Pollutant Discharge Standard (GB/T3839-83)*;

(5) *Technological Principle and Methods for Enactment of Local Air Pollutant Discharge Standard (GB/T13201-91).*

1.3 Environmentally sensitive areas and object to be protected

Both current factory and technological transformed factory of Junma Company locate within planning regions of Zhumadian city. The sensitive targets of adjacent schools and residential areas are main protective targetivesof this project. Zhumadian city is not within sulfur dioxide pollution control district and the environmental air in the area has reached Grade II according to *Environmental air Quality Standard* by 2005. The surface-water of factory is from Huaihe Basin. The planned water quality of pollutant-holding aquatic system-Huangyou river is IV type. Water from lower reaches and Huangnihe will finally flow into Suya lake, for which the water body function is classed as type III.

See table 1.3-1 and attached Fig 8 for distribution of main environment protective targets in factory area. See table 1.3-2 for distribution of sensitive points around factory area.

Table 1.3-1 **Environmentally sensitive areas and object to be protected**

Environmental category		**Environmentally sensitive areas and object to be protected**	Functional division	Pollutant controlled	Control requirements
Environmental air		Factory area and villages around factory	Category II	TSP, PM_{10}, SO_2, NO_2, NH_3, H_2S and methanol	①Volume of process waste gas and boiler flue gas is up to the discharge standards and meet volume control requirements. ②Regional environmental air quality won't decline due to project implementation
Water enviro-nment	Surface water	Huangyou River (pollutant-holding section)	Category IV	Cod, Ammoniacal Nitrogen, Sulfide,	①Volume of various waste water is up to the discharge standards and meet volume

		Suya lake	Category III	Cyanide Compounds and Volatile Phenol	control requirements. ② Current function of surface water can't decline.
	Under-ground water	Phreatic water around factory and pollution & waste discharge aquatic system of project	Category III	pH, volatile phenol, S^{2-}, CN^-, NH-N, Nitrate-N and NIT (calculated based on N)	Function of phreatic water can't change due to pollution discharge of project
Sound environment		Residential area within 200m from the factory	Category II	Control of noise source intensity and noise in factory	No people disturbing problem
Solid waste		Environmental air, surface water and underground water in factory area	Comprehensive utilization and safe disposal of csectioner and spent catalyst of gas-making furnace and boiler		Won't cause pollution to factory and its surrounding environment

Table 1.3-2 Distribution of sensitive targets around factory

Environmental element	Protection target	Position and distance from factory	Population (person)	Targetive function	Remarks
Environmental air	Living quarters of factory	W vicinity	2300	Living quarters in factory	Take current factory as the center
	Living quarters of Gongluduan	N50m	400	Nearest Living quarters outside the factory	
	Fuzhuang village	N350m	1200	Village near the factory	
	Angel bilingual kindergarten	W150m	280	Educational unit near the factory	
	13th primary school	W100m	550	Educational unit near the factory	
	Transportation technical school	NW260m	1200	Village near the factory	
	Fulou village	SW150m	1500	Village near the factory	
	Zhouwancun village	W600m	2000	Village near the factory	Take technological transformed factory as the center
	Dongliulizhuang village	N800m	1000	Village near the factory	
	Niuzhuang village	E vicinity	200	Village near the factory	
Water environment	Huangyou river	S14000m	/	IV type pollutant-holding aquatic system	Take current factory as the center
	Suya lake	E20km	/	III type aquatic system, mainly for flood prevention, irrigation, agriculture and fish-farming	
Sound environment	Living quarters of Gongluduan	N100M	400	Nearest Living quarters outside the factory	Take current factory as the center
	Living quarters of factory	W vicinity	2000	Living quarters near the factory	
	Qianjin new village	SW vicinity	500	Living quarters near the factory	
	Niuzhuang village	E vicinity	200	Village near the factory	Take technological transformed factory as the center

Table 1.3-2 Distribution of sensitive targets around factory

Environmental element	Protection target	Position and distance from factory	Population (person)	Targetive function	Remarks
Environmental air	Living quarters of factory	W vicinity	2300	Living quarters in factory	Take current factory as the center
	Living quarters of Gongluduan	N50m	400	Nearest Living quarters outside the factory	
	Fuzhuang village	N350m	1200	Village near the factory	
	Angel bilingual kindergarten	W150m	280	Educational unit near the factory	
	13th primary school	W100m	550	Educational unit near the factory	
	Transportation technical school	NW260m	1200	Village near the factory	
	Fulou village	SW150m	1500	Village near the factory	
	Zhouwancun village	W600m	2000	Village near the factory	Take technological transformed factory as the center
	Dongliulizhuang village	N800m	1000	Village near the factory	
	Niuzhuang village	E 紧邻 E vicinity	200	Village near the factory	
Water environment	Huangyou river	S14000m	/	IV type pollutant-holding aquatic system	Take current factory as the center
	Suya lake	E20km	/	III type aquatic system, mainly for flood prevention, irrigation, agriculture and fish-farming	
Sound environment	Living quarters of Gongluduan	N100M	400	Nearest Living quarters outside the factory	Take current factory as the center
	Living quarters of factory	W vicinity	2000	Living quarters near the factory	
	Qianjin new village	SW vicinity	500	Living quarters near the factory	
	Niuzhuang village	E vicinity	200	Village near the factory	Take technological transformed factory as the center

*: According to assessment, the technological transformed factory will move eastward about 200m so that it is 800m from Zhouwan after movement and the it is more than 1000m between Zhouwan and synthetic ammonia production unit.

1.4 Assessment grade and range

1.4.1 Assessment grade of environmental air

See table 1.4.1 for discharge amount in equivalent and assessment grade of main pollutants calculated according to grading principles in *Guidelines for Environmental Impact Assessment (Atmospheric Environment)* （HJ/T2.1－2.3－93）.

Table 1.1-1 Confirmation of assessment grade of environmental air

Item	Unit	Evaluate factors			Remarks
		SO_2	PM_{10}	NO_x	
Environmental standard (C_{0i})	mg/Nm^3	0.50	0.15	0.24	1.$P_i=Q_i/C_{0i}\times10^9$; 2.Smoke dust adopts Grade II standard in GB3095-1996
Discharge amount(Q_i)	t/h	0.68×10^{-3}	0.32×10^{-3}	0.165×10^{-3}	
Discharge amount in equivalent (P_i)	m^3/h	1.36×10^6	2.1×10^6	6.88×10^5	
Grading standard	$2.5\times10^8>P_i$				
Terrain	Complex				
Assessment grade	Grade III				

1.4.2 Confirmation of assessment grade of water environment

According to grading principles of water environmental impact assessment in *Guidelines for Environmental Impact Assessment (Surface Water Environment)* （HJ/T2.3-93）, the surface water is confirmed as grade III. See table 1.4-2 for grading basis.

Table 1.4-2 Environmental impact assessment of surface water

Item	Waste water discharge of constructed project	Complexity level of waste water quality for constructed project	Scale of surface water	Requirements of surface water quality	Confirmation of grading
Description	912	Category of pollutant	＜$15m^3/s$	CategoryIV	Grade III
Assessment basis	200 ≤Q＜1000	Water quality is complex	Stream	CategoryIV	

1.4.3 Assessment grade of sound environment

This project belongs to technological transformed project and the site is farmland with villages nearby and 200 peoples within 200 meters before constructing according to clause 4.2.2.2 in *Guidelines for Environmental Impact Assessment (Sound Environment)* HJ/T2.4—1995 (will move after construction finishes). Based on the plan, the site is listed in industry area and is applicable to category III standard in GB3096-93. It is confirmed that the grade for sound environmental impact is category III and assessment factor is Leq (A).

1.5 Assessment range

In accordance with the assessment grade and in consideration of local annual dominant wind direction and distribution of main protective targets, the assessment range are confirmed as follows:

Environmental air: centered around the factory, eastward for 2.5km, southward for 3.75km and westward & northward for 6km each; total area is $100km^2$.

Surface water: from 200m in upstream of factory waste water inlet of Huangyou river to front 15km in downstream before flowing into Huangnihe

Underground water: underground water along the village for waste water ditch outside the factory

Noise: factory boundary noise and acoustic environment sensitive point within 200m.

1.6 Assessment standard and factor

1.6.1 Environmental quality standard

See table 1.6-1 for environmental quality standard based on No.6 letter [2005] of Environmental Protection Bureau of Zhumadian City.

Table 1.6-1 Environmental quality standard

Environ-mental element	Standard name and level (category)	Pollutant	Concentration limit		(mg/L) Dry farming
			Category III	Category IV	
Surface water	*Environmental Quality Standard for Surface Water (GB3838-2002)* category III and IV *Standards for Irrigation Water Quality (GB5084-92)* dry farming	pH	6～9	6～9	—
		COD	≤20	≤30	≤300
		BOD_5	≤4	≤6	≤150
		Ammonian	≤1.0	≤1.5	—
		Cyanide	≤0.2	≤0.2	≤0.5
		Volatile phenol	≤0.005	≤0.001	≤1.0
		Trate nitrogen	≤10	—	—
		Sulfide	≤0.2	≤0.5	≤1.0
		Fluoride	≤1.0	≤1.5	≤2.0
		Petroleum type	≤0.05	≤0.5	≤10
Environmental air	*Environmental air Quality Standard (GB3095-1996)* grade II	Pollutant	Value time		Concentration limit
		SO_2	Yearly value Daily value One hour average		0.06 0.15 0.50
		TSP	Yearly value Daily value		0.20 0.30
		PM_{10}	Yearly value Daily value		0.10 0.15

		NO_2	Yearly value Daily value One hour average	0.08 0.12 0.24
	Sanitary Standard for Design of Industrial Enterprises (TJ36-79) maximum allowable concentration in residential area	Methanol	One time Daily value	3.00 1.00
		NH_3	一次 One time	0.20
		H_2S	一次 One time	0.01
Under-ground water	*Quality Standard for Ground Water* (GB/T14848-93) category III	Pollutant		Concentration limit for category III
		pH		6.5～8.5
		Total hardness (calculated based on $CaCO_3$)		≤450
		Total dissolved solids		≤1000
		Ammonian		≤0.2
		NO_2^--N		≤0.02
		NO_3^--N		≤20
		Volatile phenol (calculated based on phenyl hydroxide)		≤0.002
		Prussiate		≤0.05
Sound environment	*Ambient Noise Standard for Urban Area(GB3096 - 93)* category III	Equivalent continuous sound A level		Day 65dB(A)
				Night 55 dB(A)

1.6.2 Discharge control standard of pollutant

See table 1.6-2 for discharge control standard of pollutant of this project

Table 1.6-2 Discharge control standard of adopted

Pollution	Standard name and level (category)	Pollution factor	Standard limit	
			mg/L	kg/t*
Waste water	Table 2 in *Water Pollutants for Ammonia Industry (GB13458-2001)*	Discharge of water	$50m^3/t^*$	
		pH	6～9	
		COD_{Cr}	150	7.5
		SS	100	5.0
		Ammonian	70	3.5
		Cyanide	1.0	0.05
		Sulfide	0.5	0.025

		Volatile phenol	0.1	0.005
		Petroleum type	5	0.25
Waste gas	*Table 2 in Integrated* Discharge *Standard of Air Pollutants*, grade II	Fugitive discharge of methanol	Maximum concentration point outside the factory: 12mg/m^3	
		Fugitive discharge of particulate matter	Maximum concentration point outside the factory: 1.0mg/m^3	
		Particulate matter	150mg/m^3(current) 120mg/m^3(newly built)	
			(25m exhaust funnel) 7.6kg/h (35m exhaust funnel) 16.5kg/h	
		Methanol	190mg/m^3 （40m）50kg/h	
	Table 1 and table 2 in *Discharge Standard for Odor Pollutants (GB14554 - 93)*	Sulfureted hydrogen	Factory boundary (current) 0.1mg/Nm^3 ((technological transformation) 0.06 mg/Nm^3 35m exhaust funnel) 1.8kg/h (60m exhaust funnel) 5.2kg/h	
		NH_3	Factory (current) 2.0 mg/Nm^3 (technological transformation) 1.5 mg/Nm^3 (60m exhaust funnel) 75kg/h	
	Discharge Standard of Air Pollutants for Coal-Burning Quill-burning Gas-fired Boiler (GB13271-2001), category II (current)	Smoke and dust	I time period≤250mg/Nm^3 II time period≤200mg/Nm^3	
		SO_2	I time period≤1200mg/Nm^3 I time period≤900mg/Nm^3	
Solid wastes	*Standard for Pollution Control on the Storage and Disposal Site for General Industrial Solid Wastes (GB18599-2001), Standard for Pollution Control on Hazardous Waste Storage (GB18597-2001) , Standard for Pollution Control on the Security Landfill Site for Hazardous Wastes (GB18598-2001)*			
Noise	*(GB12348-90)* category III standard	Noise	Day 65dB(A) night 55dB(A)	

Remark: * t is the volume of NH_3.

1.7 Assessment object, content and emphases

1.7.1 Assessment object

Technological Transformation Project on Route of Synthetic Ammonia Raw Materials of Henan Junma Chemical Industry Co., Ltd, including existing project and project under construction.

1.7.2 Assessment content

(1) Current condition of regional environmental air, water environment and ambient noise shall be monitored and current environment quality shall be assessed based on full

investigation of natural environment, socioeconomic situation and current sewage disposal, etc in factory area.

(2) Pollutant discharge of this project shall be defined according to the analysis and calculation of environment pollution factors.

(3) Centered on environmental air and surface water, the influence range and degree of project operation on regional environment shall be predicted and the effect of project construction on improvement of regional environment quality shall be assessed.

(4) Based on the principle of cleaning production, standardized discharge, replacing the old by the new, increasing output and reducing pollutant and overall control, etc, the feasibility of pollution control measures for existing project & Technological Transformation Project and the cleaning production level of project shall be analyzed and assessed; modification suggestion on existing environmental issues of existing project shall be proposed.

(5) Definite conclusions of environmental impact on project and environmental feasibility for project construction shall be provided.

1.7.3 Assessment emphasis

Pollution factors and pollution control measures analysis of project, environmental air impact assessment, accidents environmental risk assessment, environmental feasibility study for site selection and control of total discharge of pollutants

2. Environment overview of Area Effected by Proposed Project

2.1 Natural environment overview of the region

2.1.1 Geopolitical location

Zhumadian is located in the south of Henan Province. The geographic coordinates is that: longitude between 113°10′ and 115 ° 12' east, latitude between 32 ° 18 ' and 33 ° 35' north.

Junma Company lies in the planning area of Zhumadian city, the eastern section of Dongfeng Road of of Zhumadian city. It faces Beijing-Zhuhai expressway on east and borders on Beijing-Guangzhou railway and 107 national highway on west, combining with Zhuxin in front, the traffic is very convenient. The proposed site of Technological Transformation Project locates about 1km in the southeast of the existing factory.

Zhumadian is not within control area of sulfur dioxide pollution and it belongs to the Huaihe river basin.

2.1.2 Terrain, land feature and geology

Zhumadian locates in aggraded flood plain region in front of Funiu Mountain. With open geography, it slightly slopes to the east. The terrain is relatively flat and the fluctuation difference of terrain is small (the relative height difference is about 1m). The factory is in neogenic basin of arcuate tectonsic belt between Funiu Mountain and Dabie Mountain and the upper is covered with the quaternary flood alluvial stratum of small thickness. The superficial aqueous stratum consists of middle and upper pleistocene series alluvial of quaternary, pluvial facies fine sand, medium-fine sand and sand gravel, and the buried depth of water is 6-8m; the deep aqueous stratum consists of fine sand, muddy medium coarse sand and pebble gravel, etc in flood alluvial at the bottom of pleistocene series of the quaternary and ice accretion, lacustrine deposit and shale at the upside of lower pleistocene series, and the buried depth of water is 60-250m.

2.1.3 Climatic features

Zhumadian is in the transition zone between north subtropical zone and warm temperate zone and has a continental monsoon type humid climate. It has four distinct seasons and mild climate. According to the meteorological data from Zhumadian meteorological station for many years, the city's annual average temperature is 14.9 ℃, the annual average atmospheric pressure 1006.9hPa, the annual average relative humidity is 73%, the annual sunshine is 2166.8 hours, the annual average rainfall is 979.2mm, the annual average evaporation is 1498.5mm and the annual average frost-free period is 217 days.

The dominant wind direction for the city throughout the year is northwest, and the west wind and the northeast wind take the second place. The factory locates at the downwind direction of local dominant wind; the annual average wind speed is 2.1m/s and the static wind frequency is 13.3%.

2.1.4 Hydrology and hydro-geology

2.1.4.1 Surface water

Zhumadian belongs to Hongru river system of Huaihe river basin. Main rivers in factory area cover Lianjiang river, Lengshui river, Xiaoqing river and Huangyou river, etc, which flow into Suya lake reservoir.

The surface water in factory area belongs to Hongru river system of Huaihe river basin. Huangyou river is the pollutant-holding aquatic system, which originates from eastern suburb of Zhumadian city and holds industry and domestic sewage from eastern part of Zhumadian city. Huangyou river is one small tributary at the up stream of Suya lake reservoir and it flows into Suya lake reservoir in Runan area after joining another small tributary of Huangheni.

Suya lake reservoir locates in Runan county of eastern Zhumadian city and is about 20km from this project. With the length of 35km from north to south, width of 15km from east to west, total area of 167km^2, reservoir capacity of 1656, 000,000m^3 , water elevation between 52.5 meter and 53.5 meter, highest water level of 54.5 meter in flood season, highest water level of 52.5 meter in non-flood season, Suya lake is the largest plain artificial regulating reservoir with main functions of flood prevention and irrigation and additional functions of power generation, agricultural use and fish-farming, etc and it has long been known as “Taihu lake in Jiangbei district”. In June, Suya lake reservoir was specially approved by provincial government as wetland natural protection area at provincial level. According to the statistics, tens of thousands of birds build the nests in the lake area throughout the year currently. About 130 kinds of migratory birds and resident birds are found, which includes 3 kinds of first class national protected animals and 11 kinds of birds that are listed in *Convention on International Trade in Endangered Species of Wild Fauna and Flora*.

See attached Fig.5 for water system in factory area.

2.1.4.2 Underground water

Underground water condition: the assessed area is in neogenic basin of arcuate tectonsic belt between Funiu Mountain and Dabie Mountain, the base is the stratum of terrigenous clastic rock and carbonate rock through ocean-land interaction or marine sediment of paleozoic carbon system or ordovician and cambria systems, it will directly deposit into continental beds of tertiary system and the upper is covered with the quaternary flood alluvial stratum of small thickness. The superficial aqueous stratum consists of middle and upper pleistocene series alluvial of quaternary, pluvial facies fine sand, medium-fine sand and sand gravel, and the buried depth of water is 6-8m; the deep aqueous stratum consists of fine sand, muddy medium coarse sand and pebble gravel, etc in flood alluvial at the bottom of pleistocene series of the quaternary and ice accretion, lacustrine deposit and shale at the upside of lower pleistocene series, and the buried depth of water is 60-250m.

The groundwater of shallow layer is supplied with precipitate water, lateral radial flow of ground water and well irrigation. The radial flow direction of shallow groundwater in factory area is from northweast from southeast generally. Hydraulic gradient in low-water period is 1.3‰～2.5‰ and hydraulic gradient in high-water period is 1.3‰～2‰. Drainage manner in shallow layer mainly cover agriculture exploitation, evaporation drainage and radial flow drainage, etc. The underground water quality is good but is poor and is mainly supplied by water of diversion project from Banqiao to Zhumadian.

2.2 Social and economy overview of the region

The site of project is under the administration jurisdiction of Yicheng district, Zhumadian city and Zhumadian Municipal Committee and Municipal Government also locate here. Yicheng district currently has jurisdiction over 11 countries of Xianglin, Laojie, Xiangshan, Liuge, Shunhe, Humiao, Gucheng, Zhuguodong, Shuitun, Guanwangmiao and Zhushi, etc and four subdistrict administrative offices of Dongfeng road, Renmin street, Xinhua street and Xiyuan street. According to the statistic in the year of 2003, the total population in Yicheng district was 570,400, including the non-agricultural population of 227,100 and the agricultural population of 343,300; arable land area of the region was 38,800 hectares; the annual gross domestic product (calculated based on the current year’s price) was RMB 5.25 billion, for which the first industry was RMB 530 million, the second industry was RMB 2.61 billion and the tertiary industry was RMB 2.11 billion and they separately accounted for 10.1%, 49.7% and 40.2% of the gross national product. From above we can see the industry, building and other social services occupy a very important position in the urban economic structure of Yicheng district. Light industry is dominant in the region and the output of light and heavy industries separately accounts for 57.7% and 42.3% the total output value.

Zhumadian has a convenient transportation: the 107 National Highway and the Beijing-Guangzhou railway cross the city and distance from Bejing-Shenzhen Expressway to the eastern part of Zhumadian is less than 1km. The criss-crossed roads among Zhumadian urban areas and its nine counties make one convenient transportation network being formed.

2.3 Urban development and environmental protection planning of Zhumadian

2.3.1 Uban development plan

Urban characteristics for Zhumadian city is that: it is an important city in central south of Henan province and is a modern city developing trade, tour and new and high technology industries based on processing of agricultural and side-line products , medicine and textile and other light industries.

Development direction of city land use for construction: focusing on development of eastern and northern parts and developing western parts properly.

Urban planning structure: group planning structure is adopted. The city can be divided into three parts of east, west and north based on Beijing-Guangzhou Railway, Lengshui river and Lianjiang river. The west group, including orginal western areas and adjacent areas , lies west of Railway, south of Lengshui river and north of Lianjiang river, and is the business and finance center, culture center and comprehensive living area at municipal level; the north group lies west of Railway and north of Lengshui river and is the new developed area, administrative center , concentrated development zone of high and new industries and supporting residential district of the city; the east group lies in east of Railway, that is the northern parts of the city and its adjacent areas, and is the area of secondary and tertiary industries and center of warehousing, logistics and wholesaling, provided with group level business center and matching residential district.

Industrial land-use planning of central area: the industrial land-use for urban is planned to be 1239.4hm^2, which accounts for 16.84% of total urban construction land. It is planned to divide into eastern industrial park, northern industrial area and sourthern industry area.

Industrial park in east of the city: arrange the first and second industries and the tertiary-industry with little pollution; the place between the east 3rd ring road and highway is planned to be as long-term industry land use; enterprises with great pollution discharge must be strictly prevented from entering into the northern part of Lianjiang river.

Industrial district in north of the city: focusing on developing high and new technology industry which has little influence on environment based on current high and new technology industrial development zone and in combination with development and construction of new developed area in northern part of city.

Industrial district in south of the city: for areas in the west of railway and in the south of

Lianjiang river, industries without exhaust gases pollution can be arranged and industries which have slight influence on environment may be developed properly.

All the proposed factory addresses of this project are in the industrial park in east of the city:

See Fig.7 for overall urban planning of Zhumadian city

2.3.2 Environmental protection planning

According to the 11th Five-Year Ecological Improvement and Environmental Protection in Zhumadian city, the main goal for environmental protection is:

Environmental air: by 2005, the SO_2 and NO_2 in the air can be up to the grade II standard of *Ambient Air Quality Standard* for Zhumadian city. Focus during the 11th Five-Year period shall be paid on controlling smoke and dust, and industry powder. By 2005, the discharge of industry smoke and dust, and the power shall be separately controlled within 40,000 tons and 30,200 tons, and the discharge of SO_2 shall be controlled within 32,220 tons.

Water environment: by 2005, water quality for chief tributary of Huaihe River governed by the city and Yangtze River valley must satisfy the surface water quality environment standard confined by the planning. The Huai River region is the main polluted area. By 2005, the maximum pollution discharge of Hongru river of Huai River region shall be controlled within 52.65 million tons and the maximum allowable discharge amount of COD shall be 11908 tons.

2.4 Regionalization according to environmental function

Environmental air: Zhumadian city lies in the function zone with category II environmental air and the quality of environmental air implements grade II standard in *Ambient Air Quality Standard GB 3095-1996*.

Water environment: the main function for Huangyou River is pollution discharge of the city under non-flood season and water function has not been defined. In this assessment, the function of river is evaluated based on category IV according to actual situation. Water of Suya lake reservoir belongs to category III. Corresponding standards in *Surface Water Ambient Quality Standard GB3838-2002* shall be implemented.

Sound environment: noise function in the area of the factory has not yet been defined and belongs to industrial park in east of the city according to city planning, so the category III standard of *Standard of Environmental Noise of Urban Area GB3096-93* shall be implementd.

2.5 control index for Total volumes of major pollutants

See table 2.5-1 for requirements of Environmental Protection Bureau of Yicheng district, Zhumadian city for total volume control planning of main pollutants of waste gas and water in the whole area. See table 2.5-2 for total volume allocated to Junma Chemical Industry Co., Ltd,

Table 2.5-1 Requirements of Zhumadian city for total volume during the 11th Five-Year period Unit: t/a

Name	Waste gas		Wast water
	Smoke and dust	SO_2	COD
Total volume of the city	3688.91	5725.24	4403

Table 2.5-2 Total volume index for Junma Chemical Industry Co., Ltd, Unit: t/a

Name	Waste gas		Waste water
	Smoke and dust	SO_2	COD
Total volume	761.9	162.9	142.3

2.6 Overview of area pollution

See table 2.6-1 for air pollution source discharge in Yicheng district of Zhumadian city based on pollution source data in the year of 2004.

Table 2.6-4 Air pollution source in Yicheng city in the year of 2004

S/N	Enterprise name	Waste water		Waste gas	
		COD (t/a)	Discharge destination	Sulfur dioxide (t/a)	Fume and dust (t/a)
1	Zhumadian Jinma Paper Co., Ltd	469.8	City sewage treatment plant	0	0
2	Junma Chemical Group Co., Ltd	33.9	Huangyou River	754.5	56.5
3	Zhumadian Beer Brewery	25.3	City sewage treatment plant	0	0
4	Henan Tianfang Pharmaceutical Co., Ltd.	602	City sewage treatment plant	415.6	84.4
5	Zhumadian Tobacco Factory	9.52	City sewage treatment plant	0	0
6	Zhumadian Meter Factory	38.0	City sewage treatment plant	0	0
7	Huazhong Chia Tai Co., Ltd	166.5	Xiaonihe River	201	45.8
8	State-owned No.639 Plant	1.8	City sewage treatment plant	0	0
9	Zhumadian Thermal Power Plant	7	City sewage treatment plant	3662	604
10	Gucheng Power Plant	4.5	Taohe River	3842	3020
11	Zhumadian Center People's Hospital	11.96	City sewage treatment plant	14.4	2.84
12	Zhumadian Psychiatric Hospital	2.98	Xiaoqinghe River	1.44	0.40
13	Zhumadian Yima Textile Co., Ltd	32.2	Xiaoqinghe	83.9	20.5

			River		
14	Henan Jinque Electric Co., Ltd	4.29	City sewage treatment plant	0	0
15	Zhumadian Dingzhi Instrument Co., Ltd	0.96	City sewage treatment plant	13.9	3.15
16	Zhumadian Yuanyang Lighting Co., Ltd	1.08	City sewage treatment plant	19.2	30.5
17	Zhumadian Underwear Factory	12.5	City sewage treatment plant	11.0	3.89
18	Zhumadian Xinhe Textile Co., Ltd	6.51	City sewage treatment plant	14.2	4.99
19	Zhumadian First People's Hospital	6.33	City sewage treatment plant	9.79	8.11
Total		1437.13		9042.93	3885.08

3. Project Analysis

3.1 Project overview

3.1.1 Name, type and location of project

Name: Technological Transformation Project on Route of Synthetic Ammonia Raw Materials of Henan Junma Chemical Industry Co., Ltd (hereinafter referred to as "Technological Transformation Project").

Type: technological transformation

Location: eastern industrial zone of Zhumadian city, Henan province (see Fig.2)

Owner: Henan Junma Chemical Co., Ltd

3.1.2 Main technical and economical norms

See table 3.1-1 for main technical and economical norms

Table 3.1-4 Main technical and economical norms

S/N	Project	Unit	Qty	Remark
1	Product scheme and scale			
1.1	Synthesis gas (CO+H2)	Nm^3/h	79848	Replace existing gasification device
1.2	Synthetic ammonia	10,000 t/a	22	Existing device scale keeps the same, cancel gas desulfurization and renew conversion process
1.3	Urea	10,000 t/a	40	Existing device scale keeps the same
1.4	Methanol	10,000 t/a	15	Existing device scale keeps the same
2	Annual operation time	h	7920	

3	Staff	Person	230	Rely on current staff
4	Total investment of project	RMB 10,000	98126	
4.1	Including environmental protection investment	RMB 10,000	4140	
6	Main finance assessment index			
6.1	IRR of all investment (pre-tax)	%	19.31	
6.2	IRR of all investment (after-tax)	%	12.76	
6.3	Return period of investment (after-tax)	Year	6.28	Include two years of construction

3.1.3 Construction site and general layout plan

The existing project of Junma Company lies in the eastern part of Zhumadian city and is 2.5km from the center of city. The factory faces Zhuxin road on the north and Yicheng Avenue on the east. Resident around factory is concentrated and sensitive targets are many, see Fig 1.3-2 for distribution. The factory was built in 1969 and existing project is formed through many times technological transformation based on synthetic ammonia of 3000 t/a and NH HCO of 12000 t/a, therefore there is no uniform general layout plan for current factory: the synthetic ammonia section is in Midwest of the factory, urea section is in northeast of factory, boiler is in west of gasification workshop, coal storage field in the south of gasification workshop and the ammonia storage tank is next to prilling tower and is close to the north factory boundary. See Fig 3 for general layout plan of current factory.

This project belongs to technological transformation type. The proposed site locates about 1km in the southeast of the existing factory. The project faces Yicheng Avenue on the west and faces under-construction Lianjiang road on the north and its terrain is wide and flat. Zhongyuan gasfication methanol and gas-fired power plant are built around. The distance from north to south is about 600m and from east to west is about 700m for propsed site and the terrain in south is higher than the north. The factory is about 1km from Beijing-Zhuhai Expressway, about 5km from 107 National Highway and only 3km from the Zhumadian station of Beijing-Guangzhou Railway so that the transportation is very convenient. See Fig 2 for geographical locations of proposed factory.

The technological transformation factory covers an area of 420,000 m^2, followings are arranged from east to west of the site according to the process procedures of ammonia: coal field, gasification, conversion, desulfurization and decarbonization, desulfurization, compression, synthesis, and methanolizing & methanation, etc; the temporary residue field is arranged in the north of coal field; ammonia tank of existing project is arranged in the north of coal-slurry preparation device and comprehensive building, compressor station, recycled water, waste water collection tank and the original water treatment device, etc are arranged in the south of main process line; in the same time, positions for constructing office building, main sub-station, devices for instrument repair, machine repair, electric repair, integrated warehouse, chemical warehouse, installations for methanol distillation and methanol tank farm installation, etc shall be reserved. See Fig 4 for overall layout plan of Technological Transformation Project.

3.1.4 Consumption and source of raw material and fuel

See Fig 3.1-2 for consumption and source of raw material and fuel of existing project, under-construction project and the proposed project. See table 3.1-3 for composition of feed coal and fuel coal.

Table 3.1-3 Consumption and source of raw material, fuel and adjuvant material

S/N	Project name	Unit	Consumption and source			
			Current production (including under-construction project)		After the project being transformed	
1	Main raw material and fuel		Consumption	Source	Consumption	Source
1.1	Feed coal	t/a	45×10^4	Coal of Jincheng	43.5×10^4	Coal of Yima, Henan province
1.2	Fuel coal	t/a	12.8×10^4	Coal of Pingdingshan		
2	Adjuvant material					
	NHD	t/a			60	Local
	Na_2CO_3	t/a	176.4	Local		
	Catalyst	t/a	83.79	Relevant domestic manufacturers	74.6	
	Molecular sieve	t /a			13	Relevant domestic manufacturers

Table 3.1-3 Composition analysis of feed coal and fuel coal (%)

Name	Carbon content	Ash	Fugitive constituent	Sulfur content	Low heating value
Feed coal of current production	74.96	15	7.5	0.8	
Feed coal of current production	53.2	20	25	1.2	23500kJ/kg
Feed coal of Technological Transformation Project	65.0	17.0	27.97	0.58	21530kJ/kg

3.2 Overview of existing project and pollution factor analysis

3.2.1 Composition of existing project

3.2.1.1 Main works

See table 3.2-1 for composition of main works of existing project:

Table 3.2-1 Composition of main works

S/N	Device name	Unit	Device scale	Process method	Changes after Technological Transformation Project
1	Gasification	Nm^3/h	67500	Fix bed intermittent gasification process, 16 gas furnaces with diameter of 2.6m (15 for operation and 1 for standby)	Replaced by new gasification process
2	Synthetic ammonia	t/a	$16×10^4$	$8×10^4$ t/a dual type, made through the process of gas desulfurization, MT & LT CO shift, desulfurization of gas, reciprocating compression and 32MPa synthesis.	Replaced by new synthetic process
3	Urea	t/a	$25×10^4$	$13×10^4+12×10^4$ t/a dual type, adopt water solution total recycle process	Unchanged

3.2.1.2 Aided engineering

See table 3.2-2 for composition of aided engineering of existing project.

Table 3.2-2 Composition of aided engineering

S/N	Facility name	Current facility scale	Changes after Technological Transformation Project
1	Air separation	300 Nm^3/h	Replace with new air separation device
	Blowing waste heat recovery	Amount of evaporation: 35t/h; pressure: 2.5MPa	Cancel
2	Sulfur recovery	800 t/a	Replace with new sulfur recovery device
3	Fuel gas recovery cabinet	$11×10^4$ m^3/h	Remain
4	Treatment of gasification sewage	3000 m^3/h	Remain

3.2.1.3 Public works

See table 3.2-3 for composition of public works of existing project.

Table 3.2-3 Composition of public works project

S/N	Facility name	Current facility scale	Changes after Technological Transformation Project
1	Boiler	10 t/h×1 (fluidized bed combustion boiler); 20t/h×1 (chain furnace); 20 t/h×1(fluidized bed combustion boiler); 35t/h×1(chain furnace);	10 t/h×1 (fluidized bed combustion boiler); 20t/h×1 (chain furnace); Cancel 20 t/h×1(fluidized bed combustion boiler) and remain 35t/h×1(chain furnace)

S/N	Facility name	Current facility scale	Changes after Technological Transformation Project
2	Water supply	Take groundwater, water supply capacity: 1200 t/h Actual water consumption: 515 t/h	Water supply facility for Technological Transformation Project relies on the current facility and no need to increase.
3	Water drainage	90 t/h	Technological Transformation Project relies on the current facility and make proper innovation.
4	Desalted water	Desalted water: 150t/h; actual water consumption: 80t/h Soft water: 150t/h; actual water consumption: 50t/h	Technological Transformation Project relies on the current facility and no need to increase.
5	Water circulation	Circulated water amount: 26200 m^3/h	Current gasification water circulation system will be removed after Technological Transformation Project finishes.

3.2.1.4 Storage engineering

See table 3.2-4 for composition of storage engineering project

Table 3.2-4 Composition of storage engineering project

S/N	Facility name	Current facility scale	Changes after Technological Transformation Project
1	Storage of feed coal	Storage capacity: 3×10^4t	Newly-built in the technological transformation factory
2	Storage of fuel coal	Storage capacity: 0.3×10^4t	
3	Temporary residue site	Capacity: 3 ×104 m^3	
4	Urea warehouse	3000 t	Unchanged
5	Ammonia warehouse	100 $m^3\times4$	Move from current factory to technological transformation factory
7	Urea loading and unloading platform	Eight-space through-type truck fill stand	Unchanged

3.2.2 Process flow and pollution generation section analysis

3.2.2.1 Gasification device

(1) Brief introduction of process flow

The current gasification adopts traditional fixed bed intermittent gasification process. There are 16 gas furnaces (15for operation and one fore standby) with diameter of 2.6m in the current factory and the gas production capacity is 67500 Nm3/h. The specific process is summarized as follows:

Add the feed coal into to the furnace from its top side with automatic feeder and load air to make the coal burn; then add the water and air to make them react with hot carbon and generate semi-water gas. The left residue after gasification will be discharged into storage hopper continuously by ash discharge system and then discharged out regularly. During production operation, one gasification process can be divided into five steps: blowing, upper-blow gasification, low-blow gasification, secondary upper-blow gasification and air blowing-off. See Fig 3.2-1 for process flow and pollution generation section analysis of existing gasification device.

(2) Main production equipment

See table 3.2-5 for main equipment of gasification device

Table 3.2-5 Main production equipment of gasification device

S/N	Name of equipment	Specification and model	Qty
1	Air blower	Air flow: 700 m3/min	6 sets
2	Gas-making furnace	Φ2.6m	16 sets (15 for operation and one for standby)
3	Combustion chamber		14 sets
4	Waste heat boiler	Vertical type	14 sets
5	Gas cleaning tank		14 sets
6	Washing tower		6 sets

(3) Pollution source analysis of device

① Waste gas

The existing gasification devices mainly cover following pollution source (see table 3.2-6)

G1 blowing waste: main pollutants of waste gas in blowing and combustion stage of gasification process include SO_2, H_2S and CO. The blowing waste generated by current 15 gas furnaces is about 75000 Nm^3/h.

G2 blowing waste heat recovery fume: there is one blowing waste heat recovery device with evaporation capacity of 35t/h in the factory. Blowing gas will be sent to combustion room for secondary burning and for waste heat recovery; meanwhile, the left CO, H_2S and other pollutants in the blowing air will be converted into SO_2 and CO_2. The fume in the waste heat recovery boiler will be discharge out into air through chimney stack with height of 27m after dust being removed through washer. The dust collection efficiency for washer is higher than 90% and the discharge amount and concentration of pollutant in fume meet the requirements of national standards.

Table 3.2-6 Waste gas source of current gasification device

S/N	Name of pollution source	Discharge amount	Discharge of pollutant			Discharge height	Discharge style	Remarks
			Name	Concentration	Rate			

G1	Gas making and blowing air	75000	Fume and dust	738	55.4		Intermittent	Waste heat recovery device
			SO_2	1163	87.26			
			CO	7000	525			
G2	Blowing waste heat recovery fume	88500	Fume and dust	63	5.54	27m	Continuous	Wet dust removal, efficiency>90 %
			SO_2	800	70.8			
			H_2S	15	1.3			

② Waste water

W1 gas generation sewage: gas from the furnace requires water washing. Sewage from gas washing system has features of high water temperature and complex water quality. Main pollutants include suspended solids, cyanide, sulfide and ammonia, etc. Water volume is about 2200m3/h and shall be treated with existing sewage treatment device which has the processing capacity of 3000m3/h. Most of the treated waste water shall be reused by the gas washing system.

W2 blowing waste heat recovery device dust washing water: dust of fume generated by waste heat boiler shall be removed with secondary granite water film dedustor. Main pollutants in dust washing water are SS, COD and ammonia, etc. Water volume is about 20 m^3/h and shall be treated with existing sewage treatment device.

③Waste residue

Main residues during gasification are mainly from gas furnace (S1): discharge amount for current production is 61740 t/a and disposal methods are: partials are burned as fuel of boiler and partials for compressively used by local building material factory.

Based on the site investigation of assessment, all solid wastes discharged by existing project are comprehensively used and there are no stocks in the factory.

④ Noise

Main noise source for the device is the air blower. There are six blowers with the strength of 85 ~ 95dB at present and will be removed when the Technological Transformation Project finishes.

3.2.2.2 Synthetic ammonia installation

(1) Brief introduction of process flow

There are two synthetic ammonia production devices with capacity of 80000 t/a and the actual production capacity is 220,000 t/a. The basic processes are almost the same, that is: tannin extract and desulfurization of gas, MT & LT CO shift, shift gas desulfurization, carbon-C de-carbonization, refined cuprammonium, reciprocating compression and

32MPa synthesis.

Process flow: gas from gas cabinet shall be loaded into desulfurizing tower with gas blower, and then loaded into lower pressure section of compressor for boostering into 2.1Mpa after being washed adversely with tannin extract fluid, and then loaded into shift system. The CO will react with steam and generate CO_2 and H_2 under the action of shift catalyst, the shifted gas will be sent to with decarburization section after being desulfurized. Desulfurization can be realized through absorbing CO_2 in the gas with propylene carbonate solution (the CO_2 can be used as raw material of urea workshop and sent to CO_2 compressor). The gas after desulfurized will enter into the fourth and fifth sections of compressor, then sent to copper washing device for further cleaning after being compressed into 32Mpa and then sent to ammonia converter after being boosted into 32Mpa in the sixth section of compressor, the H_2 and N_2will be synthesized into ammonia under the catalyst. See Fig 3.2-2 for process flow of existing synthetic ammonia device.

(2) Main production equipment of synthetic ammonia device

See table 3.2-7 for main equipment of synthetic ammonia device

Table 3.2-7 Main equipment of synthetic ammonia device

S/N	Equipment name	Specification and model	Qty
1	Gas blower	Air volume: 300 m3/min	2 sets
2	Gas thionizer	Φ3.0m	2 sets
3	Saturated hot water column	Φ3.0m	2 sets
4	Shift converter	Φ4.0m	4 sets
5	Conversion gas thionizer	Φ3.0m	2 sets
6	Decarbonation tower	Φ2.3m	2 sets
7	Decarbonation regeneration tower	Φ3.0m	2 sets
8	Copper washing tower	Φ0.8m	2 sets
9	Copper washing regeneration tower	Φ2.4m	2 sets
10	Feed gas compressor	Horizontal six-section reciprocating type	6 sets
11	Ice maker		4 sets
12	Synthesis gas recycling machine		2 sets
13	Ammonia converter	Φ1.0m	2 sets

(3) Device pollution sources and anti-pollution measures

① Waste gas

Main pollution sources of waste gas for existing synthetic ammonia device are as follows (see table 3.2-8):

G1 acidic gas desulfurized end gas: there are a lot of H2S in semiwater gases. The desulfurized end gas will be discharged after sulfur is recovered by tanning extract desulfurized device;

G2 copper wash regeneration gas: gas discharged during copper wash regeneration gas includes CO, CO2, H2 and NH3. Remove the ammonia first through washing and then reuse after being treated with gasification and blowing recovery device;

G3 synthesis off-gas: small amount of process tail gas discharged by ammonia system in order to maintain normal operation of tower, which includes H2, N2, CH4, NH3 and Ar. The synthesis off-gas produced by current production shall be sent to gasification and blowing recovery device as fuel when hydrogen is collected through washing, ammonia removal and file method;

G_4 ammonia tank off-gas: gas desorbed from the ammonia tank off-gas mainly includes NH_3, N_2 and CH_4. The ammonia tank off-gas will be sent to gasification and blowing recovery device as fuel along with synthesis off-gas after ammonia is recovered.

G5 fugitive discharge.

Table 3.2-8 Pollution sources of waste gas of existing synthetic ammonia device

No.	Name of pollution sources	Gas discharge amount	Pollutants	Discharge concentration or rate	Discharge type	Remarks
G_1	Acidic gas	300	H_2S	1.3kg/h	Continuous	Recover sulfur, discharge out desulfurization tail gas through 35m exhaust funnel; remove after Technological Transformation Project finishes.
G_2	Copper washing regeneration gas	1400×2	CO	62.9%(Vn)	Continuous	Send to gasification and blowing gas recovery system as the fuel after ammonia recovery
			H_2	5.5%(Vn)		
			NH_3	9.7%(Vn)		
			CH_4	0.2%(Vn)		
			CO_2	12.0%(Vn)		
G_3	Synthesis off-gas	2410×2	H_2	52.3%(Vn)	Continuous	Send to gasification and blowing gas recovery system as the fuel after ammonia recovery and hydrogen recovery
			NH_3	11.0%(Vn)		
			CH_4	16.0%(Vn)		
			N_2	17.4%(Vn)		
			Ar	3.3%(Vn)		
G_4	Ammonia tank off-gas	800×2	H_2	21.8%(Vn)	Intermittent	Same as above
			NH_3	52.6%(Vn)		
			CH_4	16.3%(Vn)		
			N_2	7.3%(Vn)		
			Ar	1.9%(Vn)		

No.	Name of pollution sources	Gas discharge amount	Pollutants	Discharge concentration or rate	Discharge type	Remarks
G_1	Acidic gas	300	H_2S	1.3kg/h	Continuous	Recover sulfur, discharge out desulfurization tail gas through 35m exhaust funnel; remove after Technological Transformation Project finishes.
			NH_3	50 mg/ Nm^3 12.6 kg/h		
G_5	Fugitive discharge		NH_3	7.4kg/h		

②Waste water

See table 3.2-9 for waste water resources of synthetic ammonia device

Table 3.2-9 Waste water resources of synthetic ammonia device

No.	Name of pollution sources	Water discharge amount	Discharge of pollutants			Discharge destination	Remarks
			Name	Concentration	Discharge amount		
W_1	Conversion condensed fluid	15	NH_3-N	50	0.75	Reuse after being treated with gasification waste water treatment system	Remove after technological transformation
			COD_{cr}	160	2.4		
			CN^-	1.2	0.018		
W_2	Ammoniated waste water of copper ammonia wash	2	NH_3-N	1.5%	22.5	Send to gasification waste water treatment device after being treated with urea desorption hydrolysis device	Remove after technological transformation
W_3	Ammoniated waste water of ammonia recovery	2	NH_3-N	2%	40	Same as above	
W_4	Oily sewage of synthesis workshop	2	Petroleum type	400	0.2	Send to gasification waste water treatment device after being treated with oil-water separation	Remove after technological transformation

W_1 conversion process condensed fluid: excess steam in gas will be condensed and converted into condensed fluid during conversion procedure and the fluid mainly includes pollutants of alcohols and ammonia n.

W_2 ammoniated waste water of copper ammonia wash: clean the feed gas with copper ammonia solution first, then send the discharged weak aqua ammonia into urea desorption hydrolysis device and send to the gasification waste water treatment device for further treatment.

W_3 ammoniated waste water of ammonia recovery: the weak aqua ammonia discharged by synthesis off-gas and ammonia tank off-gas ammonia recovery device also will be sent to the gasification waste water treatment device for further treatment after being treatment with urea desorption hydrolysis device.

W_4 oily sewage of synthesis workshop: oily sewage discharged by synthesis workshop shall be sent to gasification waste water treatment device for further treatment after oil -water separation and dirty oil treatment and recovery with oily sewage device finish.

③Waste residue

Waste residues generated during synthetic ammonia production include waste conversion catalyst(S1), waste synthetic catalyst (S2), and small amount of copper sludge during copper ammonia wash process. See table 3.2-10 for details.

Table 3.2-10 Pollution sources of solid wastes of existing synthetic ammonia device

	Name of pollution sources	Category	Discharge amount (a/t)	Main components	Discharge feature	Disposal method
S_1	Conversion catalyst	Danger wastes	93 t/time	Fe、Cr、Co、Mo	Replace every three years	Manufacturer recovery
S_2	Copper sludge	Danger wastes	0.05	Copper acetate, etc	Discharge in several years	Sell
S_3	Synthetic catalyst	Ordinary solid wastes	60t/次 93 t/time	FeO/Fe_2O_3	Replace every five years	Manufacturer recovery

④ Noise

See table 3.2-11 for main noise sources of this equipment.

Table 3.2-11 Noise sources of existing synthetic ammonia device

Symbol	Equipment noise	Operating quantity	Noise level	Noise control measures	Remarks
N_1	Gas blower	9	92~98	Silencer	Remove after Technological Transformation Project
N_2	Hydro nitrogen compressor	9	84~86	Sound insulation of building	Remove after Technological Transformation Project
N_3	Solution pump	12	91~94		Remove after Technological Transformation

					Project

3.2.2.3 Urea device

(1) Brief introduction of process flow

There are two urea devices in the factory and both adopt water solution total recycle process. Brief introduction of process flow is as follows:

The raw CO2, liquid ammonia and ammonium liquid obtained from circulating recovery procedure will be sent to urea synthesis tower at the same time and then converted into urea. The reaction liquid melt shall discharge from the top of tower. The reaction liquid melt of urea synthesis tower enters into the top of pre-distillation tower and the solution flows into heat distillation in the middle section automatically after flash gas is separated and makes partial ODTAB in solution decompose with excess ammonia. The urea liquid discharged from pre-distilltion tower will be sent to flash drum after being decompressed; gas will discharge from top of second urea separation tower through filler section and enter into the secondary circulating No.1 condenser after mixing with stripping gas, then will be aborbed with condensate evaporation and the generated dimethyl fluid will be sent to the first evaporator. Gas from second circulating-one condenser will be absorbed by densate evaporation in two circulating-two condensers. The generated ammonia will be sent to inert gas washer and end gas will flow to tail gas absorption tower. The urea liquid discharged from second urea separation tower will flow into flash drum and separate into gas and liquid. The urea liquid will be concentrated into urea melt through evaporation and the urea will be sent to prilling tower for prilling. The finished granular urea shall be sent to urea storage system for packing through rubber belt conveyor.

See sketch map 3.2-3 for process flow of existing urea device

(2) Main production equipment

See table 3.2-12 for main equipment of urea device

Table 3.2-12 Main equipment of urea device

S/N	Equipment name	Specification and modle	Qty
1	Urea synthesizer	ф1.384m,h=19.1	2 sets
2	CO_2 compressor	Flow: 4000 m^3/h	4 sets
3	Pre-distillation tower	ф1.1m,h=8.5	2 sets
4	One-stage absorption tower	ф1.1m,h=8.5	4 sets
5	Two-stage decomposition tower	ф0.7m,h=8.9	2 sets
6	Inert gas washer	ф1.1m,h=7.9	2 sets
7	One-stage evaporative condenser	ф1.6m,h=5.9	2 sets
8	Two-stage evaporative condenser	ф1.6m,h=5.9	2 sets
9	Prilling tower	h=64m (standby)	1 set

S/N	Equipment name	Specification and modle	Qty
10	Prilling tower	h=68m	1 set
11	Prilling tower	h=100m	1 set

(3) Device pollution sources and environmental protection measures

① Waste gas

Waste gas pollution sources of urea device mainly cover:

G1 urea process tail gas: the tail gas is from circulation and absorption system of urea system, it mainly includes un-cooled gas ammonia and shall be discharged in the air after being treated with tail air absorption tower.

G2 prilling tail gas: there are total two urea devices currently and both adopt prilling tower for prilling. The prilling tail gas discharged by the tower mainly covers urea dust and a small amount of ammonia.

G3 fugitive discharge of urea device

Table 3.2-13 Pollution sources of waste gas of urea device

No.	Name of pollution sources	Discharge amount	Discharge of pollutants			Height (m)	Discharge type	Remarks
			Name	Concentration mg/Nm^3	Rate kg/h			
G1	Tail gas of urea process	1700×2	NH_3	2100	7.14	30	Continuous	There are two systems at present
G2	Tail gas of prilling	125610	Dust	60	7.5	100/68	Continuous	
			NH_3	30	3.8			
G3	Fugitive discharge		NH_3		18.7			

② Waste water

Waste water pollution sources of urea device mainly includes:

W1 condensed fluid of urea process: the process condensed fluid generated by urea solution in the process of evaporation and concentration mainly covers NH3 and CO2 and water amount is about 16t/h. As about 4t/h ammoniated waste water is included in synthetic ammonia system so that the total water amount is about 20t/ h. The ammoniated waste water shall be discharged after desorption and hydrolysis. As there is a short supply of middle and high pressure stream, low-pressure steam is adopted by both desorption and hydrolysis system, which can’t meet the design requirements and result in the ammonia concentration about 49.2mg/L during discharge. The above value is higher than design standard and can’t realize the original design purpose that using the recovered water for boiler. At present, the discharged water is mainly delivered to gasification treatment device.

W2 oily waste water in urea workshop: the small amount of oily waste water from urea workshop, which mainly includes pollutants of oil type, shall be discharged after being treated by waste water treatment device.

W3 startup & shutdown and emergency discharge: materials in the system may be safely discharged due to startup & shutdown or emergency reasons, which may happen 2 or 4 times in each year. The discharge is normally collected with ammonia water tank and will be sent back to the system after it returns into normal condition or sold as liquid fertilizer.

See table 3.2-14 for waste water discharge of urea device:

Table 3.2-14 Pollution sources of waste water of urea device

No.	Name of pollutants	(m^3/h) Water discharge amount	Discharge concentration of pollutant			Control measures and discharge destination	Remarks
			Pollutant	Concentration	Discharge amount		
W_1	Condensed fluid of urea process	16	NH_3-N	49.2	0.64	Sent to gasification waste water treatment after desorption hydrolysis	Include ammoniated waste water of ammonia system
W_2	Oily water in workshop	1	Petroleum type	590	0.6	Sent to gasification waste water treatment after oil-water separation	-
W_3	Startup & shutdown, and accident discharge	300 $m^{3/}$time	NH3-N and CO2			Sell or return to system after collecting	

③ Solid wastes

Table 3.2-15 Pollution sources of solid wastes of urea device

Name of solid wastes	Discharge amount	Main components	Destination
Waste fine desulfurizer	38m^3/4a	Active carbon	Recovery of manufacturer

④ Noise

See table 3.2-16 for main noise resources of this device

Table 3.2-16 Noise resources of existing urea device

Symbol	Noise equipment	Operating quantity	Noise level	Noise control measures

N1	CO^2 compressor	4	86~88	Sound insulation of building
N2	Solution pump	6	91~94	Install silencer

3.2.3 Introduction and main pollution sources and environmental protection measures for existing public works

3.2.3.1 Brief Introduction of water supply and discharge of current production

(1) Primary water source and supply

At present, water for productive use of factory is from underground. Water supply capacity is 1200m^3/h, the largest water consumption is 600m^3/h and the normal water consumption is about 500 m^3/h.

(2) cooling circulating water system

There are four cooling circulating water systems in the factory and total circulating water supply is 23800m^3/h.

(3) Chemical water system

At present, there is desalted water station with capacity of 150m^3/h in the factory and the actual desalted water production is 80m^3/h.

At present, there is also one soft water station with capacity of 150m^3/h in the factory and the actual soft water production is 50m^3/h.

(4) Waste water treatment and reuse

At present, the generated waste water in the factory includes: ① gasification waste water; ②condensed fluid of conversion process③ ammoniated waste water of copper ammonia wash④ ammonia recovery waste water of synthesis off-gas and ammonia tank off-gas ⑤ condensed fluid of urea process ⑥ oily waste water of synthesis ammonia and urea workshops ⑦ ash wash water of boiler ⑧ small amount of acid and alkaline waste water discharged by desalted water station and soft water station ⑨ waste water of circulation system and ⑩domestic sewage

Among them: ③ammoniated waste water of copper ammonia wash and ④ammonia recovery waste water of synthesis off-gas and ammonia tank off-gas shall be sent to urea deep hydrolysis device for adsorption stripping and deep hydrolysis along with the condensed fluid of urea process and recovery of ammonia and urea. The processed water shall be sent to waste water factory for treatment and reuse.

⑥**oily waste water of synthesis ammonia and urea workshops shall be sent to the waste** water treatment factory for future reuse after being treated with oil-water separator in the oil station of their boundary.

Most of ① gasification waste water, ②condensed fluid of conversion process and ⑦ ash wash water of boiler and other floor washing water shall be delivered to waste water treatment factory for reuse and only a small amount of waste water is to be discharged.

⑧ small amount of acid and alkaline waste water discharged by desalted water station and soft water station is to be disposed after being neutralized and treated.

⑩domestic sewage is to be sent to city underground pipe network after being treated in septic tank.

Partial waste water from circulation water system is to be reused after being treated in waste water treatment factory and partial is to be disposed.

Drainage destination: the waste water from production will be discharged into sewage ditch through main outlet of factory and then finally into Huangyou River; domestic sewage is to be discharged into city water pipe network.

See Fig 3.2-4 for production water balance.

3.2.3.2 heat suppy of existing production

The boliers under full load in existing factory can produce steams with different level about 75t/h. See table 3.2-17 for the specific operation .

Table 3.2-17 Description of heat supply of existing boiler

No.	Boiler	Amount of evaporation	Dust and ash removal method	Remarks
1	Circulating fluid bed boiler	35 t/h	Electric dust removal and wet ash removal	100m chimney stack
2	Fluidized bed combustion boiler	20 t/h	Wet dust and ash removal	48m chimney stack
3	Chain furnace	20 t/h	Wet dust and ash removal	45m chimney stack
4	Fluidized bed combustion boiler (standby)	10 t/h	Wet dust and ash removal	

3.2.3.3 Pollution source and environmental protection measures

(1) Waste gas

Main waste gases of public works are fume of boiler. See table 3.2-18 for pollution source and control measures.

Table 3.2-18 Pollution source of existing heat supply boiler

Device	Name of pollution source	Gas discharge amount Nm^3/h	Pollutants	Discharge concentration mg/Nm^3	Rate kg/h	Discharge height	Control measures and effect
G1	Fume of circulating fluid bed boiler	57100	Smoke dust	90	5.1	100	Decarbolize in boiler, electric dust removal+water film dust removal; dust removal efficacy: 99.5%, eesulfurization efficiency: 50%
			SO_2	450	25.7		
			NOx	100	5.7		
G2	Fume of 20t/h fluidized bed combustion boile	39200	Smoke dust	180	7.1	48	Granite water film dust removal; dust removal efficacy: 93%, eesulfurization efficiency: 15%
			SO_2	860	33.7		
			NOx	300	11.8		
G3	Fume of 20t/h chain furnance	28610	Smoke dust	167	4.8	45	Granite water film dust removal; dust removal efficacy: 93%, eesulfurization efficiency: 15%
			SO_2	750	21.5		
			NOx	300	8.6		

Remarks: data from daily pollution monitoring of Zhumadian monitoring station.

(2) Waste water

The waste water pollution resources of public works mainly include ash wash water of boiler, blow-off water of desalted water station and domestic sewage. The ash wash water of boiler will be sent to gasification waste water treatment device for future treatment after initial sedimentation in the sedimentation tank in the boiler area, and then will be reused; the acid and alkaline waste water of desalted water station will be discharged after being processed in neutralization pond; the domestic sewage will be discharged into city waste water pipe network after being treated in septic tank.

Table 3.2-19 Waste water pollution sources of current public works

No.	Name of pollution source	Water discharge amount m^3/h	Pollutants	Discharge concentration mg/L	Control measures	Remarks

No.	Name of pollution source	Water discharge amount m^3/h	Pollutants	Discharge concentration mg/L	Control measures	Remarks
W_1	Ash sluice water of boiler	100	SS	140	Send to gasification circulating water treatment device after initial precipitation	Reuse after treatment
W_2	Backwash water of desalted water station	10	Acid-alkaline waste water		Neutralize the tank or post-discharge	Include preparation of pure water
W_3	Pollution discharge of circulating water system	94	SS	95	Send to the gasification waste water treatment device	Partials are used for complementary water gasification circulating water
W_4	Domestic sewage	8	COD	334	Septic tank	Discharge into city waste water pipe network

(3) Solid wastes

Main solid wastes are from waste residue of boiler and waste water treatment mud.

Table 3.2-20 Pollution source of solid wastes of public works

Name of pollution source	Discharge amount (t/a)	Main components	Discharge feature	Disposal method
Boiler ash	44000	Include C of 5～15%	Continuous	Comprehensive utilization
Mud of gasification sewage treatment device	1600	Include C of 18%	Continuous	-

(4) Noise pollution source

Main noise sources for current public works are from boiler fan and water circulating pump and see table 3.2-21 for details.

Table 3.2-21 Main noise sources of existing public works

Name of noise source	Qty (set)	Noise value dB(A)	Control measures
Boiler fan of thermoelectric station	8	87～98	Install silencer
Water circulating pump	12	80～85	

3.2.3.4 Confirmation of health protection distance of existing project

The health protection distance of fugitive discharge shall be calculated according to following formula based on relevant requirements of *Integrated Emission Standard of Air Pollutants*:

$$Q_c/C_m=(BL^c+0.25R^2)^{0.5}\cdot L^D/A$$

Where: Q_c——accessible control level of fugitive discharge amount of harmful gas for industrial enterprises (kg/h);

C_m——standard concentration limit (mg Nm^3);

L——health protection distance required by industrial enterprises(m);

R——equivalent radius of production unit (m)

A, B, C and D——calculating factor of health protection distance

According to discharge amount of NH_3 of existing project and relevant calculation parameters, we can see that through calculation: the health protection distance of NH_3 for existing project is 1491m and now taking1500m; after Technological Transformation Project finishes, the ammonia device of existing project will be removed, the urea plant will be retained and the health protection distance will become 1034m; therefore, the health protection distance of all projects after technological transformation will take the value of 1200m. According to field investigation, there are many sensitive targets in the health protection distance of existing factory, which mainly cover Qianjin new village, living quarters of company and Highway Administration Bureau, etc, and the total residents are about 2900. See Fig. 8 for health protection range.

3.2.3.5 Standard compliance assessment of pollution sources of existing project

(1) Waste water

See table 3.2-22 for main discharge outlet of factory and drainage water quality and standard compliance at the discharge outlet of domestic sewage based on monitoring data. See table 3.2-23 for drainage water quality and standard compliance at the factory's discharge outlet of domestic sewage.

Table 3.2-22 Main discharge outlet of existing project and standard compliance

Item		pH	COD	Ammonia n	SS	Petroleum type	CN^-	Volatile phenol	Discharge of water
Concentration	Concentration of discharge mg/L	6.8	200	160	180	1.5	0.5	0.09	$82m^3/h$
	Standard mg/L	6～9	150	100	100	10.0	1.0	0.2	

	Standard compliance	Yes	No	No	No	Yes	Yes	Yes	
Discharge amount	Discharge amount kg/t ammonia	-	0.43	0.34	0.39	0.003	0.001	0.0002	2.16m3/ t ammonia
	Standard kg/t ammonia	-	9.0	6.0	6.0	0.6	0.06	0.012	60 m3/ t ammonia
	Standard condition	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Remarks	This standard is based on grade II in table 1 of GB13458-2001 Discharge Standard of Water Pollutants for Ammonia Industry and monitoring result is according to the average value in two days.								

Table 3.2-23 Domestic sewage quality of existing factory and standard compliance

Item	pH	COD	BOD5	SS	Ammonia n	Petroleum type
Value range	7.12～7.15	201～594	78～242	8～84	0.34～0.36	0.46～1.45
Average value	7.14	334	134	36	0.35	0.82
Standard	6～9	150	30	200	25	10
Over-limit ratio	0	100	100	0	0	0

(2) Waste gas

See table 3.2-24 of standard compliance assessment of existing waste gas sources based on daily monitoring data and similar enterprises in the domestic.

Table 3.2-24 Standard compliance assessment of existing waste gas sources

Device name	Pollution source name	Discharge height	Pollutant name	Discharge concentration mg/Nm^3	Discharge rate kg/h	Standard compliance
Gasification	Gas making and blowing air	27	Smoke and dust	738	5.54	Yes
			SO_2	800	70.8	Yes
			H_2S	15	1.3	
Synthetic ammonia	Acidic gas	35	H_2S		2.7	No
	Fugitive discharge		NH_3		7.4	
Urea	Prilling tail gas	68/100	NH_3	30	3.8	
			Powder	60	7.5	Yes

Device name	Pollution source name	Discharge height	Pollutant name	Discharge concentration mg/Nm^3	Discharge rate kg/h	Standard compliance
	Process tail gas	35	NH_3	2100	7.1	
	Fugitive discharge		NH_3		18.7	
Boiler	1# 35t/h circulating fluid bed boiler	100	Smoke and dust	90	5.1	Yes
			SO_2	450	25.7	Yes
			NOx	100	5.7	
	2#20t/h boiling	48	Smoke and dust	180	7.1	Yes
			SO_2	860	33.7	Yes
			NOx	300	11.8	
	3# 20t/h chain	45	Smoke and dust	167	4.8	Yes
			SO_2	750	21.5	Yes
			NOx	300	8.6	

(3) Concentration of factory boundary

Odor pollutants monitoring of existing factory boundary was conducted by Zhumadian environmental monitoring station in February 2005 and see table 3.2-25 for the monitoring factory and result.

Table 3.2-25 Monitoring result of factory boundary

Pollutant	Position	Value of concentration range mg/Nm^3	Standard value mg/Nm^3	Executive standard	Over-limit ratio (%)
NH_3	East factory boundary	0.052～1.15	2.0	GB14554-93	0
	West factory boundary	0.052～1.50			0
	South factory boundary	0.034～1.32			0
	North factory boundary	0.054～0.732			0
H_2S	East factory boundary	0.0005～0.011	0.1		0
	West factory boundary	0.0005～0.008			0

Pollutant	Position	Value of concentration range mg/Nm^3	Standard value mg/Nm^3	Executive standard	Over-limit ratio (%)
	South factory boundary	0.001～0.019			0
	North factory boundar	0.001～0.015			0

According to the monitoring result, the pollutant concentration of NH_3 and H_2S can satisfy the standard requirements.

(4) Noise of factory boundary

Noise monitoring of existing factory boundary was conducted by Zhumadian environmental monitoring station in January, 2005 and see table 3.2-26 for the monitoring result.

Table 3.2-26 Noise monitoring result of existing factory boundary

Category		Monitoring result		Standard compliance		Standard
		Day	Night	Day	Night	
Noise of factory boundary	East factory boundary	76.9～77.0	74.9～76.3	No	No	Category III, GB12348-90 Day: 65 Night:65
	South factory boundary	61.5～61.6	56.5～59.5	Yes	No	
	West factory boundary	57.4～59.7	52.1～56.3	Yes	No	
	North factory boundary	73.0～75.9	68.2～68.4	No	No	

From above table we can see that the noise in all factory boundaries exceeds standard at night and the value is 1.3dB (A) ~21.3dB (A). Noise for all factory boundaries except south factory boundary and west factory boundary exceeds the standard both in day time and at night and the maximum value can be up to 12dB (A). We find out after the investigation that the main reasons for exceeding standard are high noises generated by equipment in factory and traffic noise outside the boundary of north factory.

3.2.3.6 Environmental issues existing in existing project and control measures

The existing project has following environmental issues through analysis:

(1) The current gasification, synthetic ammonia and urea projects finished for a long time so that equipment has been aged; in addition, no environmental protection acceptance has been implemented. The current and under-constructing project is complex and intersectional, procedures for certain projects are incomplete and some public works are also intersectional so that the commitment for shutting down some equipment can’t be conducted. At present, the enterprise has entrusted relevant units with check and

acceptance for environmental protection in order to ensure all environmental issues can be solved before implementation of this project.

(2) The process condensate discharged by current urea device is treated with desorption-hydrolysis method. Water from NH3-N and urea devices is les than 5PPm according to original design and will be reused for boiler. As there is a short supply of high-pressure steam load of production system and can't satisfy the demands of urea desorption-hydrolysis device so that the low-pressure steam has to be adopted, which may have influence on water quality. As water quality of system can't meet the reuse requirements so that great influences on treatment of gasification sewage and water quality of circulating system have been generated. The enterprise plans to establish power structure adjustment project (thermoelectric station, not in the range of this assessment) to solve the steam issue, through which both the requirements of urea desorption-hydrolysis device and waste water reuse can be satisfied.

(3) During environmental impact assessment of compound fertilizer project, we request the owner to improve waste water treatment facility with the principle of “replacing the old with the new”. Then, the enterprise applied Japanese overseas economic cooperation funds for construction of waste water treatment system, however, the facility has not been implemented yet. All production waste water will be discharged directly after treatment of waste water treatment system, for which nitrogen rejection device has not been installed; thus, the waste water can't be discharged up to standard. The pollutants such as COD and ammonia, etc are seriously exceeding standards so that surface water in Huangyou river is polluted; some living water also exceeds the standard even being treated by septic tank. As project water can't be discharged up the standard, cycle of concentration for current production circulating cooling water system is higher in order to reduce pollutions of waste water to environment so that water quality is aggravated, equipment corrosion is more serious. “Running, emitting, dripping and leaking” phenomena during production is acute and the pollutants also will make water quality aggravated after entering into circulating water system, thus, a vicious circle will be generated. Contamination accident risk will increase in the same time of affecting safe production. According to the requirements of No.11「2005」of Henan Environmental Protection Agency, the terminal facility for waste water treatment shall be provided after this project finishes. The capacity for the facility shall be 80m3/h and nitrogen rejection device must be installed in the facility in order to ensure that the discharged water can be up to standard stably for a long time.

(4) There is no accident water collecting tank for existing project, therefore, fluid in device and equipment washing water will be discharged directly and pollutes to water-holding body when production equipment shuts down accidentally or during its major repair. According to the requirements of No.11「2005」of Henan Environmental Protection Agency, the enterprise must construct the accident water collecting tank with capacity more than 200m^3 before then end of Jun, 2005.

(5) Danger solid wastes (copper sludge and cyanide sludge) generated are sold directly without safe treatment in factory so that environmental risks are caused. When this project finishes, all gas generating and cuprammonium washing device will be canceled and no

copper sludge or cyanide sludge will be generated.

(6) The current feed coal and fuel coal fields are open types and no dust prevention measures are taken so that the second-time dust of coal is serious and has great influence on local residents. The assessment suggests blocking the current coal field in order to minimize the influence of second-time dust.

(7) The existing project can’t meet the requirements of health protection distance. There are many sensitive targets within the zone and population is much concentrated so that great potential safety hazard exists. When Technological Transformation Project finishes, the current ammonia tank will be transferred from current factory to the technological transformation factory, through which the potential safety hazard in current factory can be eased; however, as the urea device still remains, the existing project also still can’t meet the requirements of health protection distance even the Technological Transformation Project finishes.

(8) There are two effluent outlets for existing project, which fails to meet requirements of environmental protection that only one effluent outlet can be arranged and is also not conducive to environmental protection monitoring. For existing project, the arrangement of effluent outlet must meet the requirements.

3.3 Project under construction

In order to adjust company’s product structure, improve enterprise’s capacity for adapting to market change and develop coal chemical products, the 600,000 tons/year compound fertilizer project is implemented at 200m from the southern part of current factory. At present, the project has finished and put into trial operation, however, it is still waiting acceptance. In the meantime, the company is constructing 150,000 tons/year ammonia-methanol coproduction device in the factory and implementing 30,000 tons/year melamine project and 20,000 tons/year methylamine project as well as 20,000 tons/year DMF (dimethylformamide) project in the planned “ fine chemical zone”. Based on the environmental impact reports of projects that passed technical assessment, the descriptions of projects under construction are as follows:

3.3.1 Methanol project

3.3.1.1 Main works

The under construction project is refined methanol with the capacity of 15×10^4t/a. See table 3.3-1 for main works of methanol and its relations with current synthetic ammonia device:

Table 3.3-1 Main works composition and its relationship with exiting project

S/N	Device name	Description of current device	Under-construction device

S/N	Device name	Description of current device	Under-construction device
1	Gasification	Fix bed intermittent gasification, there are 16 gas furnaces with the synthetic ammonia production capacity of 18×10^4t/a	Rely on the current project and on Technological Transformation Project when technological transformation finishes
2	Conversion	MT & LT CO shift	Rely on the current project
3	Cleaning	tannin extract and desulfurization of gas, carbon-C de-carbonization	Rely on the current project
4	Desulfurization	/	Newly-built secondary activated carbon adsorption device
5	Methanol synthesis	/	Newly-built 12.5 Mpa methanol synthesis device
6	Methanol distillation	/	Newly-built three-tower distillation device

3.3.1.2 Ancillary works

Relationship of main ancillary works.

3.3.1.3 Public works

See table 3.3-2 for composition of public works.

Table 3.3-2 Composition and relationship of public works

S/N	Facility name	Facility of under-construction project	Relying relationship
1	Primary water	Increased water consumption for under-construction project: 70 t/h	Rely on the current project
2	Water drainage	Increased drainage water for under-construction project: 40 t/h	Rely on the current project
3	Desalted water	Increased water consumption: 40 t/h	Rely on the current project
4	Water circulation	Circulated water amount: 3000 m^3/h	Rely on the current project

3.3.1.4 Storage and transportation engineering

See table 3.3-3 for storage and transportation engineering

Table 3.3-3 Composition of storage and transportation engineering

S/N	Project name	Facility of under-construction project	Remarks
1	Methanol intermediate tank farm	500 m3×1 crude methanol tank 200 m3×2 fine methanol tank	Newly built
2	Finished methanol tank farm	2000 m3×3 inner floating roo methanol tank	Newly built

3	Loading and unloading platform	Four-space through-type truck fill stand	Newly built

3.3.2 Consumption and source of raw material and fuel

See table 3.3-4 for main raw material and fuel of under-construction project.

Table 3.3-4 Consumption of raw material, fuel and main adjuvant material

S/N	Project name	Unit	New consumption
1	Catalyst	t/a	49.5

3.3.3 Analysis for project pollution factors

The environmental impact assessment of under-construction methanol project is provided by the Institute for Environmental Research of Zhumadian city on December, 2004. The assessment is mainly to briefly analyze the discharge and treatment of pollutants from under-contracture project according to the environmental impact assessment report.

(1) Brief description of process method and procedure

The under-construction 150,000 tons/year methanol device adopts ammonia-methanol coproduction process and the production procedures are as follows:

Feed gas from carbon dioxide removal section flows into compression section after secondary desulfurization and dechloridation treatment. Mixed gases of feed gas from compression section and boosted recycle gas from cycle machine will flow into the synthesizing tower from its top side in two routes and generate methanol and water under the function of copper accelerant of tower under 12.3MPa and 230～280℃. Gas will flow out from the bottom of tower and enter into methanol separator. Now, most methanol and water will be separated after condensing and crude methanol will be made, which may delivered to the crude methanol tank in rectification section through the buffer bin of methanol. The gas from methanol separator will enter into cycle machine; then parts return to water oil separator for circulating after being boosted and parts are transmitted to copper washing section in synthetic ammonia workshop after being washed in high pressure in alcohol scrubbing tower and methanol in gas being removed.

The crude methanol from methanol synthesis section will get into the middle part of deecherization tower (pre-rectifying tower) after being delivered into crude methanol preheater with pump and heated. The overhead products from super tower will be condensed through condensator; fluid enters into return tank for circulating reflux and not-condensable gas will be transmitted to boiler as fuel. The crude methanol after deetherizing will be pumped out from the bottom of tower and transmitted to the middle part of pressurized rectifying tower. The overhead products from super tower can be divided into three routes: partial methanol will be transmitted to middle tank area of fine methanol; partial methanol will be driven into upper side of pressurizing tower with reflux pump for circulating reflux; partial methanol gas mixes with methanol gas from atmospheric tower, the fluid at the bottom of pressurizing tower will be driven into the middle part of atmospheric tower through pressure in its internals and the overhead products from atmospheric tower (that is: fine methanol products) will be transmitted into the middle tank area of fine methanol through reflux pump of atmospheric tower after condensing, and another part will be driven into the upper side of atmospheric tower for circulating reflux. A small amount of fusel can be got from the middle and bottom side of atmospheric tower and the waste water at the bottom of tower will be transmitted into waste water treatment system through waste water pump. See Fig 3.3-1 for process procedure and sketch map of pollution generation.

(2) Main equipment

Table 3.3-5 Main equipment for under-construction methanol device

S/N	Name	Specification and model	Qty
1	Methanol synthesis tower	ф1.4m, H=17.9	1 set
2	Pre-rectifying tower	ф1.2m,	1 set
3	Pressurizing tower	ф1.6m,	1 set
4	Atmospheric tower	ф2.2m,	1 set

（3）Pollution Producing Section and Environmental Protection Measures

①Waste gas

The main waste gas pollution sources of combined methanol unit are G1 methanol synthetic purge gas and G2 methanol rectification non-condensable gas both of which contain high concentration of combustible gas with high calorific value and are proposed to send to the waste heat recovery unit of air generation blowing air for utilization. It also includes the unorganized discharge of methanol during G3 methanol storage and transportation.

Table 3.3-6 Waste gas pollution sources of methanol unit under construction

No.	Pollution Sources Name	Air Displacement Nm^3/h	Pollutant	Discharge Concentration	Measures and Results
G_1	Methanol	3250	CO	8.4%(Vn)	After sending to the hydrogen

No.	Pollution Sources Name	Air Displacement Nm^3/h	Pollutant	Discharge Concentration	Measures and Results
	synthetic purge gas		N_2	13.0%(Vn)	recovery unit and recovering hydrogen, send to blowing gas waste heat recovery unit.
			H_2	75.3% (Vn)	
G_2	Methanol rectification non-condensable gas	105	Methanol	20%(Vn)	Send to blowing gas waste heat recovery unit
			Dimethyl ether	76%(Vn)	
			CO and others	4% (Vn)	
G_3	Unorganized discharge of methanol storage and transportation		Methanol	0.757kg/h	Direct discharge

②Waste water

Table 3.3-7 Waste Gas Pollution Sources of Methanol Unit Under Construction

No.	Pollution Source Name	Water Discharge m^3/h	Pollutant	mg/LDischarge Concentration mg/L	Measures
W_1	Methanol rectification waste water	3	Methanol BOD_5	1.2% 12000	Send to gas generation fixture vaporization
W_2	Sewage disposal of cycle water	50	COD	80	Direct discharge
W_3	Floor wash water	5	SS COD	120 90	Send to current sewage treatment station

③Solid waste

The main solid waste pollution source of the methanol unit under construction is S1 mehanol synthetic catalyst. See Table 3.3-8.

Table 3.3-8 Overview of Solid Waste of Project under Construction

No.	Pollution Source Name	Discharge Amount (t/a)	Main Constituent	Discharge Characteristics	Disposal
S_1	Methanol synthetic catalyst	120.5	CuO、ZnO	Intermittent	Factory recovery

④Pollution source of noise

The noise pollution source of the methanol unit under construction is synthetic gas cycle machine. See Table 3.3-9.

Table 3.3-9 Main Noise Source of the Project under Construction

No.	Noise Source Name	Amount (Unit)	Noise Level dB(A)	Measures
N1	Methanol synthetic gas cycle machine	1	87	Sound insulation for building

3.3.4 Overview of Melamine Project under Construction and Pollution Generation Link

3.3.4.1Project Overview

For basic information of the project under construction, see Table 3.3-10.

Table 3.3-10 Schedule for Basic Information of Melamine Project under Construction

No.	Item	Content
1	Project scale	Annual melamine production of 30,000 t
2	Factory site for construction	Adjacent to the park of fine chemicals in the current factory
3	Approval document number of environmental assessment	Yuhuanjianbiao (2003) No. 133
4	Construction content	Main melamine unit, product warehouse, transformation and distribution room, comprehensive building, etc.
5	Connection with the current project	Water, electric power and steam for the project and the main raw materials for production (urea and ammonia) are provided by current project.

3.3.4.2 Technological Process and Pollution Generation Analysis

The project intends to adopt the improved gas phase quenching and cooling process of Tsinghua University which is summarized as follows:

74% urine, after buffering by the urine sump and pressurization by the urea is sent to the melamine reactor and injected into the top of the first group of molten salt coil pipes with the atomization gas. The mixed gas is discharged from the reactor top after reaction. The molten salt coil is set inside the reactor to provide the necessary heat for reaction. The top of reactor includes two-stage cyclone to separate the catalyst in reaction gas. The reactor operating pressure is less than 0.2 MPa and the temperature is about 380 ℃.

The gas mixture from the reactor is introduced into the hot gas condenser pipe and the heat transfer medium at the shell side is Daosheng liquid. The hot gas temperature drops after heat exchange and the high boiling substance in the gas phase condenses due to the temperature decrease. The gas mixture is discharged from the hot gas condenser, and the foreign matters as high boiling substance and catalyst are removed through the hot gas filter. The gas mixture, after passing the hot gas filter enters the crystallizer through its top and mixes with part of cold air from the urea wash tower inside the crystallizer. Following the temperature drop, melamine crystallizes and precipitates under the condition. Melamine crystals enter the cyclone separator with airflow and are discharged from the bottom by the way of screw extrusion and sent to the packaging system after separation. The airflow with NH3 and CO2 is discharged via the top of cyclone separator and sent to the urea wash tower, and discharged from the bottom of the tower after washing, dedusting and cooling by the urine from the cycle urine pump. Part of the end gas is sent to the reactor as fluidizing gas after pressurization of the carrier gas compressor, part is sent to crystallizer as the cold gas and rest is sent to the section of end gas disposal.

The exhaust from the melamine unit enters the end gas processing unit. The exhaust gas consists of 48.4wt% of the ammonia, 50.8wt% of carbon dioxide and a small amount of inert gas. The exhaust, after bubble absorption, enters the inert wash tower to wash the inert gas, returns to the sump of carbon ammonia liquid and is sent to the carbon separation tower via the carbon ammonia liquid pump. For the emission of carbon dioxide from the top of the carbon separation tower, the liquid distilled from the tower bottom enters the ammonia desorption tower, and the ammonia desorbed is sent to the liquid ammonia sump for urea unit after refining.

For the production process of melamine and pollution generation link, see Figure 3.3-2.

3.3.4.3 Pollutant Discharge

Melamine project environmental impact assessment was completed by the Environmental Protection Institute of Zhumadian City in July 2003. The assessment will be primarily based on its assessment materials and include brief analysis on the pollutant discharge of the project.

①Exhaust pollutant discharge

The exhaust generated during the melamine production primarily includes the coal burning flue gas generated by the molten salt furnace for heating the reactor, and the exhaust generated in the sections as the inert gas tower, ammonia carbon separation tower, melamine warehouse and packaging. In accordance with its approved EIA report, the project exhaust pollutants are shown in Table 3.3-11.

Table 3.3-11 Discharge of Melamine Waste Gas Pollutant

Waste gas Category	Pollution Source Name	Air Displacement (Nm^3/h)	(m) Exhaust Funnel Height (m)	Pollutant concentration and discharge rate			Measures
				Name	Discharge Concentration mg/Nm^3	Discharge rate kg/h	

Melt on Salt Furnace Exhaust	Coal burning flue gas	21700	35	Flue dust SO_2	167 607	3.62 15.5	Dedusting by venturi granite water film
Process waste gas	Idle wash tower exhaust	355	35	NH_3		0.11	Direct discharge
	Ammonia carbon separation tower exhaust	2200	35	NH_3		0.87	Direct discharge
	Top exhaust of finished product warehouse	6290	25	Dust	10	0.17	Two-stage cyclone+ bag-type dedusting
	No organized discharge			NH_3		2	

② Wastewater pollutant

Wastewater of the project mainly includes circulating cooling water, wastewater generated by the urea concentration unit, wash water of workshop and a small amount of waste water generated by the comprehensive building and laboratories. After being sent to the deep hydrolysis unit of the existing project via the waste water pump for treatment, the wastewater generated by the urea concentration unit returns for the boiler water supply without discharge; the wash water of workshop and a small amount of waste water generated by the comprehensive building and laboratories are sent to the existing sewage treatment station and then discharged via the general sewage outfall; the circulating cooling water is directly discharged. The water displacement of the project is about 14m3/h and the water quality is basically the same with the existing project.

③ Noise

The noise equipments of the project are mainly a variety of blowers and induced draft fans, compressors, cycle machines and all kinds of pumps and so on, the noise source strength of which is generally between 70 -95dB (A). After silencing, absorption and building isolation, the noise outside the factory building can be reduced to below 80 dB (A).

④ Solid waste

The solid waste generated by the project mainly includes the molten salt furnace slag and reaction catalyst. Their amount and control measures are shown in Table 3.3-12.

Table 3.3-12 Generation and Disposal of Melamine Solid Waste

No.	Category	Name	Amount (t/a)	Disposal
1	General solid waste	Slag of molten salt furnace	3400	All are utilized as building materials and pavement.
2	Dangerous solid waste	Waste catalyst	1350	Factory recovery

3.3.5 Overview of Methylamine and DMF Project under Construction and Pollution Generation Link

3.3.5.1 Project Overview

For basic information of the project under construction, see Table 3.3-13.

Table 3.3-10 Schedule for Basic Information of Methylamine and DMF Project under Construction

No.	Item	Content
1	Project scale	Annual methylamine and DMF production of 20,000 t
2	Factory site for construction	Adjacent to the park of fine chemicals in the current factory
3	Approval document number of environmental assessment	Yuhuanjian (2004) No. 9
4	Construction content	Methylamine unit, DMF unit, PSA-CO unit (CO purification unit), methylamine tank, finished DMF tank and finished product packaging and office buildings.
5	Connection with the current project	Water, electric power and steam for the project and part of the raw materials for production (methanol and ammonia) are provided by current project.

3.3.5.2 Process and pollution generation analysis

The main production units of the project include methylamine unit, DMF unit and PSA-CO unit. For the general process and pollution generation process of the project, see Figure 3.3.-3.

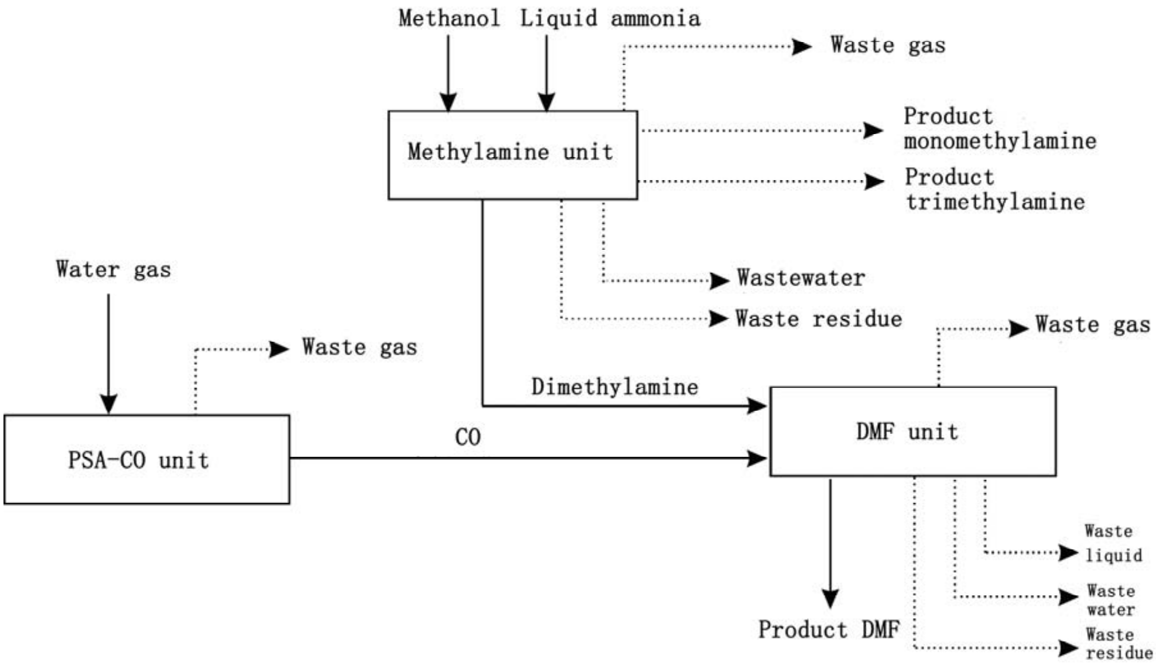


Figure 3.3.-3 Methylamine Unit and DMF Unit Process and Pollution Generation Process

Methylamine production adopts the methanol gas-phase catalytic amination process, consisting of two processes of ingredient synthesis and rectification. The exhausts generated in the methylamine production are the exhausting waste gases discharged by the synthetic tower, deamination tower, extraction tower and dehydration tower, which are discharged after the treatment of the end gas absorption tower with the amount of 0.3 t/d. Wastewater is mainly a small amount of column bottom liquid discharged by the methanol recovery tower with the amount of 48.3m3/d. The solid waste generated during methylamine production is mainly waste catalyst and distilled base solution with the amount of 0.91t / d.

DMF production unit adopts dimethylamine and CO (which is made from water gas by the PSA-CO purification unit) one- step synthesis. It is divided into two processes, synthesis and refinement. The wastewater generated in DMF production is the coagulator sealing scrubbing waste water at the end of the stripping tower with amount of 5m3/d. The exhaust is mainly a small amount of exhaust gas discharged during the CO purification process, and the exhaust gas discharged by the reactor of DMF unit, tower I and stripping tower to adjust the pressure of the reactor tower. The solid waste generated during DMF production is the column bottom liquid and waste catalyst.

3.3.5.3 Pollutant Discharge

Methylamine and DMF project environmental impact assessment was completed by the

Environmental Protection Institute of Zhumadian City in July 2003. The assessment will be primarily based on its EIA report and include brief analysis on the pollutant discharge of the project.

The types of pollutants generated during Methylamine and DMF production and their amounts are shown in Table 3.3-14 and the pollutant discharge is in Table 3.3-15.

Table 3.3-14 Main Pollutants of Methylamine and DMF Projects

Product Name	Type of Pollutant		Main Pollutants	Amount	Disposal
Methylamine	Waste water		pH, SS, COD, BOD, ammonia nitrogen, organic solvents (methanol, methylamine, etc.)	$48.3m^3/d$	Anaerobic digestion
	Process waste gas	Unorganized	N_2, H_2, NH_3,and a small amount of methanol	0.03t/d	
		Organized		0.27 t/d	Discharged by high exhaust funnel
	Waste solid		Waste catalyst, salt by-products	0.91 t/d	Landfill disposal
DMFDMF	Waste water		pH, COD, DMF, dimethylamine	$5\ m^3/d$	Sent to furnace for combustion
	Process waste gas	Reactor	CO, methylamine, DMF, DMA	1.01 t/d	Sent to furnace for combustion
		Tower I			
		PSA-CO unit	H_2、CO、CO_2、CH_4、O_2、N_2、	17.65 t/d	Sent to the current synthetic ammonia unit for recovery
	Stripping tower	Unorganized	N_2 and a small amount of DMA	0.342 t/d	
		Organized		3.076 t/d	Discharged via 30 m high exhaust funnel after condensation
	Waste solid	Column bottom liquid	DMF 、 MMF 、 DMAC	0.36 t/d	Sale
		Slag	Catalyst and by-product	1.127 t/d	Disposed as dangerous solid waste

Note: In production, the exhaust discharged via the exhaust funnel is reckoned as 90% and the unorganized is reckoned as 10%.

Table 3.3-15 Main Pollutant Discharge of Methylamine and DMF Projects

Category	Item	Unit	Amount
Waste water	Water displacement	$10,000\ m^3/a$	22.3

	COD	Discharge Concentration	mg/L	104
		Discharge amount	t/a	23.2
	Ammonia nitrogen	Discharge Concentration	mg/L	1.8
		Discharge amount	t/a	0.4
Waste gas	Discharge amount		10,000 m^3/a	4000
	Flue dust	Discharge Concentration	mg/m^3	0
		Discharge amount	t/a	0
	Dust	Discharge Concentration	mg/m^3	0
		Discharge amount	t/a	0
	SO2	Discharge Concentration	mg/m^3	0
		Discharge amount	t/a	0
	Ammonia	Discharge Concentration	mg/m^3	250
		Discharge amount	t/a	10.0
Waste solid			t/a	0

3.3.6 Overview of Compound Fertilizer Project Under Construction

3.3.6.1 Project overview

For basic information of the project under construction, see Table 3.3-16.

Table 3.3-16 Schedule for Basic Information of Compound Fertilizer Project under Construction

No.	Item	Content
1	Project scale	Annual production of compound fertilizer of 60,000 t
2	Factory site for construction	200 m to the south of the current factory district
3	Approval document number of environmental assessment	Yuhuanjian ［2001］No. 18
4	Connection with the current project	Water and electric power required by the project are supplied by the current project, and the steam required is supplied by one newly added 75t/h and one 20t/h waste heat boiler.

3.3.6.2 Process and pollution generation link analysis

（1）Process

Raw material preparation: The powdered solids as potassium chloride and filler are sent to the raw material storage hopper of the ingredient system through the bucket elevator, the solid particles as monoammonium phosphate and urea enter their own raw material storage hoppers after lifting by bucket elevator and crushing by crusher; the 99.5% molten urea before the granulation of urea unit is diluted with water to 95% or so and sent by the urea to the sprinkler of the granulator.

Granulation: The raw materials from the feeding belt together with the powder materials from the screening and crushing system and the dust removed from the cyclone separator enter into the granulator. The granulation is performed with the sprayed urea solution. The granulation exhaust contains a small amount of dust which is discharged after washing by the scrubber.

Drying: The materials from the granulator enter the stage I drying machine, and contact with the hot air from the coal-burning hot blast furnace for drying, and then enter the stage II drier after screening for further drying. The gas at the outlet of the stage II dryer mixes with hot air from the hot blast furnace after dedusting by the cyclone separator, and the gas from the stage I drier enters the scrubbing system for washing after dedusting by the cyclone separator.

Screening: The above dried materials enter the large particle screening machine for screening. The particles larger than 4mm separated out are sent to the crusher for crushing and then used as the return materials. The screened materials are screened through the screening machine and the qualified products are sent to the cooling machine. Particles less than 2mm together with the large particle materials return back to granulator as return materials.

The above qualified particles, after “cooling” by the cooling machine and “packaging” by the packaging machine (by adding packaging oil and agent) are sent to the finished product packing system for packing.

The exhaust sources are primarily the coal-burning flue gas of one new 75 t/ h heating boiler and the process exhaust of compound fertilizer production; the wastewater pollution source is 80m3/h air washing circulating water of new compound fertilizer, which is for recycling without discharge; the new solid waste is mainly boiler slag.

The technological process and pollution generation process of the project under construction are shown in Figure 3.3-4.

3.3.6.3 Pollutant Discharge

The environmental impact assessment of the project was completed by the Environmental Protection Institute of Zhumadian City in April 2001. The assessment will be primarily based on its EIA report and include brief analysis on the pollutant discharge of the project.

The types and amount of pollutant generated during the production of compound fertilizer with annual output of 600,000 t are shown in Table 3.3-17.

Table 3.3-17 Main Pollutant Discharge of Compound Fertilizer with Annual Output of 600,000 t Unit: t/a

Product Name	Type of Pollutant		Main Pollutants	Output	Discharge amount	Disposal
Compound fertilize	Waste gas	Flue gas of one 75t/h boiler	Flue dust	12672	126.72	Desulfurization in furnace, electrostatic precipitation of three electric fields + water film dedusting, the processed flue gas is discharged through 100 m chimney
			SO_2	849.02	424.51	
			Nox	77.06	77.06	
		Process end gas	Flue dust	4542	45.42	Cyclone + sprinkling dedusting
			SO_2	4066	34.56	
	Waste solid		Boiler slag	52600	0	Fully used for materials of production and building with comprehensive utilization

3.4 Overview of Technological Project

3.4.1 Construction Program

This project is a transformation project of raw material path which adopts the coal-water slurry gasification process to replace the existing fixed layer intermittent gasification process and also involves the transformation of the existing synthetic ammonia unit. The existing methanol rectification and urea units are not included in the transformation. After transformation, the total ammonia production capacity is 300,000 t/a including 220,000 t/a synthetic ammonia and 80,000 t/a methanol.

3.4.2 Main Construction Content

The raw material path transformation will involve the sections of gasification and synthesis. It will newly build the production units as the air separation, gasification, conversion, desulfurization & decarbonization, sulfur recovery, methanol methanation, synthesis, synthetic gas compressor, as well as the supporting projects as the waste control, auxiliary works and public works at the proposed site. It will demolish the corresponding units of the existing project at the same time. The components of the project are shown in Table 3.4-1.

Table 3.4-1 Schedule of Project Unit scale and Components

Type	No.	Name	Description

Type	No.	Name	Description
1 Main production unit	1.1	Gasifier	New, 0.65MPa coal water slurry gasification process
	1.2	Conversion unit	New, Co-M0 wide temperature range sulphur endurance conversion process
	1.3	Desulfurization and decarburization unit	New, NHD desulfurization and decarburization
	1.4	Sulphur recovery unit	New, Klaus sulphur recovery unit
	1.5	Methanol methanation unit	New, medium voltage alcohol alkylation
	1.6	Synthetic ammonia unit	New, 15.0MPa synthetic ammonia process
2 Auxiliary production facilities	2.1	Air separation	New, 40000Nm^3/h, all low-pressure, air turbine expansion, air pre-cooling, molecular sieve adsorption, internal compression and nitrogen compressor process
	2.2	Synthetic gas compression	New, use of domestic centrifugal compressor
	2.3	Cooling station	Adding a large steam-driven centrifugal ammonia compressor
	2.4	Flare stack of the factory	Newly building a 60 m flare stack, φ1920mm
	2.5	Sewage disposal	New, use of three-stage flash, clarifying tank, sedimentation, vacuum filter
	2.6	Sewage treatment station	Rely on the current project and newly build biological sewage treatment facilities
	2.7	Preparation of coal slurry	Newly build two sets of coal slurry preparation system
3 Utility facilities	3.1	Water supply	The well water of the current factory used as water source and newly build a raw water purification station.
	3.2	Cooling circulating water system	20680m^3/h
	3.3	Power supply	Rely on the existing project
4 Storage facilities	4.1	Raw material coal storage	New
	4.2	Slag dump	New
	4.3	Ammonia warehouse	The current ammonia tanks are transferred to the new factory

3.4.3 Product Linkup and Correlation between the Transformation Project and the Existing Project and the Project under Construction

Product linkup and correlation between the transformation project and the existing project and the project under construction are shown in Figure 3.4-1.

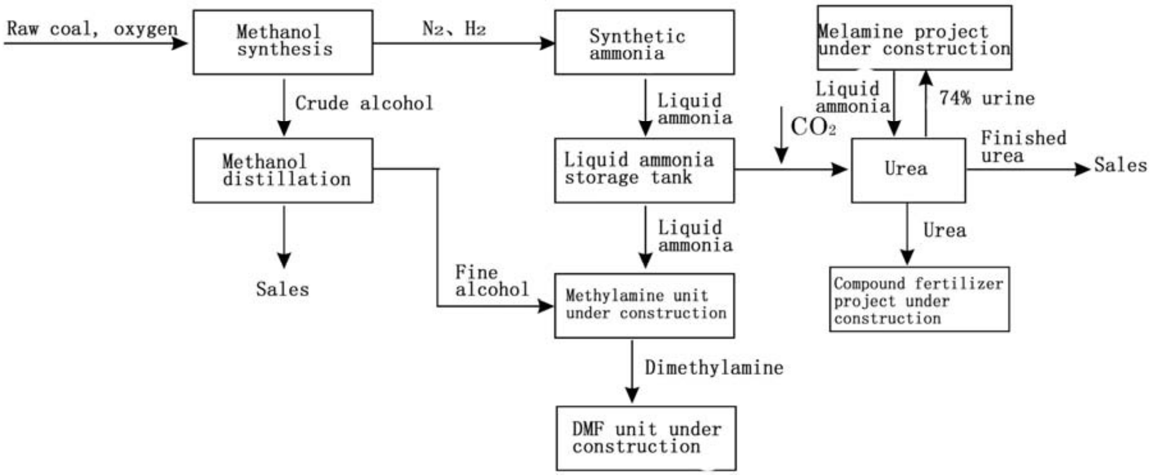


Figure 3.4-1 Diagram for Product Linkup and Correlation between the Transformation

3.4.4 Overview of Main Equipments Changed

The main equipments eliminated after the implementation of the transformation project are shown in Table 3.4-2.

The main equipments added after the implementation of the transformation project are shown in Table 3.4-3.

Table 3.4-2 Main Equipments Eliminated after the Implementation of the Transformation Project

No.	Name	Parameter and Scale	Number
I	Gasification Unit		
1	Gasification furnace	φ2610	16
2	Waste heat boiler	Stand type	14
3	Washing tower	φ5000	6
II	Synthesizer		
1	Ammonia Synthesis tower	φ1.0m	2
2	Saturated hot water tower	φ3.0m	2
3	Conversion gas desulphurization tower	φ3.0m	2
4	Conversion gas decarbonization	φ2.3m	2

	tower		
5	Ice machine		4
III	Auxiliary unit		
1	Air separation	300 m3/h	1
2	Tannin extract desulfurization	800t/a	1

Table 3.4-3 Schedule of New Main Production Equipments of Transformation Project

No.	Section Name	Model	Number
I	Coal slurry preparation section		
1	Kneaders of different kinds	Impeller diameter between 508m-1676m	6
2	Coal feeder	Weighing capacity 36.9-3.7t/h	2
3	Limestone feeder	Feeding capacity 4000kg/h	2
4	Coal storage bunker	$V=390m^3$	2
II	Gasification section		
1	Gasifier	φ2756m H=13402m	2
2	Carbon washing tower	φ2600m H=17250m	2
3	Flare stack sewage tank	φ1000m $V=1.48m^3$	1
III	Conversion section		
1	Coal gas separator	φ2600m×7482m	1
2	First shift converter	φ3700m H=11000m $V=40m^3$	1
3	Waste furnace	$F=1835m^2$ $F=884m^2$	2
IV	Desulphurization section		
1	Desulphurization tower	φ3400m×49310m	1
V	Decarbonization/fine desulphurization		
1	CO_2 absorption tower	φ3400m×56300m	1
2	Gas tower	φ2200m/φ4000m×53330m	1
3	Hydrolytic fine desulphurization tower	φ3000m×16000m	1
VI	Compression section		
1	Synthetic gas compressor	Fresh gas $3056m^3/h$ circulating gas 3360 m^3/h	1
VII	Synthetic section		
1	Ammonia Synthesis tower	φ2200m $V=35.7m^3$	1

No.	Section Name	Model	Number
2	Waste heat boiler	φ1200m F=176m^2	1
3	Hydrogen recovery unit	Amount of gas processed 4700 m^3/h	1

3.4.5 Technological Process and Pollution Generation Link

3.4.5.1 Coal gasification process

(1) Production process

①Preparation of coal-water slurry

The raw material coal delivered via the conveyor belt (<25mm = is sent to the coal storage hopper, after the amount is controlled by the weighing feeder, then sent to the rod mill. After adding a certain amount of water, the material in the rod mill is processed by wet-grinding. Add additive to control the viscosity of coal slurry and maintain its stability, and add lye to adjust the slurry pH. The concentration of the slurry from the rod mill is about 65%. The slurry is drained into the exit tank of the coal mill and sent to the coal slurry tank of the gasification section after compression by the pump at the exit tank.

② Gasification

In the gasification section, the coal-water slurry has partial oxidation reaction with oxygen to make the crude synthesis gas.

The coal-water slurry from the coal slurry tank, after compression by the coal slurry booster pump, together with the high-pressure oxygen sent by air enters the gasifier through burner and reacts with oxygen in it.

The reaction occurs at 6.5MPa, 1350 - 1400 ℃.

Gasification reaction is finished instantaneously at the reaction section of the gasifier and produces gasified gases as CO, H2, CO2, H2O and a small amount of CH4 and H2S.

The hot gas and slag leaving the reaction section of the gasifier enters the quenching chamber for water bath. Its temperature drops after water quenching. It comes out of the gasifier after saturation by water vapor. After washing, dedusting and cooling by Venturi scrubber and carbon wash tower, the gas is sent to the reaction section.

The slag generated in the gasifier reaction is separated after a water bath in the shock chamber, and flow into the slag bucket and then into the slag pool at regular time; finally, it is taken out by the slagging machine to load for shipping out.

The wash water discharged from the gasifier and the carbon washing tower, etc. is sent to the ash water treatment; and the treated water is recycled for use.

③ Ash water treatmen

This process is to separate slag and water from the black water generated by gasification, and the treated water is recycled for use.

The high-temperature black water emitted from the gasifier and the carbon washing tower is concentrated by high pressure, low pressure and vacuum flash evaporation and then enters the sedimentation tank, which is added with a flocculant to accelerate the sedimentation. The thin slag slurry sedimenting at the bottom of the tank is drawn out by the pump into the filter feeding trough, and then sent into the vacuum filter for dehydration after the pressing of the filter feeding pump. The heat of the high-pressure gas generated from flash evaporation is recycled by the ash water heater, and the condensed fluid is separated by the gas-liquid separator, and then the gas enters the conversion process- stripper.

The low-pressure gas generated from flash evaporation is directly sent to the washing tower feeding trough, the clean water on the top of the sedimentation tank overflows into the ash water tank, and into the washing tower feeding trough by the ash water pump; and small amount of ash water is discharged as waste water into the sewage treatment plant for treatment.

After the pressing of the feeding pump, the water provided by the washing tower to the feeing trough exchanges heat with the hot gases emitted from the top of the high-pressure flash evaporation jar, and then is sent into the carbon washing tower for recycling.

Diagram for production process and pollution generation section is shown in Figure 3.4-1.

⑵ Pollution generation section analysis

① Exhaust gas

G1 Exhaust gas from the coal preparation process: The discharge of the dust-contained exhaust gas produced in the coal crushing system is 4000Nm3 / h, and it is treated by the high-efficiency long-bag low-voltage large-scale pulse blowing high concentration of pulverized coal bag-typed dust catcher; the dust concentration in the treated exhaust gas is less than 80mg/m3, and it is discharged by a 35m high exhaust funnel in a continuous compliance manner.

G2 Exhaust gas from coal warehouse: The discharge of the exhaust gas from the coal warehouse is 2000m3 / h, and it is treated by the high-efficiency bag-typed dust catcher; dust concentration in the treated exhaust gas is less than 100mg/m3, and it is discharged by a 75m high exhaust funnel in an intermittent compliance manner.

G3 Exhaust gas from coal gasifier driving: The discharge of the flue gas from the driving and heating-up of the coal gasifier is 35400 m3 / h, mainly containing CO_2, H_2O, N_2 and other components, and it is sent to the torch for combustion and discharge after dedusting and washing.

G4 Flash evaporation gas: The combustible gas emitted from the coal gasification plant ash water treatment system is sent to the torch for burning and ventilation after decompression.

The discharge of the coal gasification plant exhaust gas pollution source is shown in Table 3.4-2.

Table 3.4-2 Pollution source of the coal gasification device

No.	Name of exhaust gas pollution source	Discharge rate Nm^3/h	Pollutant emission characteristics						Pollution prevention and control measures
			Name	Resulting value mg/Nm^3	Emission value mg/Nm^3	Continuous	Intermittent	Height	
G1	Dust-contained exhaust gas from the coal preparation device	4000	Dust	< 50000	<80	√		90 m	High-efficiency bag-typed dedusting, with a dust removal efficiency of 99.9%
G2	Exhaust gas from coal warehouse	2000	Dust	< 20000	< 100		√	75 m	Warehouse roof bag-typed dedusting
G3	Exhaust gas from coal gasifier driving	35400	CO H_2S NH_3		3.5kg/h 3.5 kg/h 1.2 kg/h		√	60 m	Torch burning
G4	Flash evaporation gas	225	CO H_2S NH_3	11.4% 0.38% 0.14%	100 100 33	√		60 m	Torch burning

② Wastewater

Ash waste water in unit discharged from the washing tower, most of them can be recycled after the treatment of three stages of flash vaporization, and a small amount of gray water will be disposed by the new biological treatment system before discharge in order to prevent the accumulation of pollutants.

W1 coal gasification wastewater: discharge capacity is 19m3 / h, the main pollutants are NH3-N, cyanide, suspended substance, sulfide, etc., they are sent to sewage treatment station for biological treatment.

Table 3.4-3 Coal Gasification Units Wastewater Pollution Source

NO.	pollution source name	discharge capacity (m^3/h)	main pollutant	discharge direction and processing mode
W1	Coal Gasification Wastewater	19	NH_3-N、cyanide、suspended substance、sulfide	wastewater treatment units throughout the whole plant

③Waste residue

S1 coal pulverizing waste residue: The power residues produced by this project are mainly carpolites, its discharge capacity is 200kg / h, stocked in residue field of plant temporarily, used for paving the road or landfill later.

S2 coal gasification fly ash: the discharge capacity of coal gasification fly ash is 6.8t / h, stocked in residue field of plant temporarily, used for construction materials later.

S3 coal gasification waste residue: the discharge capacity of coal gasification fly ash is 19.4t/h, stocked in residue field of plant temporarily, used for construction materials later.

Table 3.4-4 Coal Gasification Units Solid Waste Pollution Source

NO.	pollution source name	quantity discharged	main component	Remarks
S1	coal pulverizing waste residue	1584 t/a	mainly are carpolites	The comprehensive utilization of all solid wastes is used for producing construction materials.
S2	coal gasification fly ash	5.4×10^4 t/a	SiO_3、CaO、Fe_2O_3、C	
S3	coal gasification waste residue	15.4×10^4 t/a	SiO_3、CaO、Fe_2O_3、C	

④ Noise

New high noise equipment, shown in Table 3.4-5.

Table 3.4-5 Coal Gasification Units Source Pollution Noise Schedule

construction project section	noise equipment	equipment quantity	noise level dB(A)	Noise reduction measures
coal slurry preparation	coal grinding mill	2	100	set sound-proof cover、rubber cushion
	air compressor	2	95	configured vibration deadener
	various pumps	6	90～95	base vibration reduction、use sound absorber
coal gasification	various compressors	2	90～105	base vibration reduction、building sound insulation
	various large pump	10	90~100	base vibration reduction

3.4.5.2 Transformation Process

(1)Technological process of production

Technological production of transformation process and pollution link of production diagram shown in Figure 3.4-2

Convent CO component of gas in this construction section into H_2

$$CO + H_2O \longrightarrow H_2 + CO_2$$

Chemical reaction in this construction is converter reaction, expressed by the following equation, said:

$$CO + H_2O \longrightarrow H2 + CO_2$$

In the function of catalyst, the CO and H_2O in the feed gas react to form the corresponding amount of H2 and CO_2.

CO converter technique is developed along with the progress of the shift catalyst. The performance of the shift catalyst determines the flow of shift process and its advancement.

According to the different shift catalyst, at present there are three main kinds of shift process at home and abroad which divided into sulfur-tolerant shift and non-sulfur-tolerant shift.

The shift process adopts the Fe-Cr series shift catalyst, the operating temperature is 350 ~ 550 ℃, known as the middle、high-temperature shift process. Its has higher operation temperature, through the transformation the feed gas still contains about 3% of the CO. Sulfur resistance of the Fe-Cr series shift catalyst is poor, apply to the gas which total sulfur content is less than 100ppm.

The shift process adopts the Cu - Zn series shift catalyst, the operating temperature is 200 ~ 280 ℃, known as the low-temperature shift process. This process is usually in Series after the middle、high-temperature shift process to reduce about 3% of the CO dropped to about 0.3%. Sulfur resistance of the Cu - Zn series shift catalyst is even worse, apply to the gas which total sulfur content is less than 100ppm 0.1ppm.

The shift process adopts the Co - Mo series shift catalyst, the operating temperature is 200 ~ 550 ℃, known as the wide temperature shift process. Its operating temperature is wide, process design is reasonable, through the transformation the feed gas still contains about 0.2% of the CO. Sulfur resistance of the Co - Mo series shift catalyst is very strong, and it has no limit requirements to the total sulfur content.

Energy consumption of the shift depends on the water / gas ratio required by the catalyst and operating temperature, in the above-mentioned three kinds of shift process which is suit for this project are the process contains the Fe-Cr and Co-Mo series shift catalyst, the water / gas ratio and operating temperature of the shift process contains the Co-Mo series shift catalyst is lower than the shift process contains the Fe-Cr system shift catalyst, therefore, it has the advantages of low power consumption. Sulfur-tolerant shift has more advantages than non-sulfur-tolerant shift which has become the main direction of the development of shift technology.

Using the sulfur-tolerant shift, due to the dust content of gasification crude synthetic gas after washing is 1 ~ 2mg/m3, total sulfur content is 3 ~ 20 g/m3, the temperature ~ 241 ℃, and it is saturated by water vapor, water and gas ratio is about 1 : 4, taking into account the project is a co-production methanol of synthetic ammonia, in order to facilitate the adjustment alcohol ammonia ratio, adding crude synthetic gas waste heat boiler, reduce water-gas ratio appropriately, and control the content of shift export CO. The crude synthetic gas after reduce the crude gas ratio can be heated directly, then taken into shift without supplemented steam: short process, low energy consumption, so coal-water slurry gasification with sulfur-tolerant shift is the best option. CO shift reaction will produce a lot of heat; reaction heat can be used to generate steam, preheated salt removal water and waste heat boiler feed water.

In summary, this project recommended the wide temperature range sulfur-tolerant shift process developed in home.

Rough gas from the gasification carbon scrubber, after separated the moisture in gas by the gas-liquid separator, sent into the crude gas waste heat boiler after entrained into the gas filter to remove impurities. Drop the temperature of crude gas down to 210 ℃ to enter the gas water knockout drum to control water-gas ratio in gas. The crude gas after the cooling and water knockout sent into the feed gas pre-heater for exchanging heat with the shift gas to about 305 ℃, and then sent into the shift kiln, generate changing reaction with its own carrying water vapor in the function of sulfur-tolerant catalyst, after the high-temperature gas through the shift kiln exchanged its heat by methane adjusted heat exchanger , then exchange heat with the entering crude gas in the feed gas pre-heater, it will convert into 1.2MPa steam at the temperature of about 430 ℃,when the temperature dropped to 270 ℃, then recover its heat by the 0.4MP waste heat boiler, boiler feed water pre - heaters, delayed water heater, and then cool it though water treated by the water-cooler to about 40 ℃ to send desulphurization and decarburization construction section.

The high-temperature process condensed fluid separated by the gas-liquid separator sent to the carbon scrubber in gasification construction section.

The low-temperature process condensed fluid separated by the gas-liquid separator raised the H2, CO, H2S, NH3 dissolved in water by flash steam and steam stripper through the stripping tower, and then sent to the feed tank of the scrubbing tower for recycling, acidic gases produced by s stripping sent to the boiler.

⑵Analysis of the producing pollution link

①Exhaust gas

G1 transformation unit acidic exhaust gas: air displacement of the acid gases emitted from the transformation unit stripper tower is 100Nm3 / h, which mainly contains H2S, NH3, HCN, and CO2, etc., sent to the sulfur recovery unit for processing.

Transformation unit exhaust gas pollution source emissions shown in Table 3.4-6.

Table 3.4-6 Transformation Unit Waste Gas Pollution Source

NO.	waste gas pollution source name	air displacement Nm3/h	pollutant emission characteristics					pollution prevention measure
			name	generated value mg/Nm3	successive	discontinuous	height	
G_1	stripping tower released air	100	H_2S NH_3 HCN	9% 16% 2%	√			sent to sulfur recovery unit

②Waste water

Shift process condensed fluid: the process condensate output produced by the transformation system is 14m3 / h, all of them for the recycling, used as washing water of the coal gas scrubber tower in the removal of coal gasification process.

Table 3.4-7 Transformation Unit Waste Water Pollution Source

NO.	pollution source name	quantity discharged (m3/h)	pollutant concentration (mg/L)			remarks
			name	generated value	discharged value	
W_2	shift process condensed fluid	14	Cyanide ammonia nitrogen Sulfide	50 25 5	0 0 0	washing water of the coal gas scrubber tower in the removal of coal gasification process

③Solid Waste

Transform waste catalyst: is mainly the oxide of CO, MO, quantity discharged is 56t/2a, send to manufacturers for recycling.

3.4.5.3 NHD Desulphurization and decarburization、refined desulphurization process

⑴Technological process of production

At present, the purification technology used for synthesis gas in the world is broadly divided into three categories: chemical absorption, physical absorption, physical and chemical absorption.

Chemical absorption method is to use the relevant ingredient in gas which can produce chemical reaction with the active ingredient in absorbent to generate compounds, the compound produced in regeneration then dissolved to release the active component and gas. The common method is ethanolamine method (MEA method), hot potassium alkaline (such as the Benfield method) and so on. Chemical absorption method solution is mainly depends on reducing pressure, heating regeneration, which normally adopted the “thermal regeneration" method.

Physical absorption method is to use the nature that the relevant components of gas can be dissolved in water or in organic solvents, use the non-electrolytes, organic solvents as absorbent. Commonly used process methods are in propylene carbonate method (PC), low-temperature methanol wash method, and polyethylene glycol methyl ether method.

Physical chemical absorption method is the method adopted both of the physical absorption and chemical absorption methods. The commonly used methods at room temperature are the methanol wash method and sulfolane method and MDEA method.

The shift gas of this project with high sulfur content, high CO_2 content, large partial pressure features According to the process conditions of conversion gas, this unit intends to use physical absorption method for the desulphurization and decarburization.

Accordance with the absorption of differences in temperature in physical absorption method, it is generally divided into thermal method and cold method. Gasification shift gas of domestic fertilizer plant is more adopted cold method for the desulphurization and decarburization, cold method is divided into NHD method and low-temperature methanol wash method. The NHD purification technology passed the appraisal of Ministry of Chemical Industry in 1984, the process has a high selectivity of the absorption of H2S, and it has a high absorption capacity for H_2S and CO_2. At present, NHD purification process has been successfully used in dozens of domestic small and medium-sized fertilizer plants; low-temperature methanol wash method uses methanol as absorbent, use its excellent characteristics that the methanol has a high solubility to acid gas at low temperature (-35 ~ 55 ℃), remove the acidic gases in the feed gas. The process is characterized by a high degree of gas purification, good selectivity, and wide range of applications. According to design data we can see that for the comprehensive energy consumption, NHD method is lower than the low-temperature methanol wash method, therefore, this project intends to use NHD purification technology.

NHD desulphurization and decarburization、refined desulphurization process production technology and production pollution link shown in Figure 3.4-3 and Figure 3.4-4.

The process gas come from the shift conversion section, after cooled by the gas heat exchanger and remove moisture by the gas-liquid separator, then sent into the bottom of the lower absorption tower to counter contact with the NHD solution from the bottom of upper tower which absorb the CO_2, then absorb all the H_2S and most of the CO_2 ,the desulphurization gas which outlet from the top of the lower tower will enter into the upper tower of the absorption tower. In the upper tower it will absorb the $CO_2$with the NHD lean fluid, the purification gas from the absorption tower is about H2S <1PPm, CO2 <0.5%, the purification gas will sent to the follow-up process after recycled and cooled by the NHD cooler. In order to ensure the total sulfur content sent into the methanol synthesis tower is $\leq$ 0.05 PPm, there is a necessity to set up organic sulfur hydrolysis and refined desulphurization unit.

The NHD-rich liquid Under come from the bottom of the lower tower of the absorption tower, after recovered part of its energy through the energy recovery turbine, then into the high flash slot of desulphurization, and produced some of H_2S, CO_2, and most of the H_2 and CO by flash vaporization. The NHD solution emitted from the bottom of the High-flash slot is exchanging heat with the lean fluid of thermal regeneration in the lean rich solution heat exchanger, and then enter the flash tank on the top of the desulphurization regeneration tower, most of the CO_2 and H_2S in the solution are flashing out, the NHD solution in the bottom of flash tank then enter into the lower part of the regeneration tower. The solution flows from the upper of the tower downward through the filler layer, and allows the dissolved gas analyzed out. Bottom solution of the regeneration tower is heated by the steam boiling heater. Desulphurization lean solution cooled by the lean rich solution heat exchanger, water coolers, NHD, and then joins with lean fluid comes from the decarburization stripper tower, and then through the solution pump, ammonia cooler to the absorb the stacked tower. The gas containing H2S emitted by the flash tank and regeneration tower is sent to the sulfur recovery plant.

The NHD-rich liquid Under come from the bottom of the lower tower of the absorption tower, part of them to absorb H_2S and COS from the lower tower of the absorption tower, after recovered part of its energy through the energy recovery turbine, then into the high flash slot of desulphurization, and produced some of H_2S, CO_2, and most of the H_2 and CO by flash vaporization. The NHD solution emitted from the bottom of the High-flash slot enters the flash tank on the top of the desulphurization regeneration tower, most of the CO_2 in the solution are flashing out, the NHD solution in the bottom of flash tank then enter into the lower part of the regeneration tower. The solution flows from the upper of the tower downward through the filler layer, regenerated by the stripping nitrogen gas, and then the stripping gas joins with the decarburization regeneration solution. The stripping nitrogen gas comes from the air separation unit. CO_2 gas emitted by the CO_2 flash tank is warmed by the gas heat exchanger to the urea unit.

(2)Analysis of the producing pollution link

① Waste gas

G1contains the H_2S acidic gases: the quantity of the discharged gas from the flash tank and the regeneration tower is 1600Nm^3 / h, with CO_2: 68.1% (V), H_2S: 27% (V), COS: 1.4% (V), CO: 0.4 % (V), recovered the sulfur by the Claus sulfur recovery unit and then emitted as off gas.

Table 3.4-9 Unit Waste Gas Pollution Source Schedule

NO.	waste gas pollution source name	air displacement Nm^3/h	pollutant emission characteristics mg/Nm^3						pollution prevention measure
			name	generated value	discharged value	successive	discontinuous	height	
G1	discharged gas from the flash tank and the regeneration tower	810	H_2S COS CO	27% 1.4% 0.4%	recycle	√		35m	after recovered the sulfur by the sent sulfur recovery unit and then emitted as off gas

② Solid waste

S1 waste organic sulfur hydrolytic reagent and refined desulphurization chemical: produced volume is 44t/2a, send to manufacturers for recycling.

Table 3.4-10 NHD Unit Solid Waste Pollution Source

NO.	pollution source name	quantity discharged	main component	remarks
S1	waste organic sulfur hydrolytic reagent and refined desulphurization chemical	44t/2a	active carbon、Fe_2O_3, etc	send to manufacturers for recycling

3.4.5.4 Methanol methanation unit

(1)Technological process

Methane methanol technology (namely, methylate in series with methanation) is the synthesis gas refined process developed successively at home and abroad in recent years, this process not only can product the by-product of the proper amount of methanol (which is 20% ~ 30% of the original synthesis ammonia gas), improve economic efficiency, but also because the CO + CO_2 in alcohol back gas is lower than the content which in the low-temperature shift and decarburization gas, so it can reduce the H2 consumption of the methanation, improve the effective use of synthesis gas.

Currently the "double methanol” processes developed at home are the medium-pressure alcohol hydrocarbon process of Hunan alcohol company, Linda's isobaric methanol methanation process, and the Nanjing Guochang Company's non-isobaric alcohol hydrocarbon process. Because the project synthesis pressure is 15.0MPa, we can only adopt the medium-pressure alcohol hydrocarbon process or other medium-pressure alcohol hydrocarbon processes. Alcohol ether fuel generated by the hydrocarbon is not marketable now, so the selection of projects is the medium-pressure alcohol hydrocarbon process.

The gas of the compressor ultimate export 15.0MPa enter into the fresh gas-oil-water separators, and then enter into the 1 # the front heat exchanger pipes after the separation of the oil and water, then enter into the 1 # methanolizing tower to produce reaction after exchange heat, gas discharged from the tower to heat gas entering the tower outside the 1 # tower heat exchanger pipes. The hot gas out of 1 # outside tower heat exchanger enters into the 1 # water cooler; after the temperature is reduced then enter into 1 # methanol separator. The gases after the separation of methanol enters into the 2 # outside part of the front heat exchanger pipes, then enter into the 2 # methanolizing tower to produce reaction after exchange heat, gas discharged from the tower to heat gas entering the tower outside the 2 # tower heat exchanger pipes. The hot gas out of 2 # outside tower heat exchanger enters into the 2 # water cooler; after the temperature is reduced then enter into 1 # methanol separator

The gas out from the 2 # methanol separator enters into the 3 # outside part of the front heat exchanger pipes, it’s further warmed by the warmer heat exchanger enters into methanation inner tower reaction, the gas temperature by reference to post-temperature heat exchanger to further raise the tower into the methanation reaction, gas discharged from the tower to heat gas entering the tower outside the 3 # tower heat exchanger pipes. The hot gas out of 2 # outside tower heat exchanger enters into the 3 # water cooler, after the temperature is reduced then enters into the water separator, and then sent into the ammonia synthesis system after the separation of water.

The diagrammatic sketch of methanol methanation unit process and production pollution flow is shown in Figure 3.4-4.

⑵Analysis of the producing pollution link

① Waste water

W1 oily sewage: the gas comes out from the compression section should treated by the oil-water separation before entering alcoholization tower, the production of the separated oily sewage is $0.2m^3$ / h, sent to disposed by the oily sewage treatment facilities and then enters into new biological treatment facilities of plant before discharge.

W2 process condensed fluid: refined gas is treated by gas-water separation before sent to the synthetic section, the production of the separated waste water is 15m3 / h, sent to condensed fluid regeneration tower of transforming section.

Table 3.4-11 Methanol Methanation Unit Waste Water Pollution Source

NO.	pollution source name	quantity discharged (m^3/h)	pollutant concentration (mg/L)			remarks
			name	generated value	discharged value	
W1	oily sewage	0.2	oils	500	< 1.5	sent to plant of water disposal after treated by the grease trap
W2	methane methanol technology condensed fluid	15	methanol			sent to condensed fluid regeneration tower of transforming section

③ Waste slag

S1 Waste Methane catalyst: produced volume is 8t/2a, send to manufacturers for recycling.

Table 3.4-12 Methanol methanation Unit Solid Waste Pollution Source

NO.	pollution source name	quantity discharged	main component	remarks
S1	waste catalyst	8t/2a	Ni、SiO_2、Al_2O_3,etc	send to manufacturers for recycling

3.4.5.5 Sulfur Recovery Process

⑴Production technology

Acid gas comes from the acid gas removal process is adopt the three-level Claus sulfur recovery process, after the two ordinary Claus conversion, the third stage switch to use the selective oxidation catalysts to oxidized H_2S directly into elemental sulfur, with a total recovery rate up to 98% which have multiple sets of industrial unit at home and abroad. The main process is as follows:

By the main air blower provides air to the main burner, acid gas into the main burner due to the oxidation, provides air combustion of fuel gas to the level of one, two, three, four burner to generate heat inert gas heated Claus reaction process gas, to provide oxidation air to the Super Claus reactor for the super-Claus reaction. To accurately control the air demand of the Klaus production process, the air flow into the main burner is controlled by a two-way regulating systems, 90% of the air amounting is regulated by the main road-regulating system based on the change of the acid gas flow and component, 10% of the total air is adjusted by the from the ratio of change of the exhaust H_2S/SO_2, through this two road-regulating systems to control the bulk concentration of H_2S is less than 0.45% in the three Claus reactor export process gas.

The process gas comes from the main burner mixing chamber enters into the waste heat boiler; the byproduct is low pressure saturated steam. After the process gas is cooled down, the sulfur vapor is condensed; the liquid sulfur is separated from the gas.

Process gas after cooling enters into a one-level combustion chamber to mix with the flue gas comes from a one-level combustion furnace, sent into a one-level Claus reactor for the catalytic reaction after heated to 245 ℃,to maintain the bed temperature of one-level Claus reactor is about 315 ℃, with the maximum number of hydrolysis of organic sulfur to improve sulfur recovery. Reaction process gas enters into a one-level sulfur condenser, cooling the process gas, condensate to separate liquid sulfur, after cooling the process gas sent into the two-level combustion chamber to mix with the flue gas comes from a two-level combustion furnace, sent into a two-level Claus reactor after heated to 225 ℃ ,then with the function of the catalyst, the process gas continue to conduct the Claus reaction in the two-level Claus reactor, reaction process gas enters into a two-level sulfur condenser, condensate to separate liquid sulfur. After cooling the process gas sent into the three-level combustion chamber to mix with the flue gas comes from a three-level combustion furnace, sent into a three-level Claus reactor after heated to 210 ℃ to conduct the Claus reaction with the function of the catalyst, reaction process gas enters into a three-level sulfur condenser to condensate and cool the process gas, condensate to separate liquid sulfur, after cooling the process gas sent into the four-level combustion chamber to mix with the flue gas comes from a four-level combustion furnace, after heated to 215 ℃ and mixed with the oxidation air comes from main air blower, then sent into the Super Claus reactor to conduct the Claus reaction with the function of the catalyst, reaction process gas enters into a three-level sulfur condenser to condensate and cool the process gas, condensate to separate liquid sulfur.

The cooling exhaust gas discharged from the three-stage condenser is sent to boiler room foe incineration treatment according to the project design after captured small amount of sulfur by the sulfur catheter.

the liquid sulfur separated by the waste heat boiler and various sulfur condensers flow to the liquid sulfur pool by itself after sealed the tank through the sulfur liquid, through the liquid sulfur pump sent to the sulfur slicing machine for curing slicing, and then sent to the sulfur bagging machine for packaging, storage and sale.

Technological production and pollution link of production diagram shown in Figure 3.4-5.

Reaction equation as follows:

$H_2S+3/2O_2=SO_2+H_2O$ (partial oxidation reaction)

$2H_2S+SO_2=3S+2H_2O$ (catalytic reaction)

$2H_2S+O_2=2S+2H_2O$ (selective oxidation catalysis)

(2)Analysis of the producing pollution link

(2.1)Waste gas

Sulfur recovery tail gas: quantity discharged of the sulfur recovery tail gas is 1600Nm3 / h, discharged through the 35m exhaust pipe according to the project design, suggested by the evaluation that the desulphurization tail gas should be restored and absorbed before discharge.

Table 3.4-13 Sulfur Recovery Unit Waste Gas Pollution Source

NO.	pollution source name	air displacement Nm^3/h	pollutant emission characteristics						pollution prevention measure
			name	generated value	discharged value	successive	discontinuous	height	
G1	Claus sulfur recovery tail gas	1600	H_2S		1.7kg/h	√		35 m	discharged at 35m after the desulphurization through the reduction absorption process

(2.2)Solid waste

Sulfur recovery waste catalyst; the quantity discharged of sulfur recovery waste catalyst is 56t/2a, send to manufacturers for recycling.

Table 3.4-14 Sulfur Recovery Unit Solid Waste Pollution Source

NO.	solid waste name	quantity discharged	main component	remarks
S1	CLAUS catalyst	$14m^3/3a$	AL_2O_3、TiO_2	recycled for reuse

3.4.5.6 Compression, ammonia synthesis process

(1)Technological process of production

Synthesis gas compressor is the key equipment of synthetic ammonia unit, the unit's efficiency and operational reliability will directly impact the production of synthetic ammonia and economic effectiveness of the factory.

Type selection of the compressor and device scale are closely related to the synthesis loop pressure, small and medium sized ammonia plants are commonly used reciprocating compressor to compress raw materials and gas and hydrogen-nitrogen synthetic gas, large-scale ammonia plant is applied centrifugal compressor. The project intends to phase out all the reciprocating nitrogen hydrogen compressor of the existing synthetic ammonia units, adds a large steam-driven centrifugal hydrogen nitrogen compressor with a circulation section.

Synthesis gas compression using a single series, the steam turbine-driven, centrifugal type, synthesis gas and the circulating gas dual-purpose compressor sets.

Purified air enters into one-stage cylinder import of synthetic gas compressor at about 5.6MPa, after pressurized by the one-stage cylinder, it’s about 15.0MPa at the export, enters into the methane methanol section after treated by water cooling and separation of oil and water, and then dehydrated by ammonia cooling and molecular sieve absorber, sent to the circulating section with synthesis recycle gas together to be pressurized to about 14.6MPa before sending them to the ammonia synthesis section.

Ammonia synthesis adopts 15.0MPa pressure level, according to domestic ammonia synthesis technique.

After mixed pressurized in circulating section of the synthesis gas compressor, the fresh gas and synthetic recycle gas are sent into the heat exchanger to exchange heat with the outlet gas of synthesis tower, when the temperature rising to about 254 ℃,them are sent into the synthesis tower, the outlet gas of synthesis tower (about 451 ℃) troughs the steam super-heater and the byproduct of waste heat boiler 4.2MPa, 430 ℃ of the medium-pressure steam, and then recovered its heat by the heat storage exchanger, cooled by the water coolers, and then condensed the reacting ammonia comes from the cold heat exchanger, the first ammonia cooler, and the second ammonia cooler, and then separated the liquid ammonia sent into the liquid ammonia discharge tank, the producing liquid ammonia emitted from the ammonia discharge tank is sent into the 2.5MPa liquid ammonia intermediate tank. recycle gas of the ammonia separated divided into two routes, one route is sent to the circulating section of the compressor for recycling after recovered and cooled by the cold heat exchanger as recycle gas, and the other route as the relief gas (mainly in order to prevent the accumulation of inert gas in the ammonia synthesis loop)sent to hydrogen recovery section.

The diagrammatic sketch of synthetic production process and production pollution flow is shown in Figure 3.4-6.

(2)Analysis of the producing pollution link

① Waste gas

G1 ammonia synthesis relief gas: the quantity discharged of ammonia synthesis relief gas is 5000Nm^3 / h, mainly containing H_2, N_2, CH_4, NH_3, and Ar, sent to ammonia recovery unit and recovered ammonia and hydrogen by hydrogen recovery unit before sending to fuel gas pipelines as fuel.

G2 ammonia storage tank relief gas: the gas stripped from the liquid ammonia storage tank is mainly contained NH_3, N_2 and CH_4. This kind of gas discharged by the current production is recovered by the ammonia recovery together with the synthesis relief gas and then sent to blowing air recovery unit as fuel.

Table 3.4-15 Ammonia Synthesis Unit Waste Gas Pollution Source

NO.	waste gas pollution source name	air displacement Nm^3/h	pollutant emission characteristics						pollution prevention measure
			name	generated value	discharged value	successive	discontinuous	height	
G1	ammonia synthesis relief gas	5000	H_2 NH_3 CH_4 N_2 Ar	52.3%(Vn) 11.0%(Vn) 16.0%(Vn) 17.4%(Vn) 3.3%(Vn)	0	√			after ammonia recovery and hydrogen recovery, sent to the fuel pipe network
G2	ammonia storage tank relief gas		H_2 NH_3 CH_4 N_2 Ar NH_3	21.8%(Vn) 52.6%(Vn) 16.3%(Vn) 7.3%(Vn) 1.9%(Vn) 50 mg/ Nm^3 12.6 kg/h	0	√			after ammonia recovery and hydrogen recovery, sent to the fuel pipe network

②Waste water

W1 ammonia recovery ammonia waste water: dilute ammonia water discharged by the ammonia / hydrogen recovery unit is $2m^3$ / h, treated by the urea depth hydrolysis unit before used as the boiler feed water.

W2 synthesis workshop oily sewage: produced volume is $0.5m^3$ / h, sent to oily sewage treatment unit treated by the oil-water separation and then discharged into new biological treatment unit and discharged after treatment.

Table 3.4-16 Transformation Unit Waste Water Pollution Source

NO.	pollution source name	quantity discharged (m^3/h)	pollutant concentration (mg/L)			remarks
			name	generated value	discharged value	
W_1	ammonia recovery ammonia waste water	2	ammonia nitrogen	2	5PPm	sent to urea stripped hydrolysis unit for treatment before reuse
W_2	synthesis workshop oily sewage	0.5	oils	400	10	sent to new biological treatment unit after oil trap treatment before discharg

③Solid waste

S1 synthesis waste catalyst: produced volume is $95m^3/5a$, it can be recycled to reuse.

Table 3.4-17 Ammonia Synthesis Unit Solid Waste Pollution Source

NO.	solid waste name	quantity discharged	main component	remarks
S1	ammonia synthesis waste catalyst	95 $m^3/2a$	Fe_2O_3、CuO,ZnO Al_2O_3	send to manufacturers for recycling

④Noise

Table 3.4-18 Ammonia Synthesis Unit Major Noise Pollution Source

noise equipment	operating number	noise level dB(A)	Noise reduction measures
synthesis gas recycled gas compressor	1	97	building sound insulation

3.4.5.7 Air Separation, refrigeration unit

(1) Process plan

The scale of the air separation unit is mainly determined by the size of production facilities as well as the needs and functions of the oxygen and nitrogen. The production of oxygen and nitrogen of the supporting air separation unit of this project are larger, in which oxygen consumption is 38700Nm3 / h, it has been part of large-scale air separation unit.

View from the process flows of the domestic and foreign large-scale air separation unit, they are basically adopted the same process, differ mainly in the different expansion refrigeration media, as well as the way of nitrogen gas compression. Features of the air expansion are large amount of expansion, flexible organizational process, strong adaptability, is widely used in air separation unit, in particular the unit to product liquid products; Although the nitrogen expansion is benefit for the expander as well as the distillation of upper tower, but because the amount of pump air is limited by the process of distillation of upper tower, so the foreign large-scale air separation units are more adopting the air expansion; nitrogen compression has two methods which are the liquid nitrogen pump compression and the nitrogen compressor compression, through a comprehensive comparison, it's more appropriate to adopt the model of liquid oxygen pump + nitrogen compressor to compress oxygen, nitrogen.

In accordance with the needs of pure oxygen of new gasification unit of the technical renovation project, the oxygen generation capacity of air separation unit of this project is 40000Nm^3 / h, intended to use the process flow of all low-pressure, air turbine expansion, the air pre-cooling, molecular sieve adsorption, inner compression plus nitrogen compressor. In order to ensure the safety under the accidental situations like the other devices shut down suddenly in the air separation unit or in case of power failure, the unit set up two small liquid nitrogen storage tank and the evaporation system, the effective volume of each tank is 15m3, providing 1500 Nm^3 / h low-pressure nitrogen gas as the gas for blowing and protecting the units of the whole plant.

Refrigeration section is responsible for providing the required cooling capacity of the NHD decarburization, synthesis and air separation unit. This project intends to eliminate the all piston-type ice machines which are has small stand-alone capacity and high power consumption from existing synthesis ammonia units, adds a large steam-driven centrifugal ammonia compressor.

⑵Analysis of the producing pollution link

The major pollution factors produced by air separation, refrigeration equipment are equipment noise, oily sewage and waste molecular sieve adsorbent.

Table 3.4-19 Air separation, Refrigeration Unit Waste Water Pollution Source

NO.	pollution source name	quantity discharged (m3/h)	pollutant concentration (mg/L)			remarks
			name	generated value	discharged value	
W1	oily sewage	6.5	oils	400	10	sent to new biological treatment unit after oil trap treatment before discharging

Table 3.4-20 Air separation, Refrigeration Unit Solid Waste Pollution Source

serial number	solid waste name	quantity discharged	main component	remarks
S1	waste molecular sieve adsorbent	46 t/10a	Al2O3	send to manufacturers for recycling

Table 3.4-21 Air separation, Refrigeration Unit Major Noise Pollution Source

unit name	noise equipment	operating number	noise level dB(A)	noise reduction measures
air separation	air compressor	1	110	building sound insulation
	booster	1	100	building sound insulation
refrigeration	centrifugal compressor	1	105	base vibration reduction、building sound insulation

3.4.6 Project auxiliary and public utility

3.4.6.1 Water supply and drainage system

（１）Water source of supplied water

The current water for production of plant comes from the underground, water supply capacity is 1200m^3 / h, currently the largest water consumption is 600m^3 / h, the normal water consumption is about 515m^3 / h.

Additional water consumption of the technological transformation project is about 598.8 m3 / h, used the deep well as a water source in existing plant area, sent the water comes from the deep well through the deep well pump to the original water purification stations in rehabilitation project plant area.

（２）Cooling recycled water system

Technological transformation project intended to add a set of recycled cooling water system, the quantity of the recycled water is 25650m^3 / h, supplemental water is 507.3 m^3 / h.

（３） Wastewater Treatment and Reuse

According to research design, the additional waste water of current technological transformation project include the domestic sewage, analysis laboratory, gasification unit, discharge water by air separation unit, as well as recycling waste water drainage, after the domestic sewage is treated by septic tanks, they are discharged into a new water collecting tank of this project joined with analysis laboratory, gasification unit, discharge water by air separation unit, and then upgraded by submersible sewage pump to the gasification wastewater treatment facilities of gasification section in the old gas plant before discharge.

According to project analysis we can see that, the existing gasification sewage treatment facilities can not meet the requirement of standard discharge of the effluent waste water, so suggested by the evaluation that should add a new biological nitrogen removal treatment unit on the basis of the gasification existing sewage treatment facilities (processing scale is 80m^3 / h) , to treat industrial waste water discharged by the new production facilities, so that after the project is completed, the discharged water of the whole plant can meet the emission standards.

The recycling sewage water is discharged directly.

（4）Drainage system

According to design information, factory drainage is discharged by the water-sewage separation, rainwater and drainage of recycled water station are discharged directly to the nearest rainwater pipes, and then join in the rainwater pipes of plant to discharged into the municipal drainage pipe network, after the waste water discharged by the production process and domestic sewage are collected by a separate sewage pipeline, and then they are sent to the sewage treatment station for processing (as for details please refer to the sections of pollution control measures) to achieve the second standard of the " Integrated wastewater discharge standard " ,and then discharged to the sewage ditch outside the factory through the overall outfall, and then meet into the Huangyou river from west to east after passing through 4km, meet with Huangni river after passing through 15km,after that joins into the upstream of the Suya lake reservoir, the planning water quality of Huangyou river is type Ⅳ, the planning water quality of Suya lake reservoir is Ⅲ.

Due to the treated wastewater of the whole plant will finally join into the upstream of the Suya lake reservoir after the technological transformation project, the sewage sensitive position, the discharged position is a little sensitive, once the contamination accident happened, it will likely to produce pollution to Suya lake reservoir and the water quality of the wayside underground water, in order to completely eliminate the pollution risks, as well as according with the views of expert evaluation suggestions, suggested by the evaluation that the various types of treated waste sewage of the whole plant should discharged into the nearest Zhumadian city sewage treatment station which is about 3km south of plant site. After the consultation with the construction unit, Junma Company has signed a sewage discharge agreement with Zhumadian city sewage treatment station, refer to the Annex 18, promises that the treated wastewater produced by the Junma Company could enter into the sewage treatment station after reaching the standard.

3.4.6.2 Storage and Transportation project

⑴ Raw material and fuel transportation volume

After the transformation, the annual transportation volume of the whole plant is 1.1426 million t, in which the input volume is 566.4 thousand t, output volume is 576.2 thousand t. Shown in Table 3.4-23.

Table 3.4-23 Raw Material Transportation Burden Table

flow direction	NO.	cargo name	transportation burden （myriad t/a）		transportation means	remarks
			before Reconstruction	after Reconstruction		
inbound	1	raw coal	45	43.5	train、car	
	2	fuel coal	12.8	12.8	car	
	3	limestone	0.28	0.28	car	
	4	molecular sieve, etc.	0.00015	0.0013	car	
	5	catalyst, desulphurization agent, etc.	0.0036	0.0144	car	
	6	LPG		0.005	car	
	7	diesel fuel		0.006	car	
	8	chemicals	0.025	0.0368	car	
	subtotal		58.11	56.64		
outbound	1	urea	30	30	train、car	
	2	synthetic ammonia	4	4	car	
	3	methanol	8	8	train、car	
	4	coal gasification waste residue	6.2	8.7	car	sell
	5	boiler ash	6.9	6.9	car	sell
	6	waste molecular sieves, etc.	0.00015	0.0013	car	recycling
	7	waste catalyst, etc.	0.0036	0.0144	car	recycled by manufacturer
	subtotal		55.10	57.62		
total			104.81	110.07		

⑵Scheme of handling, storage and transportation, processing

① Crude coal discharging car

The crude coal needed by this project is about 1318t / d, and transported by the automobile into the factory. The proposed project intends to discharge car with a car dumper, return-style layout. For the small number of special-shaped cars, they are discharged by the spiral discharging car, slot-style coal bin.

②Crude coal and fuel coal deposit

The raw coal of this project comes from the Henan Yima coal, the storage way of the coal is adopted the combination of using an open-air coal yards and a dry coal bunker, return-style layout, the size of the dry coal bunker is 40 × 200m, the coal yards' size is 100

× 3100m. Set the coal pusher and underground coal bunker as the standby facility of coal conveying system.

③ processing of raw coal

The broken of raw coal is chosen the single rotor reversible hammer mill, because the single broken capacity of a single rotor reversible hammer mill is 200t / h (a total of two), output grain size is ≤ 3mm, the ability not only can meet the requirements, but also the grain size is smaller, so that the making slurry ability of mill can be improved efficiently to ensure the quality of coal slurry, and the total energy consumption of making slurry and boiler system can be reduced.

The broken raw coal sent into the coal silo barn for storage, coal transportation is introduced from the coal output of the coal silo barn, and then sent to the coal slurry preparation system after passed the conveyor trestle bridge.

(3) Description of Technological process

When the crude coal is transported by car into the crude coal storage field, unload coal to the coal dump yard for stockpiling by the spiral coal discharging car and the grab bucket type crane, and transport the coal to the coal scuttle by the grab bucket type crane when required, and then sent them into the single rotor reversible hammer mill through the belt conveyor broken into the finished coal which grain size is ≤ 3mm, then the broken coal is transported by the belt conveyor to the coal silo barn for storage, when the coal slurry preparation system needs coals, they are transported by the belt conveyor to the pre-grinding coal storage barn of the coal slurry preparation system for making the slurry.

3.4.6.3 Material conveying project

As the current project is off-site technical transformation, from the existing plant is about 1km, the communal and ancillary facilities of the technical transformation project rely on the existing facilities, while the crude methanol gas is sent to the establish methanol unit, the sewage waste generated by the technical transformation project is sent to the new sewage treatment station in existing plant area for processing. Therefore, after the technological transformation project is completed, the existing plant area and the technical transformation plant area need to contacted by various material pipelines, due to the original design did not consider the pipeline transportation project, through the discussion of the evaluation unit with the construction units and design units, inbuilt of all kinds of pipelines and trend shown in table 3.4-24.

Table 3.4－24 The Inbuilt Of Various Materials Pipelines And Trend Schedule

flow direction	transported materials name	pipe diameter (m)	length (m)	laying *mode*	trend	material	distribution of sensitive targets

1	synthesis gas	Φ159×6	1600	buried type, buried depth is 1.2m	Technological transformation plant to the existing plant	20#carbon steel	no villages along the 200m
2	crude methanol	Φ89×4	1400		Technological transformation plant to the existing plant		
3	desalted water	Φ89×4	1800		Technological transformation plant to the existing plant ☒		
4	steam	Φ630×10	1580		Technological transformation plant to the existing plant		
5	waste waster	Φ70×4	1300		Technological transformation plant to the existing plant		

Note: All lines should lay along the east side of Yicheng Road to north about 600m, and then enter into the existing factory to waste 400m, along the way through the Yicheng Road and Lianjiang Road.

3.4.6.4 Heating

According to the building content and design data, the current project does not considered to set new heating boilers temporarily. The heat load of the process units and by-product steam of the whole plant after the implementation of this project are shown in Table 3.4-25 and Table 3.4-26.

Table 3.4 - 25 After the Technological Transformation Process Technology Unit Process Steam of the Whole Plant Schedule

NO.	unit name	temperature (℃)	pressure MPa	gas consumption (t/h)	remarks
1	air separation unit air compressor turbine	450	5.2	37.62	new added
2	air separation unit booster turbine	450	5.2	31.29	new added
3	air separation unit nitrogen compressor turbine	450	5.2	24.5	new added
4	loss of gas and water	450	5.2	3.54	
5	synthetic compressor turbine	450	3.8	36	new added
6	loss of pipe network	450	3.8	1.08	

7	desulphurization / decarburization	saturated	1.3	19.58	new added
8	air separation unit	saturated	1.3	2	new added
9	urea unit	saturated	1.3	51	existing
10	loss of pipe network	saturated	1.3	1.71	
11	methanol distillation	saturated	0.5	12.0	under construction
12	loss of pipe network	saturated	0.5	1.17	
13	melamine unit		1.0	9.45	under construction
			3.8	19.93	under construction
14	methylamine unit		0.9	25	under construction
15	DMF unit		1.5	4.75	under construction
total				280.62	

Table 3.4 - 26 After the Technological Transformation Process Technology Unit byproduct Steam of the Whole Plant Schedule

NO.	unit name	pressure MPa	temperature (℃)	gas production (t/h)
1	synthetic unit	3.8	450	32
2	shift unit	1.3	190	57
3	shift unit	0.5	149	39
total				128

In Table 3.4-25 and Table 3.4-26 we can see that the whole quantity of the various pressures of steam required by the process units after the implementation of technological transformation project is 280.62t / h, the quantity of by-product steam of process unit is 128 t / h, there is still 152.62 t / h of steam need to supplied by the heating boilers, there are two boilers and one 35 t / h and one 75t / h circulating fluidized bed boiler in the whole plant after the implementation of technological transformation project, which can supplied 110 t / h of steam, as well as 42.62 t / h of steam have no source. According to business information provided by the company, junma company is implementing the dynamics structural adjustment, the steam required by the whole plant will supplied by the thermal power station of the whole plant after the implementation of technological transformation project.

3.5 Materiel balance calculation

(1) Material Flow

Material flow of the whole plant after the completion of technological transformation process is shown in Figure 3.5-1.

(2) Water balance calculation

Water balance calculation of the whole plant after the completion of technological transformation process is shown in Figure 3.5-2.

(3) Sulfur balance

Sulfur balance of the whole plant after the completion of technological transformation process is shown in Figure 3.5-3.

(4) Nitrogen balance

Nitrogen balance of the whole plant after the completion of technological transformation process is shown in Figure 3.5-4.

(5) Steam Balance

Steam balance of the whole plant after the completion of technological transformation process is shown in Figure 3.5-5.

3.6 Summary and compliance evaluation of the plant pollution sources after the technological transformation process.

（1）Waste water

According to information provided by the design units and analogy of the sewage situation with the similar enterprises at home, the plant pollution sources after the technological transformation process are shown in Table 3.6-1.

After the production wastewater and sewage wastewater of the whole plant are treated by the terminal wastewater treatment facilities after the technological transformation process, they are discharged to the Zhumadian city sewage treatment station through the sewage pipe network, emission compliance situation is shown in table 3.6-2.

Table 3.3-18 after the Technological Transformation Process Wastewater Pollution Source of the Whole Plant

NO.	unit	pollution source name	discharge capacity (m^3/h)	remarks
1	new coal gasification	coal gasification wastewater	19	sent to new biological sewage treatment station for treatment before discharge
2	new shift	shift process condensed fluid	14	sent to coal gasification unit for use , reused all
3	new methanol methanation	oily sewage	0.2	sent to new biological sewage treatment station after treated by the grease trap before discharge
		technology condensed fluid	15	sent to shift process section condensed fluid stripping tower

NO.	unit	pollution source name	discharge capacity (m^3/h)	remarks
4	new synthetic ammonia	ammonia recovery ammonia wastewater	2	Treated by the urea depth hydrolysis unit before used as the boiler feed water.
		synthetic workshop oily sewage	0.5	sent to new biological sewage treatment station after treated by the grease trap before discharge
5	new air separation	oily sewage	6.5	sent to new biological sewage treatment station after treated by the grease trap before discharge
6	existing urea	urea process condensed fluid	20	Treated by the urea depth hydrolysis unit before used as the boiler feed water.
		workshop oily sewage	0.5	sent to new biological sewage treatment station after treated by the grease trap before discharge
		startup and shutdown and accidental discharge	300m^3/次	collected into the storage tank for sale or return to system
7	methanol under construction	methanol residue liquid	3	sent to terminal wastewater treatment facilities of the whole factory
8	melamine under construction	workshop dissatisfied water	4	sent to new biological sewage treatment station before discharge
9	methylamine and DMF under construction	methylamine production wastewater	2	treated by anaerobic digestion method before discharge
		DMF production wastewater	0.2	sent to boiler for combustion
10	public works	desalination of water backwashing water	25	neutralized in neutralizing pool before discharge
		domestic sewage	8	sent to new biological sewage treatment station before discharge
11	recycled sewerage	technological transformation and construction-in circulating water system	231.4	Clear water, discharge

Table 3.6-2 after the Technological Transformation Process Pollutant Concentration of Wastewater Pollutants and Compliance Situation Schedule

pollutant elements	pH	COD	ammonia nitrog	suspended solids	oils	sulfide	cyanide	volatile phenol	quantity discharged of

			en						water
units		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	m^3/tNH_3
total outlet	6-9	80	30	40	1.0	0.02	0.3	0.003	1.37
standard value	6-9	150	70	100	5	0.5	1.0	0.1	50
compliance situation	compliance								

From the table we can see that, the discharged concentration of the production wastewater of the whole plant and the discharged water volume are both meet the requirements after the technological transformation process.

（2）Waste gas

Production waste gas pollution source and compliance situation after the technological transformation process are shown in table 3.6-3

Table 3.6-3 after the Technological Transformation Process Production Waste Gas Pollution Source of the Whole Plant Compliance Evaluation Schedule

unit	pollution source name	discharge capacity Nm^3/h	discharge height m	pollutants	pollutant concentration mg/Nm^3	compliance	over proof	discharge velocity (kg/h)	compliance	over proof
new coal gasification and ammonia synthesis	coal broken exhaust gas	4000	35	smoke dust	80	√		0.32	√	
	coal dust tank discharged gas	2000	75	smoke dust	100	√		0.2	√	
	torch combustion flue gas	225	60	SO_2				0.68	√	
	acid gas	1600	35	H_2S				1.66	√	
	unorganized discharge			NH_3				7.4		
methanol	methanol storage and transportation unorganized discharge			methanol				7.5		
under construction	molten salt furnace flue gas	21700	35	smoke dust	167	√		3.62	√	
				SO_2	607	√		15.5	√	

unit	pollution source name	discharge capacity Nm^3/h	discharge height m	pollutants	pollutant concentration mg/Nm^3	compliance	over proof	discharge velocity (kg/h)	compliance	over proof
	idle washing tower discharged gas	355	35	NH_3				0.11	√	
	ammonia carbon sequestration tower discharged gas	2200	35	NH_3				0.87	√	
	finished product storage tank discharged gas	6290	25	smoke dust	10	√		0.17	√	
	unorganized discharge			NH_3				2		
methylamine and DMF under construction	technology exhaust	30090	30	methanol	124	√		0.62	√	
				NH_3	250	√		1.25	√	
				methyl amine	106	√		0.53	√	
	unorganized discharge			methanol				0.31		
				NH_3				0.62		
				methyl amine				0.06		
complex manure	technology exhaust	237912	16 ~ 40	bug dust	16.1 ~ 40.3	√		6.31	√	
				SO_2	19.2 ~ 24.3	√		4.8	√	
existing urea	urea technology exhaust	340	35	NH_3	21	√		7.1	√	
	granulation exhaust	125610	68/100	bug dust	60	√		7.5	√	
				NH_3	30	√		3.8	√	
	unorganized discharge			NH_3				18.7		
boiler	existing 35t/h and under construction 75t/h fluidized bed boiler flue gas	157000	100	smoke dust	90	√		14.1	√	
				SO_2	450	√		70.6	√	
				NO_x	100	√		15.7	√	
	coal storage and transportation system unorganized discharge			coal dust				18.4		

From the table we can see that, all of the waste gas pollution sources of the whole plant are conforms to the discharged standard after the technological transformation process.

3.7 The changes of the total discharged volume of the pollutants of the whole plant before and after the technological transformation process.

After analyze the production, processing, discharge of the pollutants generated before and after the existing projects, constructing projects and technological transformation projects of the Junma company, listed the discharge changes of the pollutions of the whole plant before and after the technological transformation project of the Junma company in Table 3.7-1 ~ Table 3.7-3.

Table 3.7-1 Waste Gas Pollutant Total Quantity Discharged Summary（t/a）

items	quantity waste gas (×10^4 myriad m^3/a)	SO_2	smoke dust	NOx	bug dust	methanol	ammonia	H_2S
existing project	36.8	1201.5	178.2	630.5	8	-	181.2	22.2
under construction project	29.4	543.1	107.4	112.0	51.3	5.6	10.0	0
under construction project cancelled	10.4	436.9	94.2	161.2	29.7	-	43.3	0
whole plant before the technological transformation process	55.8	1307.7	191.4	581.3	81.0	5.6	148.0	22.2
technological transformation process	1.9	5.4	4.1	-	-	-	-	13.1
“carrying the old with the new” cancelled	7.0	560.7	43.9	-	0	-	-	22.2
whole plant after the technological transformation process	50.7	752.4	151.6	581.3	81.0	5.6	148.0	13.1
increase（＋） decrease（－）	- 5.1	- 555.3	- 39.8	0	0	0	0	- 9.1
proportion of increase or	- 9.1	- 42.5	- 20.8	0	0	0	0	- 41.0

decrease（%）								
total amount Index of the municipal bureau		761.9	162.9					

Table 3.7-2 Waste water Pollutant Total Quantity Discharged Summary（t/a）

items	quantity of wastewater（万 m^3/a）	COD	NH_3-N	Cyanide	Sulfide	oils
current situation	71.3	151.0	103.9	0.32	0.01	0.97
current compliance	-	98.6	65.0	-	-	-
under construction project	5.5	8.2	2.7	—	-	0.08
whole plant before the technological transformation process	76.8	159.2	106.6	0.32	0.01	1.05
whole plant before the technological transformation process（compliance）	76.8	106.8	67.7	0.32	0.01	1.05
whole plant after the technological transformation process	52.3	68.0	15.7	0.16	0.008	0.78
whole plant cancelled	- 24.5	- 117.4	- 90.9	- 0.16	- 0.002	- 0.27
cancelled under compliance	-	- 65	- 52.0	-	-	-
proportion of increase or decrease（%）)	- 31.9	- 57.2	- 85.3	- 50	- 20.0	- 25.7
total amount Index of the municipal bureau		142.3				

Table 3.7-3 Solid Waste Comprehensive Usage Schedule （t/a）

items	gasification boiler clinker	boiler clinker	waste catalyst（hazardous	cyanide sludge（hazardous	total

			waste)	waste) and other	
production quantity of existing project	61740	44000	37.5	1600	107377.5
production quantity of under construction	-	31535	2141	920	34596
before the technological transformation process production quantity	61740	69400	2178.5	2520	141973.5
dealing ways	comprehensive utilization	comprehensive utilization	recycled by manufacturer	handling safely	do not discharged
after the technological transformation process production quantity of whole plant	87203	69400	2222..7	2520	161345.7
production quantity increase (+) decrease (-)	25463	0	44.2	0	25507.2
quantity discharged after the technological transformation process	0	0	0	0	0

From the table we can see that after the implementation of technological transformation project, using advanced Texaco coal-water slurry gasification technology to replace the existing intermittent fixed bed gasification process, while the production scale and product scheme of the whole plant are the same, so that making the production of the gas-forming waste water and blowing gas of the whole plant significantly reduced, while constructing the supporting associated environmental control facilities. After the implementation of technological transformation project, adopting the strict pollution control measures for the waste water pollution source of the whole plant and carrying the old with the new, the quantities discharged of major pollutants of the whole plant in waste water have reduced in different degree than that before the technological transformation, in which the quantities discharged of COD and ammonia nitrogen is reduced by57.2% and 85.3% compared with the status quo, is reduced 36.3% and 76.8% compared with the status compliance, in addition to the quantities discharged of NOx, ammonia and methanol are essentially stay at the same level, the quantities discharged of SO_2, dust, H_2S are reduced compared with that before the technological transformation, were reduced respectively 42.5%, 74.1% and 41.0%; although the quantity of solid waste of the whole plant has increased compared with that before the technological transformation, but all of them have been carried out comprehensive utilization and safe disposal. This shows that after the implementation of technological transformation project, the impact to the surrounding environmental pollution discharged by the whole plant has been reduced.

4 Monitoring and Assessment of Current Environmental Quality

4.1 Current Ambient Air Quality

4.1.1 Existing Historic Monitoring

Zhumadian Gas Power Plant is about 300 m to the south of the project. Ambient air quality monitoring had been conducted for this project from November 15 to November 19, 2003. According to the project assessment outline, the data is also cited as the monitoring data.

4.1.1.1 Monitoring point layout

Monitoring points are set at Grain and Oil Import and Export Corporation of the city, East Liulizhuang, Liulou, Zhuanghu. The specific locations are shown in Table 4.1-1 and Figure 2.

Table 4.1-1 Ambient Air Monitoring Point Table

No.	Monitoring Point	Distance from the Factory Location	Relative Orientation to the Factory	Function of Monitoring Point
1	Grain and Oil Import and Export Corporation of the city	2.5km	NNW	Residence and industrial area
2	East Liulizhuang	0.8km	N	Rural area
3	Liulou	1.5km	SW	Rural area
4	Zhuanghu	1.0km	SSE	Rural area

Note: Set the transformation factory as the origin.

4.1.1.2 Monitoring Factor and Time

The ambient air monitoring had been conducted for consecutive five days from October 15 to October 19, 2003. The monitoring factors are SO_2 and NO_2. The monitoring time and frequency of the pollution factors are shown in Table 4.1-2.

Table 4.1-2 Monitoring Time and Frequency of Each Ambient Air Monitoring Factor

Pollution Factor	Time	Monitoring Time and Frequency
NO_2	One hour	7:00, 11:00, 15:00 and 19:00 four times per day, not less than 45min for every sampling

	Daily average	18hConsecutive sampling of 18h per day
SO_2	One hour	7:00, 11:00, 15:00 and 19:00 four times per day, not less than 45min for every sampling
	Daily average	Consecutive sampling of 18h per day

4.1.2 Current Situation Monitoring

According to the requirements of the EIA outline, the ambient air of the factory area is monitored on the basis of the monitoring data of Zhumadian Gas Power Plant.

4.1.2.1 Monitoring Layout

Combining the monitoring data of Zhumadian Gas Power Plant, the monitoring scope of the transformation project focuses on the leading wind and secondary wind downwind direction, the factory short distance sensitive points and key protection targets that are influenced by the project. The monitoring factors highlight the features of the project pollution discharge. According to three-degree assessment requirements and environmental characteristics, in combination of the existing data, the ambient air monitoring point layout of the factory area in this assessment is shown in the Table 4.1-3 and Figure 2.

Table 4.1-3 Ambient Air Monitoring Point Location

No.	Name	Orientation	Distance (m)	Monitoring Factor	Remark
1	Living area of the highway department	N	50	TSP、PM_{10}、SO_2、NO_2、H_2S、NH_3	Short distance concerns of the general factory
2	Niuzhuang	NW	1750		Short distance concerns of the proposed factory
3	Zhouwan	SSE	1100		The towns and villages in the direction of downwind of secondary windiness
4	Grain and Oil Import and Export Corporation of the city	NNW	2500	TSP、PM_{10}、H_2S、NH_3	Residence and industrial area
5	East Liulizhuang	N	400		Rural area
6	Liulou	SW	1500		Rural area
7	Zhuanghu	SSE	1000		Rural area

Note: Set the existing factory as the origin.

4.1.2.2 Monitoring time, frequency and method

The environment monitoring is undertaken by Zhumadian environmental monitoring station.

Monitoring Time and Frequency: For consecutive 5 days of January 26 - 30, 2005. Monitor the hourly values and daily mean values of SO_2 and NO_2, only monitor the hourly values of H2S and NH3 at 2:00, 7:00, 10:00, 14:00 and 19:00; and only monitor the daily mean values of TSP and PM10. The sampling frequency, sampling time, analytical method and quality assurance measures of the ambient air quality monitoring are implemented according to the Technical Specifications for Environmental Monitoring (atmosphere part) and the Ambient Air Quality Standard GB3095-1996 and other relevant specifications.

4.1.3 Current situation assessment

4.1.3.1 Statistics of monitoring results

The original monitoring data and the current monitoring results are summarized in statistics which are shown in Table 4.1-4.

4.1.3.2 Ambient air quality assessment

SO_2: The one-hour average concentration range of SO_2 at each monitoring point in the assessment area is within 0.003-0.100mg/ Nm^3 all of which do not exceed the standard and account for low share of the standard value. The one-hour maximum average measured value at each point only accounts for 6.6% - 20% of the standard. The daily average concentration range of SO_2 at each monitoring point in the assessment area is within 0.005 - 0.076mg/ Nm^3 all of which meet the standard. The maximum value of daily average concentration at each point only accounts for 12.0% - 50.7% of the standard. The daily maximum average measured value occurs at "Niuzhuang";

NO_2: The one-hour average concentration range of SO_2 at each monitoring point is within 0.008~0.065mg/Nm3 all of which do not exceed the standard. The one-hour maximum average measured value at each point only accounts for 6.6% - 20%. The daily average concentration range of SO_2 at each monitoring point is within 0.009~0.072mg/Nm^3 all of which meet the standard. The maximum value of daily average concentration at each point accounts for 25.0％~60.0% of the standard. The daily maximum average measured value occurs at the "Living quarter of the highway bureau";

TSP: The daily average concentration range of TSP at each monitoring point is within 0.128~1.10mg/Nm^3, the monitoring compliance rates for five days at each monitoring point are within 0 - 80%. Due to the impact of traffic dust, TSP concentration at the "Living quarter of the highway bureau" point is high. All the values in the five days exceed the standard, the maximum exceeds 2.7 times; the monitoring value of the "Liulou" point is low with the compliance rate of 80%. TSP average compliance rate of each point is 48.6%;

PM_{10}: The daily average concentration range of PM_{10} at each monitoring point is within 0.044~0.501mg/Nm^3, the monitoring compliance rates at each monitoring point for five days are within 0 - 100%. Due to the same impact of traffic dust, PM_{10} concentrations at the "Living quarter of the highway bureau" and "East Liulizhuang" points are high. All the values in the five days exceed the standard, the maximum values exceed 2.3 times and 1.8 times respectively; the monitoring value of the "Liulou" point is also low with the compliance rate of 100%. PM_{10} average compliance rate of each point is 40%;

H_2S: The one-hour average concentration range of H_2S at each monitoring point is 0.0005~0.024mg/Nm^3, the compliance rates of the monitoring points are 100% except the "Living quarter of the highway bureau" of 84%. The average compliance rate of each monitoring point in the assessment area is 98%;

NH_3: The one-hour average concentration range of NH_3 at each monitoring point is 0.015~1.00mg/Nm^3, and the compliance rate at each monitoring point is within 60%~96%; The monitoring values of the "Living quarter of the highway bureau" points are high, and 60% of 25 measured values in the five days meet the standard. The monitoring values of "Liuzhuang" and "Zhuanghu" points are low with the same compliance rate of 96%. The average compliance rate of each point is 82%;

In summary, for the ambient air in the assessment area, the two monitoring factors of SO_2 and NO_2 do not exceed the standard, and there is certain environmental capacity; high over-standard rate occurs to TSP and PM_{10}; H_2S and NH_3 basically meet the standard requirement, but over standard phenomena occur in the area near the factory, indicating that the factory has certain impact on the surrounding environment, but the overall compliance rate of the assessment area is high.

Table 4.1-4 Overview of Ambient Air Monitoring Results

Survey Point Name	Time	Statistical Indicator	Monitoring Factor					
			SO_2	NO_2	TSP	PM10	H_2S	NH_3
Grain and Oil Company	Average 1 h	（mg/Nm^3）Measuring range (mg/Nm^3)	0.010~0.056	0.008~0.065			0.0005~0.007	0.015~0.318
		Reaching standard	100% conforming	100% conforming			100% conforming	84% conforming
		The percentage of the maximum value in the standard value or the time exceeded the standard value	11.2%	27.1%			70%	0.59 time exceeded
	Daily average	（mg/Nm^3）Measuring range (mg/Nm^3)	0.014~0.043	0.012~0.053	0.128~0.581	0.078~0.232		
		Reaching standard	100% conforming	100% conforming	60% conforming	60% conforming		
		The percentage of the maximum value in the standard value or the time exceeded the standard value	28.6%	44.2%	0.9 time exceeded	0.5 time exceeded		
East Liulizhuang	Average 1 h	（mg/Nm^3）Measuring range (mg/Nm^3)	0.008~0.074	0.013~0.046			0.0005~0.004	0.015~0.379
		Reaching standard	100% conforming	100% conforming			100% conforming	88% conforming
		The percentage of the maximum value in the standard value or the time exceeded the standard value	14.8%	19.2%			40%	0.89 time exceeded
	Daily average	（mg/Nm^3）Measuring range (mg/Nm^3)	0.025~0.041	0.009~0.042	0.246~1.05	0.191~0.428		
		Reaching standard	100% conforming	100% conforming	40% conforming	nonconforming		

		The percentage of the maximum value in the standard value or the time exceeded the standard value	27.3%	35.0%	2.5 times exceeded	1.8 times exceeded		
Liulou	Average 1 h	(mg/Nm^3) Measuring range (mg/Nm^3)	0.012~0.076	0.008~0.065			0.0005~0.007	0.015~0.207
		Reaching standard	100% conforming	100% conforming			100% conforming	96% conforming
		The percentage of the maximum value in the standard value or the time exceeded the standard value	15.2%	27.1%			70%	0.03 time exceeded
	Daily average	(mg/Nm^3) Measuring range (mg/Nm^3)	0.021~0.065	0.012~0.058	0.140~0.364	0.044~0.113		
		Reaching standard	100% conforming	100% conforming	80% conforming	100% conforming		
		The percentage of the maximum value in the standard value or the time exceeded the standard value	43.3.0%	48.3.0%	0.2 time exceeded	75.3%		
Zhuanghu	Average 1 h	(mg/Nm^3) Measuring range (mg/Nm^3)	0.008~0.033	0.008~0.062			0.0005~0.006	0.015~0.221
		Reaching standard	100% conforming	100% conforming			100% conforming	96% conforming
		The percentage of the maximum value in the standard value or the time exceeded the standard value	6.6%	25.8%			60%	0.10 time exceeded
	Daily average	(mg/Nm^3) Measuring range (mg/Nm^3)	0.005~0.018	0.011~0.034	0.173~0.454	0.126~0.284		
		Reaching standard	100% conforming	100% conforming	40% conforming	20% conforming		
		The percentage of the maximum value in the standard value or the time exceeded the standard value	12.0%	28.3%	0.5 time exceeded	0.9 time exceeded		

Table 4.1-4 Overview of Ambient Air Monitoring Results (continued)

Survey Point Name	Time	Statistical Indicator	Monitoring Factor					
			SO_2	NO_2	TSP	PM10	H_2S	NH_3
Living area of the high way department	Average 1 h	(mg/Nm^3) Measuring range (mg/Nm^3)	0.010~0.165	0.005~0.035			0.0005~0.024	0.015~1.00
		Reaching standard	100% conforming	100% conforming			84% conforming	60% conforming
		The percentage of the maximum value in the standard value or the time exceeded the standard value	33.0%	14.6%			1.4 time exceeded	4.0 time exceeded
	Daily average	(mg/Nm^3) Measuring range (mg/Nm^3)	0.010~0.070	0.042~0.072	0.339~1.10	0.295~0.501		
		Reaching standard	100% conforming	100% conforming	All exceeding the standard	All exceeding the standard		
		The percentage of the maximum value in the standard value or the time exceeded the standard value	46.7%	60.0%	2.7 time exceeded	2.3 time exceeded		
Niuzhuang	Average 1 h	(mg/Nm^3) Measuring range (mg/Nm^3)	0.003~0.100	0.005~0.031			0.0005~0.006	0.015~0.556
		Reaching standard	100% conforming	100% conforming			100% conforming	88% conforming
		The percentage of the maximum value in the standard value or the time exceeded the standard value	20.0%	12.9%			60%	1.8 time exceeded
	Daily average	Measuring range (mg/Nm^3)	0.024~0.076	0.017~0.040	0.147~0.351	0.064~0.199		
		Reaching standard	100% conforming	100% conforming	60% conforming	40% conforming		

		The percentage of the maximum value in the standard value or the time exceeded the standard value	50.7%	33.3%	0.17 time exceeded	0.32 time exceeded		
Zhou wan	Average 1 h	(mg/Nm^3) Measuring range (mg/Nm^3)	0.003~0.040	0.005~0.032			0.0005~0.004	0.015~0.229
		Reaching standard	100% conforming	100% conforming			100% conforming	60% conforming
		The percentage of the maximum value in the standard value or the time exceeded the standard value	8.0%	13.3%			40%	0.14 time exceeded
	Daily average	(mg/Nm^3) Measuring range (mg/Nm^3)	0.014~0.032	0.014~0.030	0.160~0.343	0.105~0.229		
		Reaching standard	100% conforming	100% conforming	60% conforming	60% conforming		
		The percentage of the maximum value in the standard value or the time exceeded the standard value	21.3%	25.0%	0.14 time exceeded	0.52 time exceeded		
Assessment standard	One hour average concentration (primary concentration)		0.5	0.24			0.01	0.2
	Daily average concentration		0.15	0.12	0.30	0.15		

4.2 Monitoring and Assessment of Surface Water

The status quo monitoring and routine monitoring materials are used to describe and assess the status quo of Huangyou River and Suya Lake Reservoir water quality.

4.2.1 Surface water (Huangyou River) Monitoring

4.2.1.1 Monitoring section and monitoring factor

The surface water monitoring section layout and monitoring factors are shown in Table 4.2-1 and the monitoring section is shown in attached diagram.

Table 4.2-1 Surface Water Status Quo Monitoring

River Name	Monitoring Section	Monitoring Factor
Drainage ditch outside the factory	Before entering Huangyou River	Water temperature, flow, pH, COD, ammonia nitrogen, petroleum, sulfide, volatile phenol, and cyanide.
Huangyou River	200m200m upstream before the drainage ditch accesses to the river	
	500m500m downstream after the drainage ditch accesses to the river	
	Before Huangyou River accesses to Huangni River	

4.2.1.2 Monitoring analysis method

The project monitoring analysis method and methodological standard are shown in Table 4.2-2.

Table 4.2-2 Surface Water Monitoring Analysis Method

Item	Analytical Method	Standard
Water temperature		GB13095 - 91
pH	Glass electrode method	GB6920 - 86
COD	Dichromate method	GB11914 - 89
Ammonia nitrogen	Nessler's reagent colorimetric method	GB7479 - 87
Petroleum	Infrared spectrophotometry	GB/T16488-1996
Sulfide	Methylene blue spectrophotometric method	GB/T16489-1996
Volatile phenol	After distillation 4 - amino-antipyrine spectrophotometric method	GB7490 - 87
Cyanide	Isonicotinic acid - pyrazolone colorimetric method	GB7486 - 87

4.2.1.3 Monitoring Time and Frequency

This assessment activity monitors the current water quality of drainage ditch and Huangyou River for three consecutive days of January 26 - 28, 2005 and samples once per day.

4.2.1.4 Assessment standard

Based on the assessment outline, GB3838-2002 Surface Water Environmental Quality Standard class-Ⅳstandard is adopted for Huangyou River water quality assessment. For convenient comparative analysis, the drainage ditch water quality assessment refers to GB3838-2002 class-Ⅳstandard. The standard limits for assessment factors are shown in Table 4.2-3.

4.2.1.5 Statistics of monitoring results

The statistic results of surface water monitoring are shown in Table 4.2-3.

4.2.2 Suya Lake Water Quality Data Reference

2004 routine monitoring data of Zhumadian City Environmental Monitoring Station are cited in the Suya Lake water quality data. One day monitoring is conducted in the two odd-numbered months of normal water, low water and high water periods with total six times a year. The arithmetic average of the two monitoring values of each period is used as the average of the water period and the arithmetic average of three water periods is used as the annual average. The upper water body of monitoring sampling point. Results are shown in Tables 4.2-4. According to Suya Lake water environmental functional division, class-Ⅲ standard of GB3838-2002 Surface Water Environmental Quality Standard is adopted for assessment. Specific standard limits are shown in Table 4.2-4.

Table 4.2-4 Water Quality Monitoring Statistical Results of Suya Lake Reservoir Unit: mg / L except pH

Section	Date	pH	COD	Ammonia nitrogen	Petroleum	Volatile phenol	Cyanide
Normal-water period	Average value	7.63	20.0	0.54	0.04	0.006	0.002
	Reaching standard	Conforming	Conforming	Conforming	Conforming	Conforming	Conforming
Low flow period	Average value	7.79	23.1	0.60	0.07	0.009	0.002

	Reaching standard	Conforming	Conforming	Conforming	0.4 time exceeded	Conforming	Conforming
High water period	Average value	7.41	20.7	0.60	0.02	0.004	0.004
	Reaching standard	Conforming	Conforming	Conforming	Conforming	Conforming	Conforming
Whole year	Average value	7.58	21.2	0.58	0.04	0.006	0.003
	Rate exceeding limit	0	0	0	50	50	0
Standard		6~9	30	1.0	0.05	0.005	0.2

Table 4.2-3 Statistics of Drainage Ditch and Huangyou River Status Quo Monitoring Results Unit: mg/L except flow and pH

Section	Date	m^3/sFlow m^3/s	pH	COD	Ammonia nitrogen	Petroleum	Sulfide	Volatile phenol	Cyanide
Before drainage ditch enters Huangyou River	Daily mean range	0.017~0.022	8.42~8.73	167~236	149~158	0.22~0.40	0.005~0.014	0.029~0.033	0.216~1.34
	Average value	0.019	8.50	194	152	0.32	0.010	0.31	0.87
	Reaching standard		Conforming	5.5 time exceeded	100 time exceeded	Conforming	Conforming	30 time exceeded	3.4 time exceeded
200m200m upstream from the drainage entrance of Huangyou River	Range	0.004~0.004	6.86~7.14	22.0~47.9	3.66~5.01	0.02~0.18	0.006~0.014	0.001~0.003	0.002~0.144
	Average value	0.004	7.04	33.3	4.11	0.13	0.010	0.002	0.060
	Reaching standard		Conforming	0.11 time exceeded	1.7 time exceeded	Conforming	Conforming	Conforming	Conforming
500m500m downstream from the drainage entrance of Huangyou River	Range	0.022~0.027	8.16~8.45	146~198	144~150	0.21~0.31	0.002~0.011	0.010~0.012	0.229~1.32
	Average value	0.024	8.26	169	148	0.26	0.007	0.011	0.83
	Reaching standard		Conforming	4.6 time exceeded	97.7 time exceeded	Conforming	Conforming	0.1 time exceeded	3.2 time exceeded
Before Huangyou River accesses to Huangni River	Range	0.138~0.150	7.51~7.94	28.0~80.9	117~126	0.02~0.33	0.002~0.007	0.003~0.004	0.005~0.20
	Average value	0.144	7.70	49.4	122	0.20	0.004	0.004	0.011
	Reaching standard		Conforming	0.65 time exceeded	80.3 time exceeded	Conforming	Conforming	Conforming	Conforming
Standard			6~9	30	1.5	0.5	0.5	0.01	0.2

4.2.3 Assessment of surface water status quo

4.2.3.1 Huangyou River and drainage ditch section water quality assessment

We can see from Table 4.2-3 that over standard of the ammonia-nitrogen, COD, volatile phenol and cyanide in the monitoring items at different degrees occurs at the section of the drainage ditch before entering the Huangyou River which has direct connection with Juma Company. At the 200m section of Huangyou River upper reach, in addition to a small amount of surface runoff, it also receives a small amount of domestic sewage from the eastern urban district of Zhumadian, which mainly appears as the slight over standard of ammonia nitrogen and COD without over standard of other items. At the 500m section of Huangyou River lower reach, due to reception of waste water from the drainage ditch which forms the main body of the water, ammonia nitrogen, COD, volatile phenol and cyanide do not meet the standard. At the section of Huangyou River before entering Huangni River, due to the natural degradation and other runoff dilution of pollutants under way, the concentration of pollutants has been significantly reduced compared with the previous section, and all factors meet the standard except ammonia nitrogen and COD.

In summary, the water quality of Huangyou River can not meet the GB3838-2002 class Ⅳ standard.

4.2.3.2 Suya Lake reservoir water quality assessment

Take engineering-related pollution indicators for assessment. We can see from Table 4.2-4 that according to routine monitoring results, all pollutant indicators of Suya Lake in normal water period meet the standard; in low flow period, all indicators do not exceed the standard except that petroleum slightly exceeds the standard (exceeding 0.4 time); in high water period, all indicators meet the standard. In light of the annual statistics, petroleum and volatile phenols have over standard rate of 50% respectively, and the over standard rates of others are 0. For the annual average, only volatile phenols slightly exceed the standard and others do not exceed.

In light of comprehensive analysis, the overall water quality of Suya Lake is good, but some indicators can not meet the class Ⅲ standard of GB3838-2002 *Surface Water Environmental Quality Standard*.

4.3 Monitoring and Assessment of Groundwater Status Quo

4.3.1 Monitoring of groundwater Status quo

4.3.1.1 Monitoring points and monitoring factors

Six monitoring well points are set at 10m, 50m and 100m along north of the drainage ditch at Liulizhuang and Huozhuang, and the point layout and monitoring factors are shown in Table 4.3-1.

Table 4.3-1 Groundwater Quality Monitoring Sites

No.	Name	Distance from drainage ditch（m）	Monitoring Factor

<table>
<tr><td>1</td><td rowspan="3">Liulizhuang</td><td>10</td><td rowspan="6">Well depth, ammonia nitrogen, COD, pH, cyanide, petroleum, volatile phenol, nitrate, nitrite, total hardness, total E. coli and total number of bacteria.</td></tr>
<tr><td>2</td><td>50</td></tr>
<tr><td>3</td><td>100</td></tr>
<tr><td>4</td><td rowspan="3">Huozhuang</td><td>10</td></tr>
<tr><td>5</td><td>50</td></tr>
<tr><td>6</td><td>100</td></tr>
</table>

4.3.1.2 Monitoring Time and Frequency

Groundwater monitoring has been conducted for three consecutive days of January 26 ~ 28, 2005 and sampling and monitoring were done once per day.

4.3.1.3 Monitoring Result Statistics

Groundwater monitoring result statistics are shown in Table 4.3-2

4.3.2 Assessment of Groundwater Status Quo

According to the statistical results of Table 4.3-2, the six shallow groundwater qualities are assessed as follows:

The well 10m north to Liulizhuang drainage ditch: In light of the Groundwater Quality Standard (GB/T14848-93) class Ⅲ standard, three of 11 testing pollution factors including bacteriological indicator exceed the standard, namely, nitrate-nitrogen, total hardness and total coliforms with the over standard rates of 100% and the maximum over standard times of 1.2, 1.6 and 272 respectively. The others meet class Ⅲ standard;

The well 50m north to Liulizhuang drainage ditch: Similar with the water quality of the 10m well, the over standard items are nitrate-nitrogen, total hardness and total coliforms with the over standard rates of 100% and the maximum over standard times of 1.0, 0.8 and 465 respectively. The others meet class Ⅲ standard;

The well 100m north to Liulizhuang drainage ditch: Nitrate-nitrogen, total hardness, total coliforms and total bacteria number exceed the standard with the over standard rates of 100%, 100%, 100% and 33.3%, and the maximum over standard times of 1.4, 1.0, 665 and 0.1 respectively. The others meet class Ⅲ standard;

The well 10m north to Huozhuang drainage ditch: Three of 11 testing items exceed the standard, namely, nitrate-nitrogen, total hardness and total coliforms with the over standard rates of 100%, 100% and 33.3%, and the maximum over standard times of 2.1, 599 and 0.2 respectively. The others meet class Ⅲ standard;

The well 50m north to Huozhuang drainage ditch: Nitrate-nitrogen, total hardness, total coliforms and total bacteria number exceed the standard with the over standard rates of 100%, 100%, 100% and 33.3%, and the maximum over standard times of 0.9, 0.2, 599 and 0.8 respectively. The others meet class Ⅲ standard;

The well 100m north to Huozhuang drainage ditch: Nitrate-nitrogen and total coliforms exceed the standard with both over standard rates of 100% and the maximum over standard times of 1.1 and 765 respectively. The others meet class Ⅲ standard;

It indicates from the monitoring of the shallow groundwater that has different distances from the drainage ditch of the two villages of Liulizhuang and Huozhuang Zhuang, the pollution of shallow groundwater shows two distinct characteristics: First, groundwater bacterial indicator exceeds the standard seriously and generally with all the over standard rates of 100% and the maximum over standard times of up to 272 - 765 times; Second, nitrate nitrogen and total hardness have high over standard rates, of which the former has 100% over standard rate at all six monitoring wells and the latter has 100% over standard rate at all monitoring wells except those at 10m and 100m north to Huozhuang.

Table 4.3-2 Statistics of Groundwater Monitoring Results

Monitoring Point	Category	Monitoring Item											
		(m)Well Depth (m)	pH	Ammonia nitrogen (mg/L)	(mg/L)Permanganate index (mg/L)	Cyanide (mg/L)	Petroleum (mg/L)	Volatile phenol (mg/L)	Nitrate (mg/L)	Nitrite nitrogen (mg/L)	Total hardness (mg/L)	Total Coliform (unit/L)	Total amount of bacteria (unit/mL)
10m to the north of Liulizhuang	Range	20	6.38~6.47	0.14~0.15	1.4~1.5	0.002~0.013	0.02~0.02	0.001~0.001	42.8~43.8	0.002~0.002	1.11×10^3~ 1.17×10^3	1.2×10^2~ 8.2×10^2	8~47
	Average value		6.42	0.14	1.43	0.009	0.02	0.001	43.3	0.002	1.13×10^3	3.9×10^2	26
	Rate exceeding limit		0	0	0	0		0	100	0	100	100	0
	Time of the maximum value exceeded the standard								1.2 times		1.6 times	272 times	
50m to the north of Liulizhuang	Range	20	6.50~6.51	0.13~0.14	0.6~0.8	0.002~0.015	0.02~0.02	0.001~0.001	38.8~39.1	0.002~0.002	746~793	950~1400	6~82
	Average value		6.50	0.14	0.7	0.006	0.02	0.001	38.9	0.002	765	1180	35
	Rate exceeding limit		0	0	0	0		0	100	0	100	100	0
	Time of the maximum value exceeded the standard								1.0 time		0.8 time	465 times	
100m to the north of Liulizhuang	Range	30	6.53~6.66	0.12~0.12	0.8~0.8	0.002~0.005	0.02~0.02	0.001~0.001	48.4~48.9	0.002~0.002	900~918	820~2000	27~110
	Average value		6.60	0.12	0.8	0.004	0.02	0.001	48.6	0.002	907	1300	75
	Rate exceeding limit		0	0	0	0		0	100	0	100	100	33.3

	Time of the maximum value exceeded the standard								1.4 times		1.0 time	665 times	0.1 time
10m to the north of Huozhuang	Range	20	6.39~6.83	0.15~0.15	1.5~1.6	0.006~0.016	0.02~0.02	0.001~0.001	60.8~61.6	0.002~0.002	410~432	650~1800	12~120
	Average value		6.59	0.15	1.6	0.009	0.02	0.001	61.1	0.002	420	1110	66
	Rate exceeding limit		0	0	0	0		0	100	0	0	100	33.3
	Time of the maximum value exceeded the standard								2.1 times			599 times	0.2 time
50m to the north of Huozhuang	Range	30	6.55~6.78	0.11~0.12	0.6~0.9	0.002~0.002	0.02~0.02	0.001~0.001	38.3~38.6	0.002~0.002	536~564	1500~1800	32~180
	Average value		6.63	0.11	0.7	0.002	0.02	0.001	38.4	0.002	550	1630	89
	Rate exceeding limit		0	0	0	0		0	100	0	100	100	33.3
	Time of the maximum value exceeded the standard								0.9 time		0.2 time	599 times	0.8 time
100m to the north of Huozhuang	Range	25	6.49~6.62	0.11~0.11	0.6~0.7	0.002~0.007	0.02~0.02	0.001~0.001	41.8~42.4	0.002~0.002	440~443	140~2300	17~78
	Average value		6.55	0.11	0.6	0.004	0.02	0.001	42.0	0.002	442	1070	57
	Rate exceeding limit		0	0	0	0		0	100	0	0	100	0
	Time of the maximum value exceeded the standard								1.1 times			765 times	
Standard			6.5~8.5	≤0.2	3.0	0.05		0.002	20	0.02	450	3.0	100

It indicates from the above analysis that, the shallow groundwater of Huozhuang and Liulizhuang can not meet the Groundwater Quality Standard (GB/T14848-93) class Ⅲ standard, which shows the shallow groundwater in the area around the drainage ditch has certain degree of pollution.

Regional water pollution survey results show that, the drainage ditch outside the factory mainly receives the wastewater drainage from Junma Company without other sources of pollution, and nitrate nitrogen is the characteristic pollution factor of fertilizer plant, indicating the sewage contribution from Junma Company to nitrate nitrogen over standard of the shallow groundwater around the drainage ditch can not be ignored. We learn through the investigation that villagers of Liulizhuang and Huozhuang have the habit of scatter-feed of poultry and livestock at home and toilets are open-air pit toilets, therefore the over standard of the shallow groundwater bacterial indicator around the drainage ditch is mainly due to the local living and breeding habits.

4.4 Monitoring and assessment of Acoustic Environment Status Quo

4.4.1 Assessment standard

The proposed site of the transformation project is in the industrial zone, therefore the factory boundary noise should be subject to the Standard of Noise at Boundary of Industrial Enterprises (GB12348-90) Class Ⅲ standard. As the existing site neighbors Zhu(madian) - Xin(cai) Road in the north, the class Ⅳ standard should be implemented; three acoustic environment sensitive spots of the living quarter of the general factory, Qianjin Village and Niuzhuang are also located in the industrial zone, which still belong to the concentrated residential area at present, then the class-2 standard of the Urban Regional Environmental Noise Standard (GB3096-93) should be implemented. The standard limits are shown in the table below:

Table 4.4-1 Classification and Limits of Noise Standard

Noise Category	Monitoring Point	Standard	Standard Limit	
			Day	Night
Noise at factory boundary	Present site: east, south and west boundaries Site of transform factory: east, south, west and north boundaries	GB12348 - 90 Ⅲ	65	55
	Present site: north boundary	GB12348 - 90 Ⅳ	70	55
Sensitive point noise	Living quarter of the general factory, Qianjin Village and Niuzhuang Village	GB3096 - 93 □	60	50

4.4.2 Acoustic environment status quo monitoring

4.4.2.1 Monitoring points

According to the preliminary investigation of assessment, the major points-of-care within 200m of the existing factory and the transformation factory are residential areas and villages. This assessment will combine on-site investigate to conduct noise monitoring over the points-of-care within 200m of the existing factory and the transformation factory and monitoring over the noise at the boundary of the existing factory and the transformation factory. The monitoring point locations are shown in Table 4.4 - 2 and Figure 2.

Table 4.4-2 Monitoring Points of Factory Boundary Noise and Acoustic Environment

No.	Name of Points	Distance from the Factory	Function
1	Living quarter of the general factory	W50m	Sensitive points of acoustic environment
2	Qianjin New Village	Adjacent in SW	
3	Niuzhuang	Adjacent	

Note: Niuzhuang sets the transformation factory as the origin and the others set the current factory as the origin.

4.4.2.2 Monitoring method, time and frequency

Monitoring Method: The factory boundary noise monitoring method is subject to the *Measurement Method for Noise at Boundary of Industrial Enterprises* and the acoustic environment monitoring method is subject to GB/T14623 *Measurement Method for Environmental Noise of Urban Area*.

Monitoring Time and Frequency: Monitoring has been conducted for two consecutive days of January 29 ~ 30, 2005 with a daytime monitoring and a nighttime monitoring per day.

4.4.2.3 Monitoring result statistics

Monitoring results are shown in Table 4.4-3.

Table 4.4-3 Factory Boundary and Sensitive Point Noise Monitoring Results Unit: dB (A)

Monitoring Point			Date	Monitoring Value		Standard Value	
				Day	Night	Day	Night
Noise at factory boundary	Current factory address	East side	2005.1.29	77.0	76.3	65	55
			2005.1.30	76.9	74.9		
		South side	2005.1.29	61.6	56.5		
			2005.1.30	61.5	59.5		
		West side	2005.1.29	59.7	56.3		
			2005.1.30	57.4	52.1		
		North side	2005.1.29	75.9	68.4	70	55
			2005.1.30	73.0	68.2		
	formation factory	East	2005.1.29	55.6	50.2	65	55

			2005.1.30	53.6	48.3		
		South side	2005.1.29	55.3	51.2		
			2005.1.30	51.9	49.8		
		West side	2005.1.29	57.2	53.6		
			2005.1.30	51.4	48.9		
		North side	2005.1.29	58.3	53.3		
			2005.1.30	58.9	54.3		
Sensitive point noise		Living quarter of the general factory	2005.1.29	59.3	53.5	60	50
			2005.1.30	56.5	47.9		
		Qianjin New Village	2005.1.29	54.4	49.2		
			2005.1.30	51.8	47.0		
		Niuzhuang	2005.1.29	51.9	48.8		
			2005.1.30	54.9	47.0		

4.4.3 Acoustic Environment Status Quo Assessment

4.4.3.1 Factory boundary noise status quo assessment

(1) At the east factory boundary, the two measured values of daytime and nighttime exceed the *Standard of Noise at Boundary of Industrial Enterprises* (GB12348-90) class III standard; at the south factory boundary, the daytime value does not exceed the standard but the nighttime one does; at the west factory boundary, both the daytime and nighttime values meet the standard; at the north factory boundary, due to traffic noise impact, both the two-day daytime and nighttime measured values exceed the *Standard of Noise at Boundary of Industrial Enterprises* (GB12348-90) class III standard;

(2) Transformation factory noise assessment

As the transformation factory is far away from the existing factory, it suffers little impact of engineering noise and other sound sources and the noise at different sides of the factory basically reflects the background noise value before the construction. In light of the Urban Regional Environmental Noise Standard (GB3096-93) class-3 standard, both daytime and nighttime noise values meet the standard.

4.4.3.2 Acoustic environment sensitive point noise status quo assessment

The noise monitoring results of the three acoustic environment sensitive points of the living quarter of the general factory, Qianjin Village and Niuzhuang Village show that all the two-day daytime and nighttime noise values at each monitoring point can meet the Urban Regional Environmental Noise Standard (GB3096-93) class-2 standard.

5 Prediction and Evaluation of Environmental Impact

5.1 Prediction and Evaluation of Environmental and Atmospheric Impact

5.1.1 Characteristics of Weather Conditions

5.1.1.1 Ground Weather Data

(1) Data Source

The ground weather data used in the evaluation is based on the observed results of the Zhumadian Meteorological Station. The chemical factory is located to the southeast of Zhumadian, less than 10 km from the Zhumadian Meteorological Station. The topographic condition of the factory and the Zhumadian Meteorological Station both belong to plain, so it is feasible to adopt the observed data from the Zhumadian Meteorological Station.

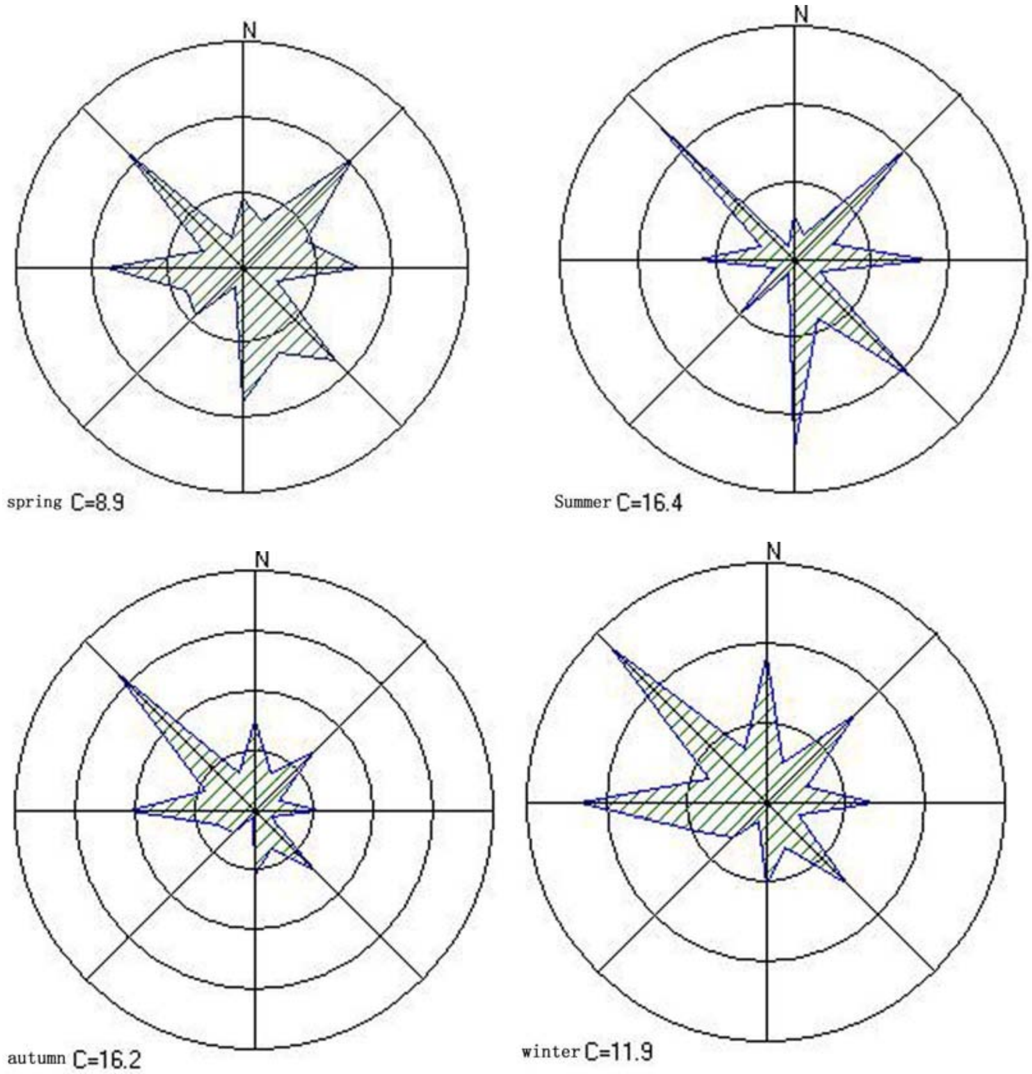
(2) Climate Characteristics

In Zhumadian where the project is carried out, the terrain is flat and the height above the sea level is below 100m. According to the general type of climate regions, the land has a northern warm temperate climate. But it is in the south of the northern warm temperate zone. If heading southward, the land then enters the northern subtropical climate region. The obvious characteristics of the climate in the land are the simultaneity of rain and heat, the four distinct seasons and abundant sunshine and heat. The climate of the four seasons around the year differs much from each other. In the spring, there is relatively less precipitation; in the summer, it is hot and there is concentrated rainfall; in the autumn, it is cool; in the winter, it is cold without much rain and snow. The reason for such a climate is that in winter, the cold air from the north invades the land and the northern wind prevails, leading to cold and dry air and very little rain and snow. In the summer, the land is mostly under the control of the low pressure system, the southern wind from the sea to the continent prevails and the weather is both humid and rainy. The spring and autumn, as the transitional periods of the winter and summer, are short with alternating coldness and heat. The most notable characteristics of the precipitation in Zhumadian are that heavy and showery rainfall always occurs in the summer, leading to rainstorms. As to the diffusion conditions, in the spring, it is clear and sunny for most of the time and there is relatively strong wind, which helps the relocation and diffusion of pollutants. In the summer, the atmosphere is often in an unstable state and there is vigorous vertical convection, which also creates favorable conditions for the diffusion of pollutants. The autumn features in clear and fresh days without much strong wind, which does no good to the spread of pollutants. The air in the winter is more stable than that in the autumn and thermal inversion often takes place, which makes it the most unfavorable period for the spread of pollutants.

(3) Factors of Ground Weather

① Frequency Distribution of Ground Wind Direction

According to statistics of the 2002-2004 data of the ground wind direction from the Zhumadian Meteorological Station, the most common wind all the year around is the northwestern wind with the frequency of 13.4%, followed by the western wind with the frequency of 9.4%. Besides these two directions, there is also the northeastern wind with the frequency of 8.7%. The above wind directions have no impact on Zhumadian but mainly influence the rural areas in the downwind direction. The east-south-east wind and the southeastern wind that can affect Zhumadian have a total frequency of 10.2%. The period in which the smoke and gas from the chemical factory may influence the urban area of Zhumadian is mainly in the summer. In the whole year, the frequency of calm wind is 13.3%. The middle summer and the autumn have the largest frequencies of calm wind with both above 16.0% while the spring has the smallest calm wind frequency of 8.9%.



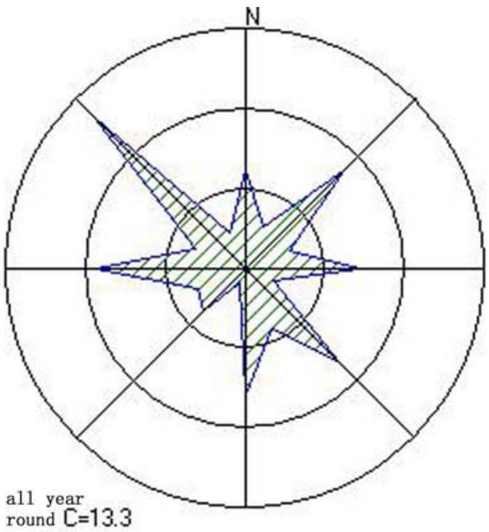


Diagram 5.1-1 Rose Diagram of Frequency of Wind Directions in Each Season and All Year Around (each circle for 5%)

Table 5.1-1 Frequency of Wind Directions in Each Season and All Year Around

Wind Direction / Time	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	C
Spring	4.6	3.4	10.2	4.5	7.8	2.4	8.7	6.1	8.9	1.3	4.4	4.0	9.0	2.8	11.0	2.1	8.9
Summer	2.9	1.7	10.0	2.7	8.6	1.8	10.6	4.0	12.1	1.0	4.9	1.3	6.2	2.3	12.6	0.9	16.4
Autumn	7.5	3.5	6.9	2.2	5.4	1.4	7.1	3.4	5.3	0.6	2.7	3.2	10.5	4.5	16.3	3.4	16.2
Winter	9.3	2.7	7.7	2.7	6.7	2.1	7.0	3.0	5.1	1.2	3.0	4.6	11.8	3.9	13.8	3.7	11.9
All Year Around	6.1	2.8	8.7	3.0	7.1	1.9	8.3	4.1	7.9	1.0	3.8	3.3	9.4	3.4	13.4	2.5	13.3

② Analysis of Characteristics of Ground Wind Speed and Diffusion of Pollutants

According to the statistics of the 2002-2004 data of ground wind speeds corresponding to wind directions, tables 5.1-2 to 5-6 respectively present the average wind speed in each month and all year around, the average wind speed of each wind direction, the average wind speed in each season, the average wind speed in each hour of a day and the frequency of each level of wind speeds.

Table 5.1-2 Average Wind Speed in Each Month and All Year Around （m/s）

Time	1	2	3	4	5	6	7	8	9	10	11	12	All Year Around
Wind Speed	2.2	2.2	2.6	2.4	2.2	2.4	2.0	1.3	1.6	1.8	2.1	2.0	2.1

Table 5.1-3 Average Wind Speed of Each Wind Direction （m/s）

Wind Direction	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
Wind Speed	2.0	1.9	2.3	2.4	2.2	2.3	2.7	2.9	3.0	2.0	2.4	2.5	2.4	1.8	2.2	1.8

Table 5.1-4 Average Wind Speed in Each Season （m/s）

Time	Spring	Summer	Autumn	Winter
Wind Speed	2.4	1.9	1.8	2.1

Table 5.1-5 Average Wind Speed in Each Hour （m/s）

Hour	1	2	3	4	5	6	7	8	9	10	11	12
Wind Speed	1.7	1.6	1.6	1.5	1.6	1.6	1.6	1.8	2.1	2.4	2.6	2.7
Hour	13	14	15	16	17	18	19	20	21	22	23	24
Wind Speed	2.8	2.8	2.8	2.7	2.5	2.1	1.9	1.8	1.9	1.8	1.8	1.7

Table 5.1-6 Frequency of Each Level of Wind Speeds （%）

m/s Level m/s / Time	≤1.0	1.1~1.9	2.0~2.9	3.0~3.9	4.0~5.9	≥6.0
Spring	17.1	21.4	30.0	18.5	11.8	1.2
Summer	28.3	24.8	25.1	14.8	6.6	0.4
Autumn	27.8	27.5	25.9	13.4	5.2	0.3
Winter	21.6	23.7	28.9	16.5	8.3	1.1
All Year Around	23.7	24.3	27.5	15.8	8.0	0.8

From table 5.1-2 to 5-6, we can illustrate the following points:

a. The average wind speed all year around is 2.1 m/s. Compared with the average wind speed in recent years (recent three decades), the average wind speed tends to decline. Among all months of a year, March has the largest average wind speed of 2.6 m/s while August has the weakest average wind speed of 1.3 m/s. As to the conditions of wind speeds, the best condition for the diffusion in a year takes place in March while the relatively weak diffusion condition happens in August.

b. Among all seasons in a year, the spring has the largest average wind speed of 2.4 m/s while the autumn has the smallest average wind speed of 1.8 m/s. Obviously, the best period for the diffusion is the spring while the relatively worse period is the autumn.

c. Among the average wind speeds of each direction, the largest is the southern wind of an average of 3.0 m/s, followed by the south-south-east wind of an average of 2.9 m/s. Generally speaking, the southern wind has a relatively large average wind speed, which is favorable for alleviating the polluting extent to the downwind direction.

d. Among all the hours of a day, the period from 19:00 to 8:00 in the next morning has an average wind speed of less than 2.0 m/s and the period after midnight has the smallest average wind speed between 1.5 and 1.6 m/s. Obviously, the diffusion is relatively weak during the night and the weakest occurs after midnight. In the daytime from 9:00 to 18:00, the wind speed is more than 2.0 m/s. The best condition for diffusion takes place around the noon.

e. The frequency of the wind speed level below 2.0 m/s in a year reaches 48.0%, nearly a half. The highest frequency happens in the autumn, followed by the summer. These two seasons have frequencies of over 50%. The spring has the lowest frequency of 38.5%. So it is not hard to find that the wind power in the summer and the autumn is not good for the diffusion while the spring is more favorable for the diffusion. By analyzing the overall conditions of the wind power, the land does not have sound conditions for the diffusion of pollutants.

③ Air Pressure, Temperature, Humidity, Precipitation, Evaporation

According to the statistics of the weather data in the recent three decades from 1971 to 2000 in the Zhumadian Meteorological Station, the annual average air pressure is 1006.9hpa. The annual average temperature is 14.9 ℃ with the lowest average temperature of 1.3 ℃ in January and the highest average temperature of 27.2 ℃ in July (see Table 5.1-7 for details). The annual temperature difference reaches 25.9 ℃. The extreme high temperature is 40.6 ℃ while the extreme low temperature is -18.1 ℃. The annual average relative humidity is 73%. The annual average precipitation is 979.2 mm, making it one of the regions with the most precipitation in the province. The rainfall is mainly concentrated from June to September, accounting for 62.5% of the whole year’s precipitation. In the winter, there is rare rainfall, especially from December to February which only accounts for 6.4% of the whole year. The little rainfall in the winter does no good to the cleaning of pollutants in the air. The annual average evaporation amounts to 1498.5 mm which does not differ much from the annual precipitation.

Table 5.1-7 Statistics of Weather Factors

Item \ Time		1	2	3	4	5	6	7	8	9	10	11	12	All Year Around
Temperature (℃)	Average	1.3	3.6	8.4	15.4	20.6	25.4	27.2	26.1	21.5	16.0	9.3	3.5	14.9
	Extreme High	21.3	25.5	30.6	35.1	37.7	40.0	40.5	40.6	38.8	34.3	30.1	21.7	40.6
	Extreme Low	-18.0	-18.1	-10.0	-1.2	4.4	10.7	16.0	14.4	8.5	-1.5	-8.7	-14.8	-18.1

Air Pressure (hPa)	Average	1017.5	1015.1	1010.9	1004.8	1000.7	995.7	993.7	996.9	1004.3	1010.7	1015.2	1017.7	1006.9
Relative Humidity (%)	Average	69	69	71	71	71	70	81	83	78	73	71	67	73
Precipitation (mm)	Average	21.4	25.0	51.3	58.2	84.3	130.0	194.4	180.5	106.7	71.8	39.2	16.4	979.2
Evaporation (mm)	Average	49.9	65.0	100.3	145.1	187.6	220.4	188.3	158.0	131.8	111.8	79.3	61.0	1498.5

(4) Atmospheric Stability

The atmospheric stability is an important factor that influences the diffusion. It represents the power of atmospheric turbulence, determining the capacity of air pollutants to diffuse in an upper vertical direction. This evaluation report adopts the related materials of the ground weather in recent three years from 2002 to 2004 from the Zhumadian Meteorological Station to calculate the atmospheric stability and compile the statistics. According to the revised Pasquill Principle provided by GB/T13201-91, the atmospheric stability is classified into six levels: strong instability, instability, weak instability, moderate, relative stability and stability. The classification can be seen in Table 5.1-8.

Table 5.1-8 Frequency of Atmospheric Stability in Each Season and All Year Around （%）

Stability / Time	A	B	C	D	E	F
Spring	2.1	15.6	16.0	22.8	27.5	16.0
Summer	3.5	16.4	11.2	26.5	27.5	15.0
Autumn	2.7	14.9	8.6	22.2	27.8	23.9
Winter	0.8	5.4	9.2	30.7	32.5	21.5
All Year Around	2.2	13.1	11.2	25.6	28.8	19.1

The Table 5.1-8 shows that the frequency of stability (E and F) is the largest, accounting for 47.9% of the whole year, the frequency of moderate (D) is 25.6% and the frequency of instability (A, B and C) is also 26.5%. The frequency of strong instability is only 2.2%. According to the frequency distribution of the atmospheric stability, stability is more frequent, which means that the vertical diffusion capacity of the air is relatively weak. As to the seasons, the winter has the highest frequency of stability of 54.0%, followed by the autumn with the frequency of stability of 51.7%. The frequencies of the winter and the autumn are both above 50%, demonstrating that the diffusion capacity of the two seasons is not sound. By comparison, the spring and summer have relatively lower frequencies of stability and their instability frequencies are higher, making them favorable periods for the diffusion.

(5) Thickness of Mixed Layer

The thickness of the mixed layer is calculated according to the measure provided by HJ/T2.2-93 of Technical Guidance on Environmental Impact Evaluation. The results can be seen in the Table 5.1-9.

Table 5.1-9 Thickness of Mixed Layer under Each Type of Stability（m）

Stability	A	B	C	D	E	F
Mixed Layer	1558	1376	1250	610	259	101

5.1.1.2 Characteristics of Polluted Weather of Boundary Layer

The polluted weather condition of the boundary layer is an important factor for the transmission and diffusion of air pollutants. The polluted weather condition of the boundary layer in the evaluation is based on the test results obtained through the environmental evaluation of the Zhumadian Electricity Plant in the southeastern part of Zhumadian. Due to various reasons, the Electricity Plant failed to operate. As the present project is only about 5 km to the test spot and it is a plain region without great barriers, the available data is of good value. The test in 1993 was only conducted in the summer and at that time the influence of the Electricity Plant on Zhumadian was mainly taken into account. The project is to the southeast of Zhumadian and the key is also the impact on Zhumadian, so it is feasible to make use of the test data in the summer.

(1) Time, Hours, Subjects, Measures and Instruments of Test

The test of the polluted weather of the boundary layer was conducted from August 7 to September 5 in 1993, lasting for a month. The test hours in each day were 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21 and 23, totally 12 times. In the research of thermal inversion, the observation hours were proper added to correspond to different phases of the generation, growth and decline of thermal inversion.

The subjects for the test include normal ground weather factors, vertical wind field, vertical temperature field, etc.

The observation of the ground weather factors adopts the tested instruments stipulated by China Meteorological Administration and is conducted according to Regulation on Observation of Ground Weather.

The detection of the vertical wind field adopts the baseline measure of double pilot balloon theodolite and is conducted according to Regulation on Observation of Upper Air. The balloon’s rising speed amounts to 100m/min and the readings are recorded every 30 seconds. The observation time keeps pace with the ground observation and the collected data is processed by computers.

The detection of the vertical temperature field adopts the GZWF-type low altitude sonde. The GNZ-3-type low altitude receiver automatically receives signals and the computer automatically records the curves of temperature lamination. The carrying balloon and the rising speed are the same as the detection of the vertical wind field. The double theodolite traces the height and the detection time is the same as the vertical wind measurement. The used instruments can be seen in the Table 5.1-10.

Table 5.1-10 Instruments in the Test

Item		Test Measure	Instrument	Precision
Boundary Layer	Wind direction and speed	Double theodolite	Balloon theodolite	Precision 0.01°
	Temperature	Computer automatically recording	GZWF-type sonde	Precision 0.05℃
Ground	Wind direction and speed	Automatically recording	EL-type electric blower	Wind speed 0.3m/s, wind direction ±5°
	Temperature	Regular observation	Assmann dry and wet air gauge	Precision 0.05°
	Temperature	Regular observation	Assmann dry and wet air gauge	Precision 1%
	Air pressure	Regular observation	Dial barometer	Precision 0.1hpa

(2) Characteristics of Low Altitude Vertical Wind Field

1) Frequency Distribution of Wind Directions at Each Main Height

Table 5.1-11 shows the frequency of wind directions at each height; Diagram 5.1-2 is the rose diagram of wind direction frequencies at different heights.

Table 5.1-11 Wind Direction Frequencies at Each Main Height（%）

Wind Direction Height (m)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	C
600	2.1	5.2	4.2	10.4	16.7	18.8	9.9	8.3	4.2	3.1	2.6	1.6	0.5	3.1	2.1	7.3	
500	3.1	2.6	3.6	11.2	18.4	17.9	9.2	10.2	4.1	5.1	2.0	1.0	1.5	2.6	4.1	3.6	
400	4.0	6.5	4.0	10.9	10.4	16.9	12.9	10.0	6.5	8.0	2.0	0.5	0.5	2.5	3.5	1.0	
350	3.4	4.4	3.9	9.9	13.8	12.8	13.8	10.3	9.9	6.4	0.5	1.0	2.0	2.5	4.4	1.0	
300	3.4	4.4	6.4	7.4	13.3	12.3	10.8	10.3	12.8	6.4	0.5	1.0	2.5	4.9	2.3	1.5	
240	4.4	5.9	4.9	5.9	12.3	11.3	9.4	14.3	10.8	6.9	2.5		3.9	2.0	2.5	3.0	
210	3.9	6.9	4.4	5.9	12.3	11.3	9.4	14.3	10.8	8.4	1.0	1.5	3.9	2.5	1.5	2.4	
100	7.4	3.4	3.4	8.4	6.9	6.9	9.4	12.8	15.8	5.9	3.4	3.4	3.0	2.0	3.0	4.9	
10	2.9	4.4	4.4	3.4	4.4	5.9	7.4	8.3	9.3	2.9	0.5	0.5	2.0	2.0	3.9	3.9	33.8

Note: The test is conducted by the Meteorological Science Institution in Henan Province (the same below)

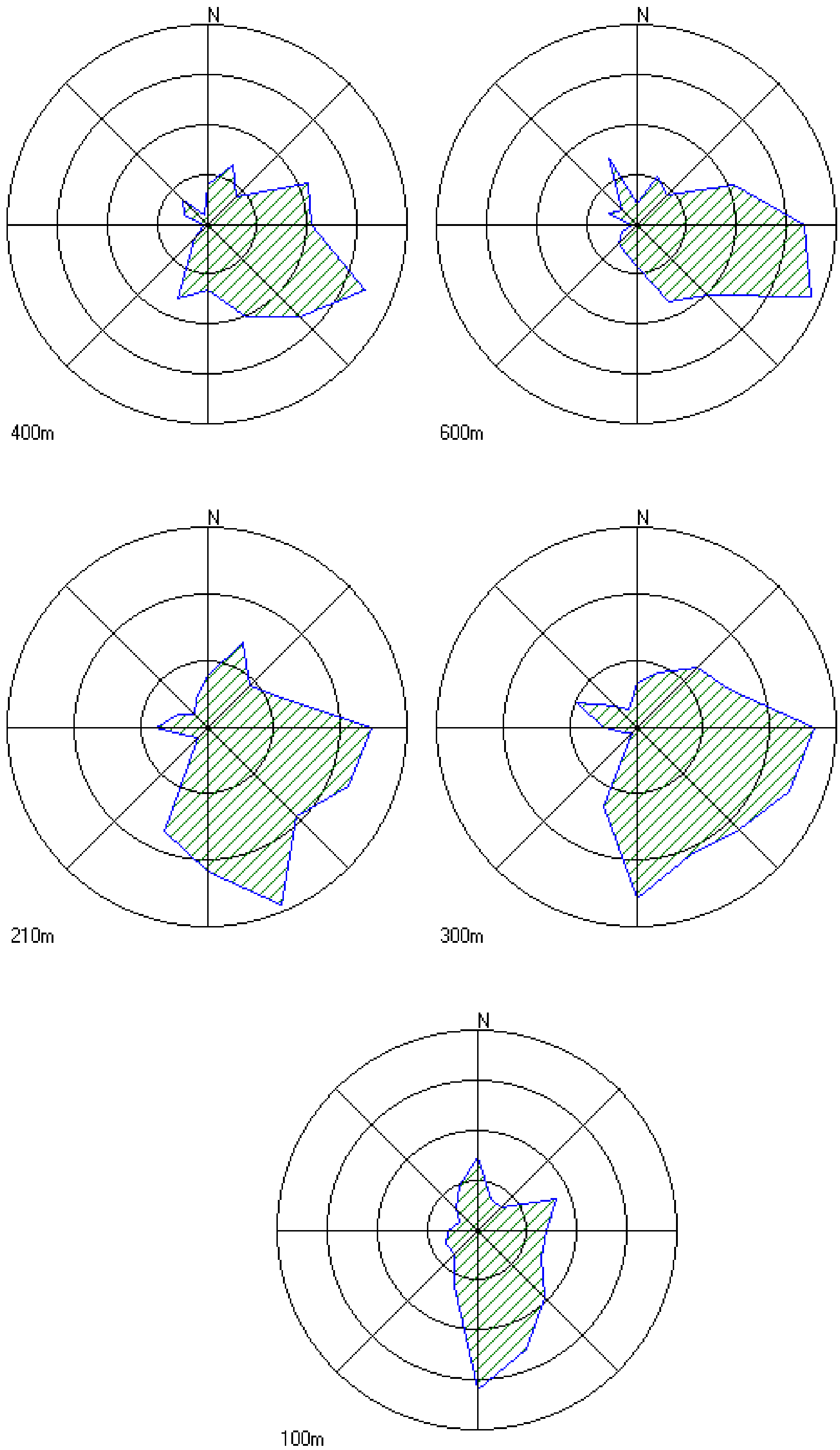


Diagram 5.1-2 Rose Diagram of Wind Direction Frequencies at Each Main Height (each circle for 5%)

From the diagram and the table, we can find that:

a. At the subaerial height below 200 m, the high frequency falls in the SSE-S circular area, ranging from 17.6% to 28.6%.

b. At 210 – 350 m high, the high frequency falls in the E-S circular area, ranging from 55.7% to 60.6%. Above 400 m, the high frequency locates in the ENE-SSE circular area, ranging from 61.1% to 66.9%.

c. Below 600m, the less high frequency is not obvious.

d. Calm wind only occurs at 10m high with a relatively high frequency of 33.8%.

2) Average Wind Speeds at Each Main Height

Table 5.1-12 to 5-14 respectively present the average wind speeds at each main height, the changes in the average wind speeds at each hour at different heights and the frequency of wind speed levels at each main height.

Table 5.1-12 Average Wind Speed at Each Main Height（m/s）

Wind Direction / Height (m)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
600	2.8	2.6	2.7	3.9	4.1	3.8	3.8	4.0	3.5	7.8	4.4	1.1	1.3	1.7	1.9	4.2
500	1.9	3.0	2.7	4.0	4.1	3.4	3.8	3.1	3.4	6.7	4.9	1.0	1.3	1.8	3.0	3.5
400	2.4	2.3	2.9	2.9	3.1	3.6	3.3	3.3	3.2	5.8	2.5	3.2	2.7	3.1	3.3	0.8
350	2.4	2.7	2.7	2.6	2.8	3.3	3.5	3.7	3.9	5.4	4.0	2.0	2.5	3.8	4.0	1.2
300	2.5	2.6	2.5	2.4	3.0	3.2	3.4	3.7	4.2	4.9	3.4	1.5	4.3	2.7	3.2	4.3
240	2.3	3.0	2.5	2.3	3.4	2.3	3.3	3.6	4.5	5.3	1.7		4.9	3.0	3.2	3.3
210	2.6	2.8	2.5	2.0	3.3	2.5	3.6	3.6	4.4	5.1	2.0	1.5	4.4	2.5	3.4	2.9
100	2.2	3.0	1.7	2.5	2.2	3.2	2.6	3.6	3.7	3.7	1.3	2.4	2.9	2.7	1.6	4.4
10	1.2	1.0	1.6	1.9	1.4	1.8	1.4	1.7	1.9	1.0	0.9	1.2	1.5	0.8	0.9	1.4

Table 5.1-13 Average Wind Speeds at each hour at different heights（m/s）

Time / Height (m)	01	03	05	07	09	11	13	15	17	19	21	23
600	3.8	3.3	3.5	3.7	4.2	4.3	3.3	4.5	1.5	3.5	3.5	3.2
500	3.6	3.1	2.9	3.8	3.7	3.6	3.0	4.4	1.6	3.7	3.6	3.1
400	3.4	3.1	2.5	3.8	3.0	2.8	2.5	4.3	1.5	3.8	3.9	3.0
300	3.4	3.0	2.7	3.7	2.6	2.7	2.7	4.0	1.6	4.2	4.0	3.2
200	3.8	3.4	2.5	3.5	2.3	2.4	2.5	4.1	1.6	4.0	4.3	3.5
100	3.2	2.6	2.4	2.4	2.4	2.7	2.3	3.3	1.4	4.1	3.9	3.0
10	0.4	0.3	0.2	0.7	1.4	1.6	1.3	1.5	0.4	1.1	0.8	0.6

From Table 5.1-12 and 5-13, we can find that:

a. In the day and the night, the wind speed changes at 5:00 and 17:00. At 17:00, the wind speeds appear small from the ground up to 600m high, all below 2.0m/s, which is unfavorable for the transmission and diffusion of pollutants.

b. Below 100m high, vertical shear takes place in the wind speed, having some impact on the transmission and diffusion of pollutants. During 15:00-17:00 and 17:00-19:00, wind speeds change with the time between 100m and 600m high.

c. Wind speeds tend to increase with the rising height.

Table 5.1-14 Frequencies of Wind Speeds at Each Main Height（%）

Wind Speed m/s / Height (m)	＜1.0	1.1~2.0	2.1~4.0	4.1~6.0	>6.0
600	6	18	39	24	14
500	7	19	42	22	10
400	4	27	40	20	9
350	7	26	40	19	8
300	8	23	39	20	9
240	18	26	35	22	9
210	10	24	35	22	8
200	10	24	36	21	9
100	12	20	45	18	5
10	60	21	18		

The above table shows that:

a. During 100m and 400m high, wind with the speed less than 1.0m/s occurs with the frequency of 4-18%. The frequency lowers down as the height increases.

b. The frequency of the wind speed below 2.0m/s is relatively high, which is unfavorable for the transmission and diffusion of pollutants to places far away.

3) Wind Speed Profile Exponent

The evaluation adopts the exponential law formula to fit the wind speed profile below 300m high. The results are seen in Table 5.1-15.

Table 5.1-15 Exponents of Wind Speed

Stability	B	C	D	E	F
Exponent	0.188	0.227	0.338	0.472	0.581

(3) Characteristics of Low Altitude Vertical Temperature Field

The vertical distribution of the atmospheric temperature determines the stability of the air and the layer of thermal inversion is also an important factor for the diffusion of pollutants in the vertical direction. The layer of thermal inversion will form a barrier layer for the rising smoke and gas and even lead to the diffusion under a closed state, deteriorating the pollution on the ground. According to the base location of the thermal inversion layer, it is divided into ground thermal inversion and low suspending thermal inversion.

1) Ground Thermal Inversion Layer

The ground thermal inversion layer is formed as the terrestrial radiation cools down. It is generated from the ground with the height as its thickness. The characteristics of the ground thermal inversion can be seen in Table 5.1-16.

Table 5.1-16 Characteristics of Ground Thermal Inversion Layer

Item	Average thickness (m)	Maximum thickness (m)	Frequency at hours (%)	Average strength (℃/hm)	Maximum strength (℃/hm)
Characteristics	96	160	6.8	0.6	1.1

The average thickness of the ground thermal inversion layer in the summer is 96m while the maximum thickness is 160m, having some influence on the diffusion of smoke and gas in the project.

2) Low Suspending Thermal Inversion

The low suspending thermal inversion layer is one whose base doesn't touch the ground. Sometimes it may form at different heights. According to the height of the base, the characteristics of the low suspending thermal inversion can be seen in Table 5.1-17 and Table 5.1-18.

Table 5.1-17 Characteristics of Low Suspending Thermal Inversion

Item / Height（m）	Average height of the base（m）	Average thickness（m）	Average strength（℃/hm）	Frequency（%）
Height of the top <210	46	93	1.6	24
Height of the base 210-600	390	118	0.8	8
Height of the base 601-900	810	138	1.1	11

Table 5.1-18 Characteristics of Low Suspending Thermal Inversion at Hours

<table>
<tr><th>Height（m）</th><th>Hour / Item</th><th>01</th><th>03</th><th>05</th><th>07</th><th>13</th><th>17</th><th>19</th><th>21</th></tr>
<tr><td rowspan="4">Height of the top <210</td><td>Average height of the base（m）</td><td>41</td><td>37</td><td>58</td><td>51</td><td></td><td></td><td>40</td><td>45</td></tr>
<tr><td>Average thickness (m)</td><td>89</td><td>96</td><td>116</td><td>97</td><td></td><td></td><td>70</td><td>86</td></tr>
<tr><td>Average strength（℃/hm）</td><td>1.0</td><td>1.0</td><td>1.4</td><td>1.7</td><td></td><td></td><td>2.7</td><td>1.0</td></tr>
<tr><td>Frequency (%)</td><td>33</td><td>50</td><td>44</td><td>55</td><td></td><td></td><td>4</td><td>38</td></tr>
<tr><td rowspan="4">Height of the base 210-600</td><td>Average height of the base（m）</td><td>395</td><td>437</td><td>500</td><td>418</td><td>425</td><td>380</td><td>240</td><td>333</td></tr>
<tr><td>Average thickness (m)</td><td>102</td><td>166</td><td>100</td><td>95</td><td>125</td><td>70</td><td>210</td><td>57</td></tr>
<tr><td>Average strength（℃/hm）</td><td>0.8</td><td>0.4</td><td>0.2</td><td>0.4</td><td>1.5</td><td>0.6</td><td>0.3</td><td>1.9</td></tr>
<tr><td>Frequency (%)</td><td>21</td><td>50</td><td>6</td><td>20</td><td>10</td><td>5</td><td>4</td><td>14</td></tr>
</table>

Height of the base 601-900	Average height of the base（m）	830	800	795	850	807	680	850	890
	Average thickness (m)	80	70	143	150	73	190	230	110
	Average strength（℃/hm）	1.4	1.4	0.8	0.4	1.3	1.1	0.7	1.6
	Frequency (%)	10	17	22	10	14	9	4	10

The above two tables show that:

a. For the low suspending thermal inversion with the height of the base below 210m, the average height of the base is 46m, the average thickness is 93m and the average height of the top is 139m, having a relatively obvious influence on the diffusion of rising smoke and gas.

b. For the low suspending thermal inversion with the height of the base between 210m and 600m, the height of the base at different hours ranges from 240m to 500m. The average height of the base is 390m and the average thickness is 118m. In terms of the height of the base and the thickness, the thermal inversion may cause closed pollution. The thermal inversion occurs at every hour of the day with a very low frequency of only 8%.

Generally speaking, the low suspending thermal inversion is a main layer of thermal inversion that influences the diffusion of smoke and gas.

5.1.3 Evaluation Ratings

According to the rating method of HJ/T2.2-93, the atmospheric evaluation is rated into three levels.

5.1.4 Evaluation Range and Factors

5.1.4.1 Evaluation Range

The evaluated area covers 52.5km2 with the factory as the center, extending 3.25km to the north, 3.75km to the south, 2.5km to the east and 5km to the west. The area includes the surrounding villages and the urban area of Zhumadian. Details can be seen in Diagram 5.1-3.

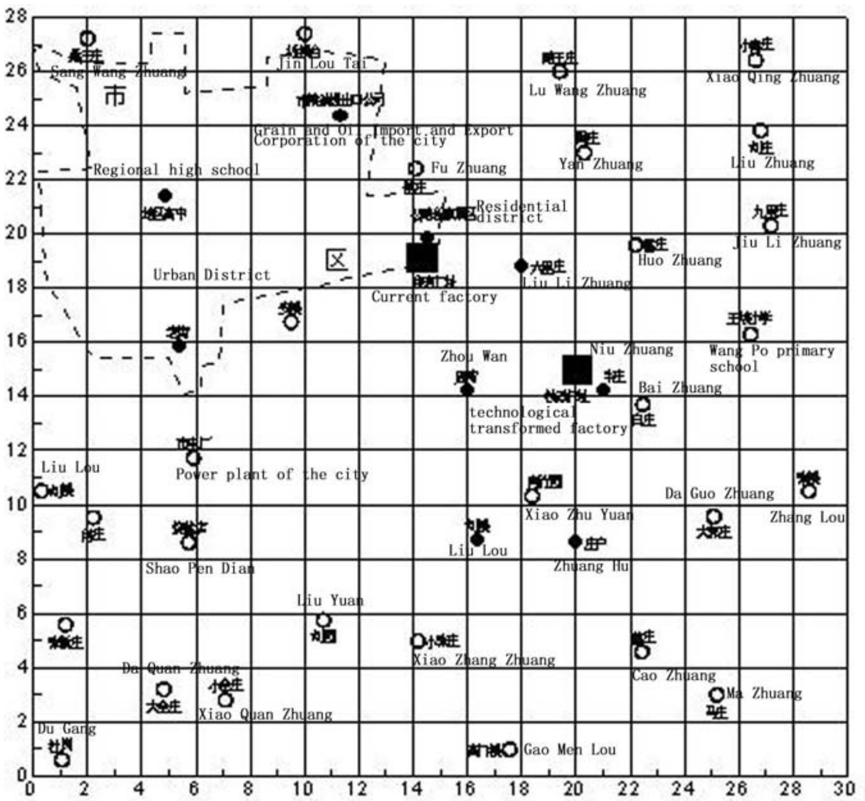


Diagram 5.1-3 Diagram of Evaluated Area and Main Related Locations (each scale for 250m, each grid for 500m)

5.1.4.2 Evaluation Factors

The expected evaluation factors include SO_2, NO_2, H_2S, CH_3OH, NH_3, PM_{10} and TSP.

5.1.5 Evaluation Standards

The evaluation standards comply with the secondary standards in GB3095-1996 of Environmental Air Quality Standard and TJ36-79 of Standards of Health Protection in Industrial Enterprise Design. The items excluded in the Standard GB3095-1996 refer to standards of maximum permissible concentration of harmful substances in the air in residential areas in TJ36-79. Details can be seen in Table 5.1-20.

Table 5.1-20 Evaluation Standards of Environmental Air Quality (mg/m^3)

Evaluation Factors	Average in an hour	Average in a day	Average in a year
SO_2	0.50	0.15	0.06
NO_2	0.24	0.12	0.08
TSP		0.30	0.20
PM_{10}		0.15	0.10
H_2S*	0.01		

NH_3*	0.2		
CH_3OH*	3.0	1.0	

Note: * means to adopt TJ36-79 of Standards of Health Protection in Industrial Enterprise Design.

5.1.6 Predictions

A coordinate is established to divide the evaluated area into square grids (250m between adjacent grids). Predictions and evaluations of concentration are conducted on each grid and related locations.

The atmospheric stability is classified into three levels (instability, moderate and stability) and the wind speed is divided into three levels (1.5 m/s, 2.1 m/s, 3.5 m/s). After the technical restructuring of the project, the maximum influence of the one-hour average concentration of SO_2, NO_2, H_2S and NH_3 on each related location and the affecting wind direction are predicted and evaluated.

After the technical restructuring of the project, the maximum landing concentration of SO_2, NO_2, H_2S and NH_3 and the distance are predicted.

During the project under construction and the technical restructuring, the influence of the unorganized emission on the factory is predicted.

During the technical restructuring, the maximum ground concentration of SO_2, NO_2 and H_2S in each related location is predicted.

The influence of TSP and SO_2 on each related location under abnormal conditions is predicted.

Two typical days are selected to predict the distribution of daily average concentration of SO_2, NO_2, PM_{10} and TSP and draw a diagram.

Changes in the daily concentration of SO_2, NO_2, PM_{10} and TSP after the technical restructuring and the project under construction are completed and the alternative pollution sources are removed are predicted and analyzed. A diagram is drawn for the changes and compared with the current values.

The distribution of annual average concentration of SO_2, NO_2, PM_{10} and TSP is predicted and a diagram is drawn.

Changes in the annual concentration of SO_2, NO_2, PM_{10} and TSP after the technical restructuring and the project under construction are completed and the alternative pollution sources are removed are predicted and analyzed. A diagram is drawn.

The health protection distance of CH_3OH and NH_3 is calculated.

The rationality of the overall layout of the factory is analyzed. The environmental feasibility of the project is clearly concluded from the perspective of the atmospheric protection.

5.1.7 Selection of Prediction Mode and Related Parameters

5.1.7.1 Prediction Mode

(1) Formula of the height of rising smoke and gas

When the rate of heat release of smoke and gas exceeds or equals 21000 kJ/s and the difference between the smog temperature and the environmental temperature (ΔT) exceeds or equals 35K, the height of rising smog can be calculated according to the following formula:

When $Q_h \geq 21000$ kJ/s,

$$\Delta H = 1.427 Q_h^{1/3} H^{2/3} U^{-1}$$

When $2100 \leq Q_h$ <21000 kJ/s,

$$\Delta H = 0.332 Q_h^{3/5} H^{2/5} U^{-1}$$

$$Q_h = 0.35 P_a Q_v \frac{\Delta T}{T_s}$$

$$\Delta T = T_s - T_a$$

When Q_h<1700kJ/s or ΔT<35K,

$$\Delta H = 2(1.5 V_s D + 0.01 Q_h)/U$$

Wherein:

Q_h: rate of heat release of smog, kJ/s;

H: geometric height of exhaust funnel, m;

P_a: atmospheric pressure, hP_a;

Q_v: actual exhaust removal rate, m^3/s;

T_s: outlet temperature of smog, K;

T_a: environmental temperature, K;

U: average wind speed at the outlet of exhaust funnel, m/s;

D: the diameter of the outlet of exhaust funnel, m;

V_s: the discharging speed of smog at the outlet of exhaust funnel, m/s;

When wind exists, the conditions of stability are

$$\Delta H = Q_h^{1/3} \left(\frac{dT_a}{dz} + 0.0098\right)^{-1/3} U^{-1/3}$$

Wherein:

$\frac{dT_a}{dz}$: the temperature gradient above the geometric height of exhaust funnel, K/m;

When there is calm wind and breeze,

$$\Delta H = 5.50 Q_h^{1/4} \left(\frac{dT_a}{dz} + 0.0098\right)^{-3/8}$$

(2) Concentration prediction mode

When there is wind ($U_{10} \geq 1.5 m/s$), it is the point source diffusion mode:

$$c = (\frac{Q}{2\pi U\sigma_y\sigma_z})\exp[-(\frac{Y^2}{2\sigma_y^2})]\cdot F$$

$$F = \sum_{n=-k}^{K}\{\exp[-\frac{(2nh-H_e)^2}{2\sigma_z^2}]+\exp[-\frac{(2nh+H_e)^2}{2\sigma_z^2}]\}$$

In the project, K=0.

When there is breeze ($U_{10} < 1.5m/s$), the point source diffusion proceeds in the following mode:

$$c_L = \frac{2Q}{(2\pi)^{3/2}\gamma_{02}\eta^2}\cdot G$$

$$\eta^2 = X^2 + Y^2 + \frac{\gamma_{01}^2}{\gamma_{02}^2}\cdot H_e^2$$

$$G = \exp(-\frac{U^2}{2\gamma_{01}^2})\cdot[1+\sqrt{2\pi}\cdot s\cdot\exp(\frac{s^2}{2})\cdot\Phi(s)]$$

$$\Phi(s) = \frac{1}{\sqrt{2\pi}}\int_{-\infty}^{s} e^{-t^2/2}dt$$

$$s = \frac{UX}{\gamma_{01}\eta}$$

When there is wind ($U_{10} \geq 1.5m/s$), the abnormal discharging mode is as follows:

$$C_a = \frac{Q}{\pi U\sigma_y\sigma_z}\exp(-\frac{Y^2}{2\sigma_y^2}-\frac{H_e^2}{2\sigma_z^2})\times G_1$$

$$G_1 = \begin{cases}\Phi\left(\frac{Ut-X}{\sigma_X}\right)+\Phi\left(\frac{X}{\sigma_X}\right)-1 & t\leq T\\ \Phi\left(\frac{Ut-X}{\sigma_X}\right)-\Phi\left(\frac{Ut-UT-X}{\sigma_X}\right) & t>T\end{cases}$$

When fuming occurs, the calculation is conducted in the following mode:

$$C_f = \frac{Q}{\sqrt{2\pi}Uh_f\sigma_{yf}}\exp(-\frac{Y^2}{2\sigma_{yf}^2})\cdot\Phi(P)$$

$$P = (h_f - H_e)/\sigma_z$$

$$\sigma_{yf} = \sigma_y + H_e/8$$

$$h_f = H + \Delta h_f$$

$$X_f = A(\Delta h_f^2 + 2H\Delta h_f)$$

$$A = \rho_a C_p U/4K_c$$

$$\Delta h_f = \Delta H + P\sigma_z$$

$$K_c = 4.186\exp[-99(\frac{d\theta}{dz})+3.22]\cdot 10^3$$

The maximum ground concentration in the downwind direction of exhaust funnel and the distance to the exhaust funnel are calculated in the following mode:

$$C_m(X_m) = \frac{2Q}{e\pi U \cdot H_e^2 P_1}$$

$$P_1 = \frac{2\gamma_1 \gamma_2^{-\alpha_1/\alpha_2}}{(1+\frac{\alpha_1}{\alpha_2})^{\frac{1}{2}(1+\frac{\alpha_1}{\alpha_2})} \cdot H_e^{(1-\frac{\alpha_1}{\alpha_2})} \cdot e^{\frac{1}{2}(1-\frac{\alpha_1}{\alpha_2})}}$$

$$X_m = (\frac{H_e}{\gamma_2})^{1/\alpha_2}(1+\frac{\alpha_1}{\alpha_2})^{-1/2\alpha_2}$$

When the grain diameter is larger than 15μm, the ground concentration mode is as follows:

$$C_\rho = \frac{(1+\alpha)Q}{2\pi U \sigma_y \sigma_z} \exp[-\frac{Y^2}{2\sigma_y^2} - \frac{(V_g \frac{X}{U} - H_e)^2}{2\sigma_z^2}]$$

$$V_g = \frac{d^2 \rho g}{18\mu}$$

Multi-source mode:

The contribution of each source to the concentration of the receiving points can be added in the following formula:

$$c_n(X,Y) = \sum_r c_r(X - X_r, Y - Y_r)$$

Wherein, c_r is the concentration contributed to the point (X, Y) by the r source (X_r, Yr).

For the unorganized plane source, post positioning point source method is adopted and the diffusion parameters are revised as follows:

$$\sigma_y = \gamma_1 \mathrm{X}^{\alpha 1} + \frac{\alpha_y}{4.3}$$

$$\sigma_z = \gamma_2 \mathrm{X}^{\alpha 2} + \frac{\overline{H}}{2.15}$$

Prediction mode of the daily average concentration:

The typical weather conditions are selected and the daily average concentration is calculated by typical days according to the following formula:

$$C_{日} = \frac{1}{8}\sum_{i=1}^{8} C_{一小时}$$

Prediction mode of the long-term average concentration:

The long-term average concentration influenced by separate sources is calculated in the following formula:

$$\overline{C}(X)_i = \sum_j (\sum_k \overline{C_{ijk}} f_{ijk} + \sum_k \overline{C_{Lijk}} f_{Lijk})$$

$$\overline{C_{ijk}} = \frac{Q}{(2\pi)^{3/2} U \sigma_z (X/n)} \cdot F$$

The annual long-term average concentration influenced by multi-sources is calculated in the following formula:

$$\overline{C}(X)_i = \sum_i \sum_j \sum_k \left(\sum_r \overline{C_{rijk}}\, f_{rijk} + \sum_r \overline{C_{Lijk}}\, f_{Lijk}\right)$$

For one concentration value (sampling period of 0.5h), it can be diluted into one-hour average concentration value according to the method provided in appendix B of HJ/T2.2-93.

5.1.7.2 Selection of parameters in the mode

(1) Source strength parameters

Table 5.1-22 Table of Source Strength Parameters

Device	Name of polluting sources	Displacement Nm^3/h	Discharging height m	Pollutants	Discharging rate (kg/h)
Newly built gas generation and ammonia synthesis (new factory area)	Coal smash exhaust	4000	35	Dust	0.32
	Exhaust of pulverized coal bunker	2000	75	Dust	0.2
	Torch combustion smog	225	60	SO_2	0.68
	Acid gas	1600	35	H_2S	1.66
	Unorganized emission			NH_3	7.4
Methanol	Unorganized emission of methanol storage			Methanol	7.5
Eliminated existing gas generation (old factory area)	Gas making and blowing gas	88500	27	Soot	5.54
				SO_2	70.8
				H_2S	1.3
Eliminated existing synthesized ammonia (old factory area)	Acid gas	300	35	H_2S	2.7
	Unorganized emission			NH_3	7.4
Eliminated boiler (old factory area)	2#20t/h boiling	39200	48	Soot	7.1
				SO_2	33.7
				NOx	11.8
	3# 20t/h chain	28610	45	Soot	4.8
				SO_2	21.5
				NOx	8.6
Newly built boiler (old factory area)	75t/h circulating fluidization bed	999000	100	Soot	9.0
				SO_2	44.9
				NOx	10.0
Melamine under construction (old factory area)	Molten salt furnace flue gas	21700	35	Soot	3.62
				SO_2	15.5
	Idle exhaust scrubber	355	35	NH_3	0.11
	Emission of ammonia-carbon separation columns	2200	35	NH_3	0.87

	Exhaust of finished product storage warehouse	6290	25	Dust	0.17
	Unorganized emission			NH_3	2
Methylamine and DMF under construction (old factory)	Unorganized emission			Methanol	0.31
				NH_3	0.62
Carbamide	Processing exhaust	340	30	NH_3	7.14
	Granulation exhaust	125610	100/68	NH_3	3.8
	Unorganized emission			NH_3	18.7

(2) Diffusion Parameters

According to the regulations of HJ/T2.2-93, diffusion parameters at stability levels A and B in urban areas can be directly checked in the table, parameters at the level C refer to those at the level B, and parameters at stability levels D, E and F use those at a level ahead towards the instability direction.

(3) Determination of Typical Days

According to the geographic location of the main related locations in the evaluated area (Zhumadian), the wind direction characteristics that influence the main related locations and the discharging conditions of pollutant sources, one typical day is chosen from the data of polluted weather tests in August 1993. In addition, by investigating the wind directions, wind speeds and stability of the ground electric blower in recent four years, one typical day is chosen. The polluted weather conditions on each typical day can be seen in Table 5.1-23.

Table 5.1-23 Polluted Weather Conditions on Each Typical Day

Date	Wind direction	Wind speed (m/s)	Stability	Temperature (℃)
1993/8/22	SE~SSE~SSW	2.8~9.9	B~D~F	20.1~25.3
2001/10/6	WNW~N~NNE	1.7~6.3	B~D~F	13.4~19.7

5.1.8 Prediction Results and Evaluation

5.1.8.1 One-hour ground average concentration after the completion of technical restructuring

After the completion of technical restructuring and under different wind directions, wind speeds and stability, the maximum influence of the one-hour ground average concentration of SO_2, NH_3, NO_2 and H_2S on each related location can be predicted in Table 5.1-24.

Table 5.1-24 Maximum One-hour Ground Average Concentration （mg/ m^3 ）of Each Factor and Wind Directions Concerned

Related	Wind	SO_2	NO_2	H_2S	NH_3

locations	directions concerned	Concentration	Percentage of the standard value	Concentration	Percentage of the standard value	Concentration	Percentage of the standard value	Concentration	Percentage of the standard value
Residential district	SE	0.0012	0.2	0.0003	0.1	0.00004	0.4	0.1850	92.5
Niu Zhuang	NW	0.0024	0.5	0.0006	0.3	0.00008	0.8	0.0802	40.1
Zhou Wan	ENE	0.0018	0.4	0.0004	0.2	0.00006	0.6	0.0856	42.8
Grain and Oil Company	SE	0.0007	0.1	0.0002	0.1	0.00002	0.2	0.0679	34.0
Liu Li Zhuang	SSE	0.0020	0.4	0.0005	0.2	0.00007	0.7	0.1041	52.1
Liu Lou	NNE	0.0009	0.2	0.0002	0.1	0.00003	0.3	0.0326	16.3
Zhuang Hu	N	0.0009	0.2	0.0002	0.1	0.00003	0.3	0.0289	14.5
Regional high school	ESE	0.0005	0.1	0.0001	0.0	0.00002	0.2	0.0165	8.3
Old street	E	0.0006	0.1	0.0001	0.0	0.00002	0.2	0.0170	8.5

Note: the residential district refers to the residential district along the road and the Grain and Oil Company refers to the Municipal Grain and Oil Export and Import Company, the same below.

The above table shows that the maximum one-hour ground average concentration of SO_2, NO_2, H_2S and NH3 in each related location accounts for 0.5%, 0.3%, 0.8% and 92.5% of the standard value respectively, all within the limits. Due to the unorganized emission of NH3 from the existing carbamide device in the old factory, the residential district is relatively seriously affected by NH_3 while Niu Zhuang is most seriously influenced by other polluting factors.

5.1.8.2 Maximum landing concentration and distance after the completion of technical restructuring

Under different weather conditions, the maximum landing concentration and distance of SO_2, NO_2, H_2S and NH_3 can be seen in Table 5.1-25.

Table 5.1-25 Maximum Landing Concentration (mg/ m^3) and Distance (m) of Each Factor

Factor	Stability	Concentration	Percentage of the standard value	Wind speed m/s	Distance
SO_2	Instability	0.0025	0.5	1.5	400
	Moderate	0.0019	0.4	1.5	660
	Stability	0.0008	0.2	1.5	1750
NO_2	Instability	0.0006	0.3	1.5	400
	Moderate	0.0005	0.2	1.5	670
	Stability	0.0002	0.1	1.5	1780
H_2S	Instability	0.00009	0.9	1.5	530

	Moderate	0.00007	0.7	1.5	800
	Stability	0.00003	0.3	1.5	2180
NH_3	Instability	0.1160	58	1.5	In the new factory *
	Moderate	0.1461	73	1.5	
	Stability	0.1660	83	1.5	

*: the prediction of unorganized emission of NH_3 only calculates the technical restructuring project in the new factory.

From the table, we can find that under different weather conditions, the maximum landing concentration of SO_2 and NO_2 after the completion of technical restructuring accounts for 0.5% and 0.3% of the standard value respectively. The distances to the torch are all 400m. The maximum landing concentration of H_2S accounts for 0.9% of the standard value and the distance to the torch is 530m. The emission of NH_3 is unorganized and has the most serious influence on the factory, accounting for 83% of the standard value.

5.1.8.3 Influence of unorganized emission source on ground concentration surrounding the factory

In the methanol project under construction and the technical restructuring, the prediction results of the ground concentration surrounding the factory caused by the unorganized emission sources of CH_3OH and NH_3 can be seen in Table 5.1-26.

Table 5.1-26 Maximum Ground Concentration Caused by Unorganized Emission Sources Surrounding the Factory

Boundaries	CH_3OH (old factory)		TSP (old factory)		NH_3 (new factory)		NH_3 (old factory)	
	Concentration (mg/m^3)	Percentage of the standard value	Concentration (mg/m^3)	Percentage of the standard value	Concentration (mg/m^3)	Percentage of the standard value	Concentration (mg/m^3)	Percentage of the standard value
Northern boundary	0.0969	3.2	0.4772	47.7	0.0721	3.6	0.3537	17.7
Northeastern boundary	0.0729	2.4	0.6611	66.1	0.0499	2.5	0.4102	20.5
Eastern boundary	0.0627	2.1	1.1262	112.6	0.0811	4.1	0.4869	24.3
Southeastern boundary	0.0536	1.8	0.9709	97.1	0.0679	3.4	0.2908	14.5
Southern boundary	0.0634	2.1	0.4448	44.5	0.1202	6.0	0.2679	13.4
Southwestern boundary	0.0750	2.5	0.2752	27.5	0.1060	5.3	0.1421	7.1
Western boundary	0.0992	3.3	0.2715	27.1	0.1104	5.5	0.1650	8.3
Northwestern boundary	0.1399	4.7	0.2784	27.8	0.0432	2.2	0.1758	8.8

The table shows that the maximum ground concentration caused by the unorganized emission source of CH_3OH under construction in the boundaries accounts for 4.7% of the standard value, affecting the northwestern boundary most. The maximum ground concentration caused by the unorganized emission source of TSP in the boundaries accounts for 112.6% of the standard value, exceeding the limit and affecting the eastern boundary most. For the over-limit of TSP in the boundary caused by unorganized sources, it is recommended to take measures such as putting up sheds and changing open piling into closed piling so as to reduce the unorganized emission of TSP. After the removal of the gas making device in the old factory, the unorganized emission of NH_3 has reduced and the maximum in each boundary of the old factory accounts for 24.3% of the standard value. In the boundaries of the new factory, the NH3 does not account for a large amount of the standard value.

5.1.8.4 Maximum ground concentration in related locations under the fuming in the technical restructuring

When fuming pollution occurs to the boiler and funnel in the project, the maximum ground concentration of SO_2 and NO_2 in related locations and the maximum ground concentration of H_2S in related locations when the fuming occurs to the torch can be seen in Table 5.1-27.

Table 5.1-27 Maximum Ground Concentration in Related Locations under the Fuming (mg/m^3)

Related locations	SO_2		NO_2		H_2S	
	Concentration	Percentage of the standard value	Concentration	Percentage of the standard value	Concentration	Percentage of the standard value
Residential district	0.0016	0.3	0.0004	0.2	0.00027	2.7
Niu Zhuang	0.0036	0.7	0.0009	0.4	0.00054	5.4
Zhou Wan	0.0024	0.5	0.0006	0.3	0.00036	3.6
Grain and Oil Company	0.0008	0.2	0.0002	0.1	0.00014	1.4
Liu Li Zhuang	0.0028	0.6	0.0007	0.3	0.00045	4.5
Liu Lou	0.0012	0.2	0.0003	0.1	0.00018	1.8
Zhuang Hu	0.0012	0.2	0.0003	0.1	0.00018	1.8
Regional high school	0.0006	0.1	0.0001	0.0	0.00009	0.9
Old streets	0.0007	0.1	0.0002	0.1	0.00009	0.9

The above table shows that when fuming pollution occurs to the technical restructuring project, the maximum ground concentration of SO_2, NO_2 and H_2S in related locations accounts for 0.7%, 0.4% and 5.4% of the standard value respectively. Locations that are near to the factory suffer from relatively serious influence with Niu Zhuang at the first, followed by Zhou Wan.

5.1.8.5 Ground concentration of SO_2 in related locations under the accidental state of technical restructuring

The occurrence of technical restructuring accidents will have a major influence on the surroundings caused by the exhaust from the gas generation device. In the evaluation, the unfavorable conditions are predicted for one hour, i.e. one hour during the accident. After the accidental emission, the ground concentration of SO_2 and TSP in related locations can be seen in Table 5.1-28.

Table 5.1-28 Maximum Ground Concentration of SO2 and TSP in Related Locations under Accidental State of Technical Restructuring (mg/m^3)

Related locations	SO_2		TSP	
	Concentration	Percentage of the standard value	Concentration	Percentage of the standard value
Residential district	0.2184	43.7	0.1238	12.4
Niu Zhuang	0.1684	33.7	0.4960	49.6
Zhou Wan	0.2281	45.6	0.1930	19.3
Grain and Oil Company	0.1707	34.1	0.0641	6.4
Liu Li Zhuang	0.2283	45.7	0.2049	20.5
Liu Lou	0.1961	39.2	0.1245	12.4
Zhuang Hu	0.1956	39.1	0.1527	15.3
Regional high school	0.1755	35.1	0.0466	4.7
Old streets	0.1760	35.2	0.0519	5.2

The above table shows that after the accidental emission in the technical restructuring, the maximum ground concentration of SO_2 in related locations accounts for 45.7% of the standard value, all within the limits with Liu Li Lou most seriously influenced. The maximum ground concentration of TSP in related locations accounts for 49.6% of the standard value, all within the limits with Niu Zhuang most seriously influenced. Despite of these, measures should be taken to avoid the above accidents as much as possible.

5.1.8.6 Prediction of daily average concentration in typical days in technical restructuring

Prediction results of the daily average concentration of each factor in typical days in technical restructuring can be seen in Diagram 5.1-4~5-11 and Table 5.1-29~5-30.

Table 5.1-29 Maximum Grid Concentration (mg/m^3) in Typical Days in Technical Restructuring and Locations of Grid

Typical days	Factors	Concentration	Percentage of the standard value	Location of grid	Direction and distance（m）
1993/8/22	SO_2	0.0006	0.4	19,18	NNW,791
	NO_2	0.0001	0.1	19,18	NNW,791
	PM_{10}	0.2574	171.6	20,15 (in the factory)	S,30
	TSP	0.3942	131.4	20,15 (in the factory)	S,30

2001/10/6	SO_2	0.0004	0.3	18,13	SW,1118
	NO_2	0.0001	0.1	18,13	SW,1118
	PM_{10}	0.2928	195.2	20,15 (in the factory)	S,30
	TSP	0.4539	151.3	20,15 (in the factory)	S,30

Table 5.1-30 Daily Average Concentration (mg/m^3) in Typical Days in Related Locations in Technical Restructuring

Date	1993/8/22							
Factors	SO_2		NO_2		PM_{10}		TSP	
Related locations	Contribution value	Percentage of the standard value	Contribution value	Percentage of the standard value	Contribution value	Percentage of the standard value	Contribution value	Percentage of the standard value
Residential district	0.0001	0.1	0.0000	0.0	0.0125	8.3	0.0287	9.6
Zhou Wan	0.0000	0.0	0.0000	0.0	0.0000	0.0	0.0000	0.0
Grain and Oil Company	0.0001	0.1	0.0000	0.0	0.0062	4.1	0.0138	4.6
Liu Li Zhuang	0.0003	0.2	0.0001	0.1	0.0172	11.5	0.0390	13.0
Date	2001/10/6							
Factors	SO_2		NO_2		PM_{10}		TSP	
Related locations	Contribution value	Percentage of the standard value	Contribution value	Percentage of the standard value	Contribution value	Percentage of the standard value	Contribution value	Percentage of the standard value
Niu Zhuang	0.0002	0.1	0.0001	0.1	0.1134	75.6	0.2049	68.3
Grain and Oil Company	0.0000	0.0	0.0000	0.0	0.0000	0.0	0.0000	0.0
Liu Li Zhuang	0.0000	0.0	0.0000	0.0	0.0000	0.0	0.0000	0.0
Liu Lou	0.0001	0.1	0.0000	0.0	0.0027	1.8	0.0061	2.0
Zhuang Hu	0.0001	0.1	0.0000	0.0	0.0071	4.7	0.0158	5.3

From the diagram and table, we can see that the daily average grid concentration of SO_2 and NO_2 in typical days in the technical restructuring accounts for 0.4% and 0.1% of the standard value respectively, both taking place about 791m to the NNW of the factory site. The maximum daily average grid concentration of PM10 and TSP exceeds 0.95 times and 0.51 times of the standard value respectively, both occurring in the factory. The maximum daily average concentration of SO_2 and NO_2 in related locations accounts for 0.2% and 0.1% of the standard value, with Liu Li Zhuang and Niu Zhuang most seriously influenced. The maximum daily average concentration of PM_{10} and TSP in related locations accounts for 75.6% and 68.3% of the standard value respectively, with Niu Zhuang most seriously influenced.

5.1.8.7 Changes in the daily average concentration

The values contributed to the daily average concentration of SO_2, NO_2, PM_{10} and TSP in typical days in the technical restructuring in related locations are chosen. Meanwhile, their influence on the project under construction and the existing eliminated project is also taken into consideration. The changes in the daily average concentration in typical days can be seen in Diagram 5.1-12~5-19 and Table 5.1-31~5-32.

Table 5.1-31 Changes in the Daily Average Concentration (mg/m^3) in Typical Days （1993/8/22）

Factors	Related locations	Technical restructuring project	Project under construction	Existing eliminated project	Changes
SO2	Residential district	0.0001	0.0000	0.0000	0.0001
	Grain and Oil Company	0.0001	0.0024	0.0229	-0.0204
	Liu Li Zhuang	0.0003	0.0000	0.0000	0.0003
	Regional high school	0.0000	0.0000	0.0002	-0.0002
	Old streets	0.0000	0.0000	0.0000	0.0000
	Grain and Oil Company	0.0000	0.0004	0.0082	-0.0078
	Liu Li Zhuang	0.0001	0.0000	0.0000	0.0001
	Regional high school	0.0000	0.0000	0.0001	-0.0001
PM10	Residential district	0.0125	0.0000	0.0000	0.0125
	Grain and Oil Company	0.0062	0.0006	0.0076	-0.0008
	Liu Li Zhuang	0.0172	0.0000	0.0000	0.0172
	Regional high school	0.0001	0.0000	0.0000	0.0001
	Old streets	0.0000	0.0000	0.0000	0.0000
TSP	Residential district	0.0287	0.0000	0.0000	0.0287
	Zhou Wan	0.0000	0.0000	0.0000	0.0000
	Grain and Oil Company	0.0138	0.0007	0.0065	0.0080

	Liu Li Zhuang	0.0390	0.0000	0.0000	0.0390
	Regional high school	0.0001	0.0000	0.0001	0.0000

Note: changes refer to the contribution value of technical restructuring project plus the contribution value of the project under construction minus the contribution value of the existing eliminated project, the same below.

From the table, we can see that the daily average concentration of SO_2 and NO_2 in the factory has reduced and that of PM_{10} and TSP has increased (due to the project under construction). Generally speaking, the environmental air has become better than before.

Table 5.1-32 Changes in Daily Average Concentration (mg/m^3) in Typical Days （2001/10/6）

Factors	Related locations	Technical restructuring project	Project under construction	Existing eliminated project	Changes
SO2	Residential district	0.0000	0.0000	0.0007	-0.0007
	Niu Zhuang	0.0002	0.0020	0.0152	-0.0130
	Zhou Wan	0.0000	0.0005	0.0149	-0.0144
	Grain and Oil Company	0.0000	0.0000	0.0000	0.0000
	Liu Li Zhuang	0.0000	0.0000	0.0033	-0.0033
	Liu Lou	0.0001	0.0009	0.0084	-0.0074
	Zhuang Hu	0.0001	0.0010	0.0063	-0.0052
	Regional high school	0.0000	0.0000	0.0000	0.0000
	Old streets	0.0000	0.0000	0.0001	-0.0001
NO2	Residential district	0.0000	0.0000	0.0001	-0.0001
	Niu Zhuang	0.0001	0.0004	0.0051	-0.0046
	Zhou Wan	0.0000	0.0001	0.0055	-0.0054
	Liu Li Zhuang	0.0000	0.0000	0.0008	-0.0008
	Liu Lou	0.0000	0.0002	0.0034	-0.0032
	Zhuang Hu	0.0000	0.0002	0.0023	-0.0021
	Old streets	0.0000	0.0000	0.0000	0.0000
PM10	Residential district	0.0000	0.0000	0.0000	0.0000
	Niu Zhuang	0.1134	0.0005	0.0009	0.1130
	Zhou Wan	0.0000	0.0001	0.0080	-0.0079
	Liu Li Zhuang	0.0000	0.0000	0.0076	-0.0076

	Liu Lou	0.0027	0.0002	0.0065	-0.0036
	Zhuang Hu	0.0071	0.0002	0.0025	0.0048
TSP	Residential district	0.0000	0.0000	0.0001	-0.0001
	Niu Zhuang	0.2049	0.0006	0.0042	0.2013
	Zhou Wan	0.0000	0.0001	0.0044	-0.0043
	Liu Li Zhuang	0.0000	0.0000	0.0007	-0.0007
	Liu Lou	0.0061	0.0003	0.0026	0.0038
	Zhuang Hu	0.0158	0.0003	0.0019	0.0142
	Regional high school	0.0000	0.0000	0.0000	0.0000

5.1.8.8 Addition of daily average concentration

The current daily average concentration of SO_2, NO_2, PM_{10} and TSP in related locations and the maximum contribution value of daily average concentration in typical days of technical restructuring are added. Meanwhile, the influence of the project under construction and the existing eliminated project is taken into account. The addition can be seen in Table 5.1-33.

Table 5.1-33 Addition of Daily Average Concentration (mg/m^3)

Factors	Related locations	Current value	Technical restructuring project	Project under construction	Existing eliminated project	Addition	Percentage of the standard value
SO_2	Residential district	0.070	0.0001	0.0000	0.0000	0.0701	46.7
	Niu Zhuang	0.076	0.0002	0.0020	0.0152	0.0630	42.0
	Zhou Wan	0.032	0.0000	0.0005	0.0149	0.0176	11.7
	Grain and Oil Company	0.043	0.0001	0.0024	0.0229	0.0226	15.1
	Liu Li Zhuang	0.041	0.0003	0.0000	0.0000	0.0413	27.5
	Liu Lou	0.065	0.0001	0.0009	0.0084	0.0576	38.4
	Zhuang Hu	0.018	0.0001	0.0010	0.0063	0.0128	8.5
NO_2	Residential district	0.072	0.0000	0.0000	0.0001	0.0719	59.9
	Niu Zhuang	0.040	0.0001	0.0004	0.0051	0.0354	29.5
	Zhou Wan	0.030	0.0000	0.0001	0.0055	0.0246	20.5
	Grain and Oil Company	0.053	0.0000	0.0004	0.0082	0.0452	37.7
	Liu Li Zhuang	0.042	0.0001	0.0000	0.0000	0.0421	35.1
	Liu Lou	0.058	0.0000	0.0002	0.0034	0.0548	45.7
	Zhuang Hu	0.034	0.0000	0.0002	0.0023	0.0319	26.6
PM_{10}	Residential district	0.501	0.0125	0.0000	0.0000	0.5135	342.3
	Niu Zhuang	0.199	0.1134	0.0005	0.0009	0.3120	208.0

	Zhou Wan	0.229	0.0000	0.0001	0.0080	0.2211	147.4
	Grain and Oil Company	0.232	0.0062	0.0006	0.0076	0.2312	154.1
	Liu Li Zhuang	0.428	0.0172	0.0000	0.0000	0.4452	296.8
	Liu Lou	0.113	0.0027	0.0002	0.0065	0.1094	72.9
	Zhuang Hu	0.284	0.0071	0.0002	0.0025	0.2888	192.5
TSP	Residential district	1.10	0.0287	0.0000	0.0000	1.1287	376.2
	Niu Zhuang	0.351	0.2049	0.0006	0.0042	0.5523	184.1
	Zhou Wan	0.343	0.0000	0.0001	0.0044	0.3387	112.9
	Grain and Oil Company	0.581	0.0138	0.0007	0.0065	0.5890	196.3
	Liu Li Zhuang	1.05	0.0390	0.0000	0.0000	1.0890	363.0
	Liu Lou	0.364	0.0061	0.0003	0.0026	0.3678	122.6
	Zhuang Hu	0.454	0.0158	0.0003	0.0019	0.4682	156.1

Note: addition = current value + contribution value of technical restructuring project + contribution value of project under construction – contribution value of existing eliminated project.

The above table shows that the addition of the daily average concentration of SO_2 in related locations accounts for 8.5~46.7% of the standard value with the maximum value in the residential district, all within the limits. The addition of the daily average concentration of NO_2 in related locations accounts for 20.5~59.9% of the standard value with the maximum value in the residential district, all within the limits. The addition of the daily average concentration of PM10 and TSP accounts for 72.9~342.3% and 112.9~376.2% of the standard value respectively with the maximum values both in the residential district and the over-limits are caused by the over-limits of the current values.

5.1.8.9 Prediction of annual average concentration of technical restructuring project

The predicted results of the annual average concentration of each factor in the technical restructuring project can be seen in Diagram 5.1-20~5-23 and Table 5.1-34~5-35.

Table 5.1-34 Maximum Annual Average Concentration (mg/m^3) in Technical Restructuring and Grid Locations

Factors	SO_2	NO_2	PM_{10}	TSP
Concentration	0.0001	0.00003	0.0784	0.1624
Percentage of the standard value	0.2	0.03	78.4	81.2
Grid locations	21,14	21,14	20,15 (in the factory)	20,15 (in the factory)
Direction and distance (m)	SE,354	SE,354	S,30	S,30

Table 5.1-35 Annual Average Concentration (mg/m^3) in Related Locations in Technical Restructuring

Factors	SO_2		NO_2		PM_{10}		TSP	
Related locations	Contribution	Percentage of the standard value	Contribution	Percentage of the standard value	Contribution	Percentage of the standard value	Contribution	Percentage of the standard value
Residential district	0.0000	0.0	0.00001	0.01	0.0019	1.9	0.0041	2.0
Niu Zhuang	0.0001	0.2	0.00002	0.03	0.0503	50.3	0.1151	57.5
Zhou Wan	0.0000	0.0	0.00001	0.01	0.0042	4.2	0.0094	4.7
Grain and Oil Company	0.0000	0.0	0.00000	0.00	0.0007	0.7	0.0016	0.8
Liu Li Zhuang	0.0000	0.0	0.00001	0.01	0.0028	2.8	0.0063	3.1
Liu Lou	0.0000	0.0	0.00000	0.01	0.0017	1.7	0.0038	1.9
Zhuang Hu	0.0000	0.0	0.00001	0.01	0.0025	2.5	0.0057	2.8
Regional high school	0.0000	0.0	0.00000	0.00	0.0003	0.3	0.0007	0.3
Old streets	0.0000	0.0	0.00000	0.00	0.0006	0.6	0.0012	0.6

The diagram and table show that the maximum annual average concentration of SO_2 and NO_2 in the technical restructuring accounts for 0.2% and 0.03% of the standard value respectively, both within the limits and taking place about 354m to the SE of the factory site. The maximum annual average concentration of PM_{10} and TSP accounts for 78.4% and 81.2% of the standard value respectively, both within the limits and taking place within the factory. The maximum annual average concentration of SO_2 and NO_2 in related locations accounts for 0.2% and 0.03% of the standard value respectively, with Niu Zhuang most seriously influenced. The maximum annual average concentration of PM_{10} and TSP accounts for 50.3% and 57.7%, both within the limits and with Niu Zhuang most seriously influenced.

5.1.8.11 Changes in annual average concentration

By taking into account the influence of the project under construction and the existing eliminated project on the technical restructuring project, the changes in annual average concentration can be seen in Diagram 5.1-24~5-27 and Table 5.1-36.

Table 5.1-36 Changes in Annual Average Concentration (mg/m^3) in Related Locations

Factors	Related locations	Technical restructuring project	Project under construction	Existing eliminated project	Changes
SO_2	Residential district	0.0000	0.0001	0.0088	-0.0087
	Niu Zhuang	0.0001	0.0006	0.0072	-0.0065

	Zhou Wan	0.0000	0.0002	0.0041	-0.0039
	Grain and Oil Company	0.0000	0.0002	0.0040	-0.0038
	Liu Li Zhuang	0.0000	0.0004	0.0081	-0.0077
	Liu Lou	0.0000	0.0002	0.0027	-0.0025
	Zhuang Hu	0.0000	0.0003	0.0033	-0.0030
	Regional high school	0.0000	0.0002	0.0028	-0.0026
	Old streets	0.0000	0.0003	0.0028	-0.0025
NO_2	Residential district	0.00001	0.0000	0.0026	-0.00259
	Niu Zhuang	0.00002	0.0001	0.0024	-0.00228
	Zhou Wan	0.00001	0.0000	0.0015	-0.00149
	Grain and Oil Company	0.00000	0.0000	0.0013	-0.00130
	Liu Li Zhuang	0.00001	0.0001	0.0026	-0.00249
	Liu Lou	0.00000	0.0000	0.0010	-0.00100
	Zhuang Hu	0.00001	0.0001	0.0012	-0.00109
	Regional high school	0.00000	0.0000	0.0010	-0.00100
	Old streets	0.00000	0.0000	0.0010	-0.00100
PM_{10}	Residential district	0.0019	0.0000	0.0096	-0.0077
	Niu Zhuang	0.0503	0.0001	0.0013	0.0491
	Zhou Wan	0.0042	0.0000	0.0013	0.0029
	Grain and Oil Company	0.0007	0.0001	0.0012	-0.0004
	Liu Li Zhuang	0.0028	0.0001	0.0025	0.0004
	Liu Lou	0.0017	0.0001	0.0006	0.0012
	Zhuang Hu	0.0025	0.0001	0.0006	0.0020
	Regional high school	0.0003	0.0001	0.0006	-0.0002
	ld streets	0.0006	0.0001	0.0006	0.0001
TSP	Residential district	0.0041	0.0000	0.0239	-0.0198
	Niu Zhuang	0.1151	0.0002	0.0033	0.1120
	Zhou Wan	0.0094	0.0001	0.0032	0.0063
	Grain and Oil Company	0.0016	0.0001	0.0029	-0.0012
	Liu Li Zhuang	0.0063	0.0001	0.0063	0.0001
	Liu Lou	0.0038	0.0001	0.0014	0.0025
	Zhuang Hu	0.0057	0.0001	0.0015	0.0043
	Regional high school	0.0007	0.0001	0.0016	-0.0008
	Old streets	0.0012	0.0001	0.0015	-0.0002

From the diagram and table, we can see that the alternative reduction of the annual average concentration of SO_2 and NO_2 in related locations has some positive effect on the environment and PM10 and TSP have increased in Liu Zhuang, Zhou Wan, Liu Lou and Zhuang Hu. Generally speaking, the environmental air quality has improved.

5.1.9 Health Protection Distance of the Factory

According to the regulations of GB13201-91, the health protection distance is calculated in the following formula:

$$\frac{Q_c}{Q_m} = \frac{1}{A}(BL^C + 0.25r^2)^{0.5} L^D$$

L : health protection distance, m;

r : equivalent radius of unorganized emission sources, m;

A、B、C、D : coefficients in the calculation of health protection distance;

Q_c : emission of unorganized emission sources, kg/h;

Q_m : concentration standard, mg/m^3.

According to the formula, the health protection distance of CH_3OH under construction should be 50m. In other words, the shortest distance between the residential district and the boundary of the methanol tank field should be 50m. The health protection distance of NH_3 in the technical restructuring should be 617m. In other words, the shortest distance between the residential district and the ammonia synthesis and gas making device should be 617m. The health protection distance of NH_3 in the current project should be 1034m. In other words, the shortest distance between the residential district and the carbamide device should be 1034m. According to the requirements of GB13201-91, the health protection distance of methanol under construction should be 100m, the health protection distance in the technical restructuring project should be 700m and the health protection distance in the current project should be 1200m.

According to the requirements of Standards of Health Protection Distance in Small-scale Nitrogenous Fertilizer Plants (GB11659-89), the wind speed in the region in five years reaches 2~4m/s and the ten thousand ton rate of synthesized ammonia in the technical restructuring project is larger than 2.5, so the health protection distance in the technical restructuring project should be 1000m.

5.1.10 Conclusion

In the case of wind, the maximum ground one-hour average concentration of SO_2, NO_2, H_2S and NH_3 in related locations accounts for 0.5%, 0.3%, 0.8% and 92.5% of the standard value respectively, all within the limits. Under different weather conditions, the maximum landing concentration of SO_2 and NO_2 after the completion of technical restructuring accounts for 0.5% and 0.3% of the standard values respectively, both taking place 400m away from the torch. The maximum landing concentration of H_2S is 0.9% of the standard value, occurring 530m away from the torch. The maximum landing concentration of NH_3 is 83% of the standard value, occurring within the factory. When fuming pollution occurs to the technical restructuring project, the maximum ground concentration of SO_2, NO_2 and H_2S in related locations accounts for 0.7%, 0.4% and 1.2% of the standard value, with Niu Zhuang most seriously influenced as it is near to the factory site.

The maximum ground concentration in the boundaries caused by the unorganized emission sources in the CH_3OH project under construction accounts for 4.7% of the standard value, with the northwestern boundary most seriously influenced. The maximum ground concentration in the boundaries caused by the unorganized emission sources of TSP accounts for 112.6%, exceeding the limit and most seriously affecting the eastern boundary. After the removal of gas making device in the old factory, the unorganized emission of NH_3 has reduced with the maximum accounting for 24.3% of the standard value in the boundaries of the old factory and 6% in the boundaries of the new factory.

After the accidental emission of the technical restructuring project, the maximum ground concentration of SO2 in related locations accounts for 45.7% of the standard value and the maximum ground concentration of TSP accounts for 49.6%, both within the limits.

The maximum daily average concentration of SO_2 and NO_2 in typical days in the technical restructuring project accounts for 0.4% and 0.1% of the standard value, both occurring about 791m to the NW of the factory site. The maximum daily average concentration of PM_{10} and TSP exceeds 0.95 times and 0.51 times of the standard value respectively, both occurring within the factory. That maximum does not exceed the limits outside the factory. The maximum daily average concentration of SO_2 and NO_2 in related locations accounts for 0.2% and 0.1% of the standard value respectively, with Liu Li Zhuang most seriously influenced. The maximum daily average concentration of PM_{10} and TSP in related locations accounts for 75.6% and 68.3% of the standard value respectively, with Niu Zhuang most seriously influenced.

Changes in the daily average concentration of SO_2 and NO_2 in typical days in related locations vary from the positive to the negative, but generally the changes feature in positive changes. And Changes in the daily average concentration of PM_{10} and TSP also range from the positive to the negative. Generally speaking, the environmental air quality has improved.

The maximum addition of the daily average concentration of SO_2 and NO_2 in related locations accounts for 46.7% and 59.9% of the standard value, all within the limits. The addition of the daily average concentration of PM_{10} and TSP in related locations accounts for 72.9~342.3% and 112.9~376.2% of the standard value respectively with the maximum values both in the residential district and the over-limits are caused by the over-limits of the current values.

The maximum annual average concentration of SO_2 and NO_2 in the technical restructuring accounts for 0.2% and 0.03% of the standard value respectively, both within the limits and taking place about 354m to the SE of the factory site. The maximum annual average concentration of PM_{10} and TSP accounts for 78.4% and 81.2% of the standard value respectively, both within the limits and taking place within the factory. The maximum annual average concentration of SO_2 and NO_2 in related locations accounts for 0.2% and 0.03% of the standard value respectively, with Niu Zhuang most seriously influenced. The maximum annual average concentration of PM10 and TSP accounts for 50.3% and 57.7%, both within the limits and with Niu Zhuang most seriously influenced.

Changes in the annual average concentration of SO_2 and NO_2 in related locations are negative, showing obvious positive environmental effect. The changes in the daily average concentration of PM_{10} and TSP vary from the positive to the negative.

Generally speaking, the environmental air quality has improved.

Taking the unorganized emission area as the origin, the health protection distance of the CH_3OH project under construction is 100m, the health protection distance of the ammonia factory in the technical restructuring is 1000m and the health protection distance of the present ammonia factory is 1200m.

It is recommended to change the open piling of coal into semi-closed piling to reduce the unorganized emission of TSP.

In all, the place can accommodate no more TSP and PM_{10}. Generally speaking, the construction of the project has a positive effect on the environmental benefits of SO_2 and NO_2 in the region. After the removal of the present gas making and ammonia synthesis device, the pollution of ammonia in the current project has lessened, having relatively good environmental benefits for the surrounding residents and alleviating the pressure of environmental risks. From the perspective of the atmospheric environment, the construction of the new factory is acceptable.

5.2 Analysis of Influence of General Discharging on Water Environment

5.2.1 Analysis of influence of general discharging on surface water

The waste water pollutant sources in the current project of Junma Group mainly include discharging from the sewage treatment station, discharging from the circulating water system, acid and alkaline waste water and demineralized water. But as the sewage treatment station has no biochemical and denitrogenation device and the carbamide deep hydrolysis device has to adopt the low pressure steam for the high pressure steam of the current production system has high loads, the water quality is affected and does not meet the requirements of recycling and the discharging water has be sent to the sewage treatment station. So it has a major influence on the sewage treatment and circulating water quality, leading to the overload of COD, ammonia nitrogen and cyanide in the discharged water. After the implementation of the project, the present project is to be transformed and the present gas making sewage is cancelled. At the same time, the present sewage treatment facilities are to be transformed and the biochemical and denitrogenation device is increased so that the discharged waste water complies with the discharging standard. The deep hydrolysis device may adopt high pressure steam. The water quality may meet the needs of design. The discharged water may be used to supply the boiler. The main pollutants in the discharged water in the whole factory will decrease much more than before.

The discharged waste water in the current project of Junma Group flows into the sewage ditch outside the factory through the total discharging outlet and then joins Huangyou River after running through 4km from the west to the east. Huangyou River is a small branch in the upper range of Suya Lake. The water quality in Huangyou River falls into IV category. The River originates from the eastern part of Zhumadian and joins Huangni River after running through 15km, ultimately merging into Suya Lake reservoir. The water quality of Suya Lake falls into III category.

According to the result of monitoring the status quo, before the sewage ditch flows into Huangyou River, the cross section features in the waste water generated in the chemical production of Junma Group. In the monitored project, ammonia nitrogen, COD, volatile phenol and cyanide all exceed the limits to a varying degree. Ammonia nitrogen seriously exceeds the limit. At the same time, the water quality in Huangyou River can no longer meet the requirements in the IV standards in Surface Water Quality Standard GB3838-2002. After the sewage ditch flows into Huangyou River, COD and ammonia nitrogen in the monitored project cause serious pollution. The contribution of the discharged water from Junma Group to the pollution of Huangyou River can not be neglected.

According to experts, it is recommended that after the completion of technical restructuring project, the waste water that is treated to comply with standards will no longer be discharged into the surface water body but directly discharged into the Zhumadian sewage treatment station about 3km to the factory, thus eliminating the pollution of the discharged water from the factory to Huangyou River and Suya Lake reservoir. Therefore, the technical restructuring will have an obvious positive effect on the improvement of surface water quality.

5.2.2 Analysis of influence of general discharging on groundwater

According to the result of monitoring the status quo of the shallow groundwater along the bank of the sewage ditch outside the factory, the discharged water of the present project of Junma Group has caused pollution to the shallow groundwater. Nitrate nitrogen seriously exceeds the limit with the rate of 100%.

After the completion of technical restructuring, the discharged waste water of the factory will be directly discharged into the urban sewage treatment station through sewage pipeline net. The sewage ditch outside the factory will no longer accommodate the discharged waste water from Junma Group. After hardening, the ditch will become the storage pool for fire fighting when risky accidents occur to Junma Group. The quality of the shallow groundwater along the bank of the sewage ditch outside the factory will improve obviously.

5.3 Prediction and evaluation of the influence on sound environment

Although the project relocates its venue, the projected site is still within the industrial area of Zhumadian. Its sound environment function is the third category and there is no residential district in the surrounding 200m of the factory site. Outside the western boundary of the projected factory site is Yicheng Avenue while outside the rest boundaries are all agricultural fields. According to related regulations of Technical Guidelines on Evaluation of Environmental Influence (sound environment) (HJ/T2.4～1995), the sound environment rating of the project is defined as the third category. As there is no residential district in the surrounding 200m of the projected factory site, the influence on the boundaries after the operation of the technical restructuring will be predicted and the current value of the sound environment in the factory region will be added. The influence of the synthesized sound level on the boundaries will be analyzed and the rationality of the plane layout of the factory region will be evaluated. At the same time, it is to briefly analyze the improvement of the sound environment in the present factory site helped by the elimination of part of the existing device after the completion of the technical restructuring.

5.3.1 Prediction and evaluation of the influence on sound environment in the factory

5.3.1.1 Strength of main strong noise sources and their distribution

The main strong noise sources of the project include coal pulverizers, crushers, various blowers, compressors and pumps. These strong noises all take place in the workshops and other strong noise sources include coal breakers and coal delivery trestles whose noise levels are around 90～105 dB (A). The strength of main strong noise equipment can be seen in Table 5.3-1. The preventative measures are sound insulation of the factory, basic shock absorption, sound-proof shield, rubber interlay and mufflers, which may reduce noise by about 20dB. The noise strength outside the workshops is 70~85dB. The distribution of equipment can be seen in the appendix diagram Four.

Table 5.3-1 Noise Strength of Equipment　　　Unit: dB（A）

No.	Name of workshop	Name of equipment	Number	Equipment noise	Noise value at 1m outside the workshop	Control measures
1	Compression plant	Compressor	8	90～105	70	Shock absorption, mufflers
2	Gas generation	Various pumps	8	90～100	70	Shock absorption, sound proof by buildings
3	Preparation of coal slurry	Rod mill	2	100	75	Sound proof cover, rubber underlay
4	Air separation	Device of air separation	1	115	85	Sound proof by buildings
5	Air compression station	Air compression machine	2	120	85	Sound proof cover
6	Coal breaker room	Coal breaker	1	105	80	Sound proof by buildings

5.3.1.2 Prediction mode

Attenuation formula of point sound sources:

$$L(r)=L(r_0)-20\log(r/r_0)-\Delta L;$$

Addition formula of multi-source noises:

$$L=10\lg(\sum_{i}^{n}10^{0.1L_i})$$

Wherein: L(r)—equivalent level A sound value at r from the noise source, dB (A);

$L(r_0)$ -- equivalent level A sound value at r_0 from the noise source, dB (A);

L—addition value of noise at the spot of prediction, dB(A);

Li—noise value from the I sound source to the prediction spot, dB(A);

r—the distance from the related locations to the noise source, m;

r_0—the distance from the reference point to the noise source, r_0 is 1m;

△L—various attenuation factors, including air absorption, shields and ground effects, etc.

5.3.1.3 Prediction results

According to the plane layout of the project and based on the prediction of the contribution value of the operation to the boundaries by the prediction mode and the addition of the current maximum value of the sound environment in the factory site, the comprehensive impact of the noise in the factory is calculated. The prediction results can be seen in Table 5.3-2 and the distribution of predicted noise levels can be seen in Diagram 5.3-1.

Table 5.3-2 Prediction Results of Noises Unit: dB（A）

Item	Contribution value	Current monitoring value		Synthesized sound level		Standard
		Daytime	Night	Daytime	Night	
South to the eastern boundary	36.1	53.6～55.6	48.3～50.2	53.7～55.6	48.6～50.4	GB12348-90 III category Daytime: 65dB Night: 55dB
North to the eastern boundary	33.2			53.6～55.6	48.4～50.2	
East to the southern boundary	53.2	51.9～55.3	49.8～51.2	55.6～57.4	54.8～55.3	
West to the southern boundary	42.0			52.3～55.5	50.5～51.6	
South to the western boundary	28.5	51.4～57.2	48.9～53.6	51.4～57.2	48.9～53.6	
North to the western boundary	35.1			51.5～57.2	49.1～53.6	
East to the northern boundary	37.0	58.3～58.9	53.3～54.3	58.3～58.9	53.4～54.3	
West to the northern boundary	32.1			58.3～58.9	53.3～54.3	

5.3.1.4 Evaluation of noise predictions

According to the prediction results, the contribution value of the technical restructuring to the boundaries is between 28.5 and 53.2dB (A), all within the limits.

The monitoring results of the current noise conditions fall within the limit. After the addition of the influence of the project, the synthesized sound level increases to a varying degree than the current value, but the increase is not large. The noise values at daytime and night both fall within the limit.

5.3.1.5 Analysis of rationality of the plane layout of the factory

According to the plane layout of the factory, the main production line is arranged at the center of the factory and extends along the west-east direction in two lines. In the south, there is orderly designed with methanol/methanation, methanol intermediate tank area, solution tank area, decarbonization and desulphurization, sulfur recycling and treatment of lye. In the north, processes including freezing, hydrogen recycling, synthesis, compression, exchange, gas generation and preparation of coal pulp are arranged. The main highly noisy equipment is located in the center of the factory, reducing the influence on the surroundings. The toner workshop is to the north of the change processing site. In the east of the factory, there is coal pile site, dry coal bunker and temporary slag yard. The front area and the office building of the factory are set in the west of the factory, closely adjacent to the gate of the factory, facilitating the contact with the outside world. The west, south and north of the factory are all reserved with land for further development.

The prediction of the influence of the noises indicates that after corresponding measures of noise reduction are taken on the highly noisy equipment, the noise over the boundaries can be under effective control. The noise values at the daytime and the night both fall within the limits. The plane layout of the factory is relatively reasonable.

5.3.2 Analysis of the influence of the sound environment in the present factory

After the completion of the technical restructuring, the current gas making project will be replaced and at the same time, production equipment such as the air separation, conversion, purification and synthesized compression in the present factory will be removed and rebuilt in the technical restructuring project. The main highly noisy equipment to be removed can be seen in Table 5.3-3. The distribution of the highly noisy equipment to be eliminated can be seen in the appendix diagram three.

Table 5.3-3 Strength of High Noises to Be Removed in the Present Factory

Unit: dB（A）

No.	Name of device	Name of equipment	Number	Strength
1	Gas making device	Air blaster	6	85～95
2	Synthesis device	Blower	9	92～98
		Compressor	9	84～86
		Solution pump	12	91～94
Total			36	84～98

Table 5.3-3 shows that after the operation of the technical restructuring, there are 36 pieces of main highly noisy equipment to be removed in the new factory and the strength mostly ranges between 84 and 98dB (A). The elimination of the highly noisy equipment will greatly improve the quality of the sound environment in the present

factory site.

5.4 Analysis of the influence of material transportation

5.4.1 Transportation of raw materials

5.4.1.1 Quantity and means of transportation

According to the project analysis, after the completion of the technical restructuring, the total transportation quantity of the whole factory in a year amounts to 1,142,600 tons in which the imported quantity is 566,400 tons, mainly including 563,000 tons of raw coal and fuel coal and 1,440 tons of catalysts while the exported quantity is 576,200 tons, including 80,000 tons of methanol finished products, 156,000 tons of boilers and gasified ashes and 2,000 tons of byproducts of sulfur. The transportation of commodities is mainly through the road or railway.

The factory site of the technical restructuring is to the southeast of the present factory site, adjacent to Yicheng Avenue in the west and 1km to the present factory site. The present factory site is closely adjoining Zhuxin Road, only 3km to the station of Zhumadian (national second level station) of Jingguang Railway, 1km to Jingzhu Expressway in the east and 5km to 107 State way. There are no sensitive objects along the way and the transportation is very convenient. At the same time, under the circumstance that sealed tank cars dedicated to transporting ashes are prepared and the management of car conditions is strengthened, the transportation of raw materials does not have obvious influence on the environment along the way.

5.4.2 Analysis of the influence of the methanol transportation on the environment

As methanol is a toxic and explosive chemical hazard, the evaluation will briefly analyze the influence of the transportation of methanol products on the environment and put forward corresponding countering measures.

(1) Analysis of the influence of methanol transportation on the environment

Methanol is toxic and has high flammability. The burning point is 464℃. Methanol steam can blend with the air to form explosive mixture and the limit of explosion is 6.0~36.5%. According to the rating standard of the hazardous extent of occupational contact with poisonous things, methanol is defined as III category (hazard of poisoning). The influence of the transportation of methanol products mainly lies in the pollution accidents during the process of transportation and the pollution accidents are mainly caused by the leaking and explosion of vehicles carrying chemical products. According to the occurrence of pollution accidents in the road transportation of hazardous products, the pollution caused by pollution accidents is quite serious. Based on related data, in the late November, 2003, on Kailuo Expressway, a methanol tank car that had a loading capacity of 11 tons but actually carried 50 tons exploded in the tires due to serious overload, leading to the turnover of the car and subsequent leaking of methanol to cover the whole ground surface. Fortunately, the accident was handled soon and did not cause serious pollution to the environment. However, if the accident took place in the section of the bridge or near the residential area, the 50 tons of methanol would follow the bridge surface to leak into the water or the residential locations, leading to serious environmental pollution. Therefore, it is necessary to take preventative measures in areas such as the project and management to reduce the occurrence of such accidents. At the same time, emergent countering measures should be prepared to reduce the hazard on the environment to the minimum extent.

(2) Emergent measures

Although the probability of the occurrence of methanol transportation accidents is very low, the consequences are very serious. Therefore, it is quite necessary to take effective preventative measures. It is recommended that companies should formulate specific plans for prevention and emergency countering. The main measures are as follows:

①It is recommended that the company for the operation and management should take the lead and Puyang Government and other related units such as the Public Security Bureau, the brigades and the Environmental Protection Bureau jointly participate to form an emergency countering group for transportation accidents of hazardous products. The group is responsible for the management and emergency handling of the transportation of hazardous products on all roads or railways within Puyang including the project. The group will also implement the ensuring measures in the management and accident handling of the transportation of hazardous products.

②Vehicles used for the transportation of hazardous goods should be equipped with necessary equipment and devices to counter emergencies, such as portable fire extinguisher, gas mask and first-aid kits.

③The management of vehicles and the check of vehicles should be strengthened to ensure sound conditions of vehicles on the road. According to related requirements of Management Regulations on Security of Chemical Hazardous Goods issued by the State Council, the transportation of hazardous goods needs three certificates issued by departments of public security, i.e. license of transportation, driver’s license and guard’s certificate. All vehicles used for the transportation of chemical hazardous goods should hang a triangle flag marked with black typeface of “danger” against a yellow background in the conspicuous place in the front of the vehicle. Overloads should be prohibited.

④Enterprises that are qualified to transport dangerous goods must strictly comply with related regulations on the transportation of dangerous goods. For example, they should prepare regular vehicles and drivers dedicated to the transportation of dangerous goods, drivers of those vehicles must have received specialized training, vehicles that transport dangerous goods must keep safe speed on the road, external open flame is forbidden and at the same time, there must be escorts and escorts are required to receive specialized training.

⑤During the transportation of dangerous goods, the road management departments should keep close supervision, in case that measures can be timely taken when accidents occur.

⑥In case that leaking accidents take place in the transportation of dangerous goods, parties involved or witnesses should immediately inform the emergency department via emergency phones who then contacts the local environmental protection department, brigades and some departments with the capabilities of emergency handling to take timely measures to ensure that accidents can be controlled within shortest time, reducing the hazards on the environment.

5.4.3 Analysis of the influence of synthesized gas (ammonia) and the pipeline transportation of supply water and discharging water

As the project is relocated in the technical restructuring, about 1km from the present factory site, according to the project analysis, the required fresh water of the technical restructuring project is supplied by the present factory. The synthesized gas generated in the technical restructuring project is delivered to the present factory site as raw materials. The waste water generated in the technical restructuring project is transported to the sewage treatment station in the present factory site for processing and is then discharged to the outside. The layout of pipelines used for the water supply and discharging as well as the delivery of synthesized gas all uses the burial type with a depth of 1.2m. The pipelines extend 600m northwards along Yicheng Avenue and enter the present factory site after 400m westwards, running through Yicheng Avenue and Lianjiang Road along the way.

5.4.3.1 Analysis of the influence on the environment during construction

①During the construction, attention should be given to the protection of plants. It is not allowed to casually occupy the land other than used for the construction. After the completion of the project, the temporarily occupied vegetation and farm land should be timely recovered.

②In the process of refilling pipes and trenches, attention should be given to the tightness of the soil so that after the natural precipitation of the refilled soil, low-lying zones won’t form in pipes and trenches and water logging can be avoided, ensuring the normal and safe operation of pipelines.

③After the completion of the construction of pipelines, it is a must to clean up the remaining solid objects and life waste and it is not allowed to bury them into the soil.

As the site of technical restructuring is only 1km to the present factory site and the construction is not a huge project and can be concluded in the short term, the construction of pipelines has little influence on the surroundings as long as the measures are carefully implemented.

5.4.3.2 Analysis of the influence on the environment during the operation

Pipelines for the water supply and discharging during the operation may leak and result in collapse, thus having an impact on the environment. If the collapse takes place on the road, it is very likely to cause traffic accidents. Ammonia is a toxic and harmful chemical hazard. It can blend with the air to form explosive mixture and the mixture can burn and explode in case of open flame and high heat. At the same time, ammonia also has some toxic effect on the human health. Therefore, the transportation of synthesized gas in the technical restructuring has influence on the surroundings as displayed in that the ammonia leak caused by the wearing of pipelines or other reasons may influence the surroundings and residents. Once ammonia leaks, the consequences will be very serious. In order to avoid accidents of pipelines used for the water supply and discharging as well as the gas supply during the operation, enterprises should take the following measures:

⑴The thickness of the wall of pipelines should be measured every three years. The seriously thinning pipelines should be repaired and replaced timely to avoid the breaking of pipelines.

⑵An emergent shutoff system should be set up. Emergent shutoff valves should be arranged at locations such as the entrance and exit of pipelines. Once the leak is detected, the pipeline can be directly cut off. The pipeline security protection system should be checked every half a year so that the range of hazardous effects can be reduced to the minimum extent.

⑶Signs at the cross points on the road should be clear and distinct and can be clearly seen from different directions and angles.

⑷Before the operation of the pipeline system, an operation and maintenance manual under normal, abnormal or emergent states should be laid down and staff for the operation and maintenance should be trained and do their jobs with certificates so as to avoid accidents caused by serious errors in the operation.

⑸Operators should carry out security activities every week to improve their awareness of security, recognize the abnormal state before accidents happen and take corresponding measures.

⑹Education should be strengthened to residents near the pipelines to avoid deliberate damage by the third party.

⑺There should be perfect check and maintenance methods. Regular maintenance should be conducted according to plans. Specialized archives (including archives of maintenance records) should be compiled to keep complete documents.

5.5 Analysis of the influence on the environment during the construction

The project is located in the east of the city, 15km to the urban center in the west. Main sensitive objects in the surroundings include Zhou Wan, about 400m to the construction site and Liu Li Zhuang, about 800m to the construction site. Zhou Wan has around 2000 residents and Liu Li Zhuang has 3000 residents. As the construction is not carried out in the old factory but in the new land, the analysis of the influence on the environment during the construction will briefly discuss the dust, waste water and noise, deal with the damage that the construction has done to the vegetation and the maintenance of water and soil, and lay stress on effective measures to reduce and prevent the impact of dust, waste water and noise on the surroundings as well as the loss of water and soil.

5.5.1 Analysis of the influence of water and soil loss during the construction as well as countering measures

5.5.1.1 Analysis of the influence of water and soil loss during the construction

Zhumadian where the project is constructed is located in the aggraded flood plain zone in front of Funiu Mountain. The current water and soil loss is relatively slight. The projected factory site is an agricultural field, the topography is flat and the fluctuation difference of the terrain is very small (relative height difference is around

1m). According to the characteristics of the project, main factors that may cause water and soil loss during the construction are the excavation of venues in the factory site and affiliated facilities, the filing and excavation of pipelines for water supply and discharging outside the factory, the repair of gas transmission pipelines and the roads into the factory. The excavation, disruption or reshape of the ground surface as well as the soil abandoning during the construction and the piling of abandoned stones destroy the surface vegetation to the extent that it loses the ability of fastening the soil and preventing the erosion, leading to the loss of water and soil.

5.5.1.2 Strategies of maintaining water and soil during the construction

①The main project design should be further optimized, the requirements of standard construction should be put forward and the excavation of earth and stone should be reduced to avoid or reduce the damage of the ecological environment and protect the safe operation of the main project.

②During the construction, the balance between excavation and filling should be kept as much as possible. The excavation, refilling, roller compaction and slope protection should be carried out at the same time.

③The temporarily abandoned dust during the construction should be piled in proper venues and necessary blocking measures should be taken. The permanent abandoned dust should be covered in the land and recovery measures should be taken.

④Construction schedules should be reasonably arranged to avoid rainy and flood seasons. At the same time, a perfect water discharging system in the factory should be built to discharge the rain and water in the factory.

⑤During the construction or in the later phase of the construction, greening measures should be taken in the factory. The front and back of the main factory houses as well as the two sides of the roads should be used to plant evergreen trees or bushes. All roads in the factory should be solidified by cement to reduce naked ground as much as possible.

5.5.2 Construction noises

The noises are mainly generated by various construction machines during the construction. The construction machines mainly include various light and heavy transportation vehicles, bulldozers in the earth and stone excavation, grabs, shovel loaders, various pile drivers during the period of piling as well as various concrete mixers, welding machines, electric motor saws, various tower hangers, portal cranes and motorcade used in the structural repairing phase. The noise values of these construction machines mostly range between 80~95 dB. The noise value of the pile driver is about 100 dB, belonging to high noise. But the pile driver is only used within short time when dealing with the ground base. In order to lessen the influence of the construction noises on the surroundings, the evaluation recommends taking the following measures during the construction:

⑴Under the premise that the normal construction is not affected, it is preferable to choose low noisy machines and equipment to reduce the noise.

⑵The working schedules should be optimized. It should be avoid as much as possible to work at noon or during the night. The operation of highly noisy machines such as pile drivers and boiler gas discharging should be arranged in the daytime. The piling should be concentrated and finished within short time to reduce the duration of noisy period. According to regulations of GB12523—90, pile drivers should be prohibited to work during the night.

As the factory to be constructed is located in the industrial zone and the neighboring villages are all more than 400m away, and the construction noise is temporary, the construction noise during the construction will not pose danger on the surroundings.

5.5.3 Influence of dust on the surroundings

The dust is mainly the naked soil after the damage of the vegetation in the construction site when the earth and stone is excavated and the second dust formed by the open earth stone and building materials. In addition, the transportation vehicles also generate dust. As the climate in the north is dry and windy, it is very likely to generate the second dust in the construction site, aggravating more the pollution to the surroundings. The evaluation recommends taking the following the measures to reduce the pollution of dust:

⑴It is desired to choose experienced and qualified construction units to conduct standard construction. The excavation of earth and stone and the piling should be regulated and constant to reduce the dust to the minimum extent.

⑵During the construction, the piling venue of earth and stone should be properly chosen and it is favorable to choose the downwind direction of the residential district. The concrete mixer should be put in the shed and the cement and sand splashed during the mixing should be regularly cleaned up to avoid dust. During the construction the abandoned soil should be timely transported and the building materials in the site that are easily covered by dust should be shielded with cloth and open stacking should be reduced. Watering should be carried out regularly in the construction site.

⑶Vehicles that transport earth and stone should be covered with canvas and slow down when passing by sensitive objects.

During the construction, construction units should take the above measures and strengthen the management. Then the influence of the dust on the environment can be controlled and the impact on the environment will also be lessened.

5.5.4 Influence of sewage and waste water on the environment

The sewage and waste water generally comes from the life sewage and cleaning water of the equipment during the construction period.

The life sewage of the construction staff can be calculated as 40~60L/d per person. It is estimated that there are 150 people living in the construction site and the daily sewage amount is 6～9m3. The amount is not large and after the simple treatment in the septic tank, it can be used to irrigate the surrounding farm land or enter the municipal sewage pipeline net, having no pollution to the ground surface water.

Main pollutants in the rinsing waste water are SS and petroleum. The amount of pollutants and the status of the water quality are at random and the changes are obvious. According to comparison survey, at most construction sites, such a part of waste water is casually discharged. As a result, it is recommended that a temporary precipitation place should be set up in the site to collect various rinsing waste water generated in the construction. After precipitation treatment, it can be recycled, the water is saved and the pollution to the surface water can be lessened.

6. Analysis of Technical and Economic Feasibility of Environmental Protection Measures

6.1 Brief introduction of environmental protection measures in the current project

6.1.1 Analysis of waste water treatment measures

Sewage generated in the current project mainly includes gas making sewage, sewage containing ammonia, boiler dedusting water, sewage containing oil and life sewage, etc. Various sewage treatment measures in the current project can be seen in Table 6.1-1.

Table 6.1-1 List of Sewage Treatment Measures in the Current Project

Category of sewage	Treatment measures	Discharging trace
Gas making sewage	Gas making sewage treatment station (precipitation, filtering, purification)	Recycled by gas making washer, discharged to the outside in small amount, cancelled after the technical restructuring
Boiler dedusting water		Dedusting in boiler
Carbamide sewage	Heating by steam, resolving by air, deep hydrolysis	Sewage ditch outside the factory

Sewage containing oil	Oil separation tank, collecting suspending oil	Sewage ditch outside the factory
Acid and alkaline sewage	Neutralization pond	Sewage ditch outside the factory
Life sewage	Septic tank	Urban sewage pipeline net

In order to know the treatment effect of the current sewage treatment facilities, the main waste water pollution sources are evaluated and the quality of the discharged water of the total sewage outlet is monitored. The monitoring results can be seen in Table 6.1-2.

Table 6.1-2 List of Current Waste Water Discharging

Item		pH	COD	Ammonia-nitrogen	BOD_5	SS	CN^-	Petroleum	S^{2-}	Salt amount	Volatile phenol
Gas making sewage	Entrance	8.6	1077	663		440	10.2	1.09	0.021		0.586
	Outlet	8.8	942	674		96	3.0	1.19	0.018		0.231
Sewage containing oil	Entrance		1022					970			
	Outlet		1085					589			
Cycling water system	Carbamide	7.5	24.2	0.23		15		0.21	0.015	1707	
	Synthesized ammonia	7.1	23.3	13.3		22		1.64	0.017	1047	
	Desulphurization	8.8	804.2	956		162		8.8	0.060	895	
Life sewage	Water quality	7.1	334	0.35	134	36		0.82			
	Standard	6~9	150	25	30	200		10			
	Qualification status	Qualified	Unqualified	Qualified	Unqualified	Qualified		Qualified			
Total sewage outlet in the factory	Water quality	6.8	200	160		180	0.5	1.5			0.09
	Standard	6~9	150	100		100	1.0	10			0.2
	Qualification status	Qualified	Unqualified	Unqualified		Unqualified	Qualified	Qualified			Qualified

Table 6.1-2 shows that the life sewage discharged to the outside and production waste water in the current project are both unqualified. The current sewage treatment facilities can not meet the requirements of the qualified discharging.

6.1.1.1 Treatment device of gas making sewage

The current treatment scale of the gas making cycling water device reaches 3000t/h and the investment amounts to 5 million yuan. It was put into operation in January 2004, mainly dealing with gas making washer, desulfurized cooling discharged water and boiler dedusting water. The treated sewage flows into the precipitation pool. After 13 times of precipitation, a majority of dust and coal ashes can precipitate. The clean water flows into the hot pool and is raised to the cooling tower through a hot pump to get cooled down. The cooled water is sent back to the gas making washer and the boiler dedusting system via the pump to be recycled. The dust and coal ashes discharged from the precipitation pool enter the drying pool and the dried ashes are sold to building materials factories.

6.1.1.2 Waste water containing ammonia

The dilute ammonia water (about 30℃ and ammonia accounting for about 2%) recycled through synthesized ammonia, store tank gas and copper washed refined gas flows into the storage tank of ammonia water after measurement. Then it is sent to the heat interchanger via ammonia water pump for temperature rising to 60~70℃ and enters the ammonia steaming tower. The ammonia water is evenly distributed in the stainless steel fillings of the stripping section after running through the multi-pore pipeline liquid distributor. It is then divided into liquid and gas after heated by the steam rising from the lower part of the tower. The gas is the ammonia and water steam while the liquid is left with the fillings along the stripping section. The liquid enters the re-boiling machine in the base of the tower and is heated to 125℃ and becomes steam. The steam rises along the gas section and the ammonia in the liquid is steamed out. The ammonia and water steam rise to the rectifying section. After treated in the rectifying section, the thick ammonia at about 102℃ partly condenses in the condenser and the ammonia temperature at the outlet of the condenser is controlled at 90℃. Then thick ammonia with the concentration of about 20% can be obtained. The thick ammonia enters the condenser and is cooled down to 40℃ and becomes thick ammonia water. The condensed liquid flowing out of the condenser runs into the top of the ammonia tower as back flow via the liquid sealing pipeline.

The waste water discharged from the base of the ammonia steaming tower contains about 50PPM of ammonia. After exchanging heat with the waste water containing ammonia in the heat interchanger, it is cooled down to about 40℃ via the cooler and delivered to the synthesized ammonia system for ammonia absorption.

The thick ammonia water obtained in the condenser and cooler flows into the thick ammonia water tank and is delivered to the carbonization section after measurement via the thick ammonia water pump.

6.1.1.3 Waste water containing carbamide

The waste water containing carbamide from the carbamide workshop first enters the carbamide waste water storage tank and then exchanges heat with the hydrolyzed hot waste liquid flowing out of the base after being pressed by the material pump in the hydrolysis tower. The temperature rises to about 130℃ and enters the upper section in the hydrolysis tower. In the upper section of the hydrolysis tower, after the carbamide waste water is heated by the gas in the base and the hydrolyzed gas, a large part of NH_3 and CO_2 contained in the waste water is hydrolyzed. After the hydrolyzed gas is condensed partly via the condenser, the remaining gas goes to the main factory houses for recycling.

The waste liquid hydrolyzed in the upper section of the hydrolysis tower exchanges heat with the hydrolyzed liquid flowing out of the hydrolysis tower in the heat interchanger after running through the material pump in the hydrolysis tower. When the temperature rises to about 190℃, it enters the hydrolysis tower and is fully hydrolyzed in the tower after exchanging heat in the base. After complete hydrolysis, it goes out of the tower and exchanges heat with the imported materials. It is further hydrolyzed in the lower section of the hydrolysis tower after the pressure is reduced. The high temperature waste liquid after the hydrolysis is discharged from the base of the tower and exchanges heat with the imported cool materials in the heat interchanger and is then delivered to the boiler room for recycling.

According to the monitoring result of the pollution sources, the inadequate supply of high pressure steam in the current project results in the fact that the discharged water from the hydrolysis tower can’t meet the requirement of the design and can’t be delivered to the boiler room for recycling. The water is sent to the sewage treatment station and partly discharged to the outside, aggravating the pollution to the ground surface water.

6.1.2 Waste gas

The waste gas and the actual treatment measures can be seen in Table 6.1-3.

Table 6.1-3 List of Waste Gas and Treatment Measures

<table>
<tr><th>Name of device</th><th colspan="2">Category of waste gas</th><th>Treatment measures</th></tr>
<tr><td rowspan="2">Gas generation device</td><td colspan="2">Gas blast</td><td>Recycling device of remaining heat</td></tr>
<tr><td colspan="2">Recycled smog</td><td>Dedusting by granite water film, discharged through 27m exhaust funnel</td></tr>
<tr><td rowspan="4">Device of synthesized ammonia</td><td colspan="2">Copper washed and regenerated gas</td><td>Delivered to the gas blast recycling system as fuels after cleaned and de-ammonized, cancelled after the technical restructuring</td></tr>
<tr><td colspan="2">Deflation in synthesis pool</td><td rowspan="2">Delivered to the gas blast recycling system as fuels after ammonia is recycled</td></tr>
<tr><td colspan="2">Deflation in ammonia storage tank</td></tr>
<tr><td colspan="2">Desulfurized acid gas</td><td>Recycling of sulfur after desulphurization</td></tr>
<tr><td rowspan="2">Carbamide device</td><td colspan="2">Emission of carbamide technique</td><td>Direct emission</td></tr>
<tr><td colspan="2">Granulation emission</td><td>Direct emission</td></tr>
<tr><td>Public project</td><td>Boiler smog</td><td>35t/h circulating fluid bed boiler</td><td>Electric dedusting, discharged from 100m funnel</td></tr>
</table>

		20t/h chain stove and 10t/h boiling stove	Dedusting by granite water film, discharged through 45m funnel
		20t/h boiling stove	Dedusting by granite water film, discharged through 48m funnel

6.1.2.1 Sulfur recycling device

The sulfur recycling device is mainly used to recycle the sulfur in the process of producing synthesized ammonia. The flow is briefly as follows:

In the production of synthesized ammonia in the sulfur recycling device, the raw material gas adopts the mimosa extract desulphurization. The desulfurized liquid that is removed of sulphide is delivered to the oxidation tower to be regenerated. The regenerated desulfurized liquid returns to the desulfurized tower for recycling. The separated sulfur bubble liquid is delivered to the sulfur bubble tank and is mixed with compressed air. Then it is filtered through a vacuum filter. The filtered biscuit is sent to the molten sulfur kettle to be heated by steam until melted down. The melted sulfur flowing out of the molten sulfur kettle cools down and sulfur can be obtained. The filtered liquid of the filter is collected by the filtered liquid tank and delivered to the desulfurized liquid system via the filtered liquid pump.

After the technical restructuring, the Crouse sulfur recycling device will be built and this sulfur recycling device will be removed.

6.1.2.2 Gas blast

There are now 16 gas making stoves (15 activated and one as backup) with the gas blast of about 75000Nm3/h. There is one set of gas blast recycling boiler of remaining heat with the evaporation capacity of 35t/h. The gas blast generated in the current project is delivered to the boiler of remaining heat to burn for the second time and the remaining heat is recycled. At the same time, the remaining pollutants in the gas blast such as CO and H_2S are converted into SO_2 and CO_2. Smog flowing out of the recycling boiler of remaining heat is dedusted by the granite water film and discharged through a 27m exhaust funnel. The dedusting rate reaches about 93%. The concentration of the smog and SO_2 in the dedusted gas is 62.6mg/Nm^3 and 838 mg/Nm^3 respectively, meeting the requirements in GB9078-1996 Discharging Standards of Atmospheric Pollutants in Industrial Stoves (300mg/Nm3).

After the completion of technical restructuring, the Texaco gas generation device will replace the present interval gasification furnace with fixed layers, eliminating this pollution source.

6.1.2.3 Recycling of ammonia

The ammonia recycling device is mainly used to recycle the ammonia in the slack deflation of ammonia synthesis and ammonia storage tank. The concrete flow is briefly as follows (see Diagram 6.1-1):

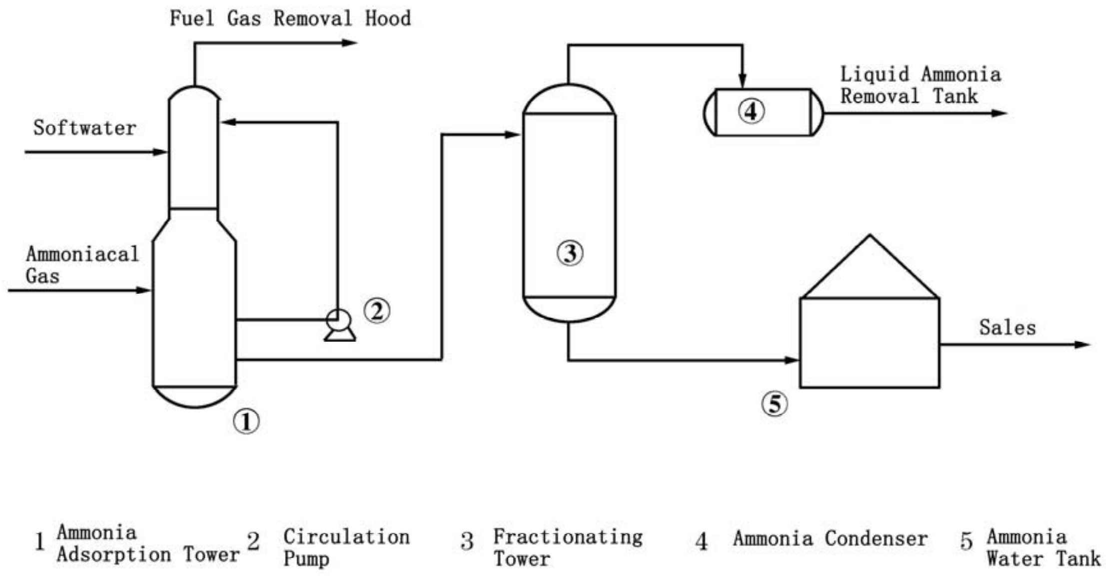


Diagram 6.1-1 Flow of Ammonia Recycling Device

After the mixture of the slack deflation of ammonia synthesis and ammonia storage tank, the dilute ammonia water or soft water that flows through the lower part of the ammonia absorption tower from the top of the tower meets each other in reverse directions. After the absorption of ammonia, the gas runs out of the top of the tower and enters the gas-water separation device. After the water is separated, it is sent to the fuel gas cabinet for storage. The absorption liquid will be sent to the rectification tower after absorbing to some concentration. The gas ammonia after rectification is sent to the liquid ammonia tank area after condensation.

The current practices prove that the technology of recycling ammonia through the slack deflation of ammonia synthesis and ammonia storage tank is mature and reliable. The ammonia recycling rate is high and the flammable gas can be used as fuels so that the comprehensive use of waste can be realized. The evaluation shows that the device is feasible.

6.1.2.4 Dedusting of smog in the boiler

The treatment effects of the smog in the boiler can be seen in Table 3.2-18.

The table shows that the smog in the boiler can be qualified to be discharged after treatment. After the completion of the compound fertilizer project, the current one 10t/h boiling stove, one 20t/h chain stove and one 20t/h boiling stove will be replaced.

6.1.3 Noises

The monitoring result of the noise in the boundaries shows that the noise values in the daytime and during the night both exceed the limit. The highly noisy equipment in the present project has had some influence on the surroundings.

6.1.4 Solid waste

The solid waste generated in the present project includes gas making ashes, boiler dust, waste catalyst, dirt containing cyanogen and a small amount of copper sludge, etc. Gas making ashes and boiler dust belong to general solid waste. The total comprehensive use will leave no storage in the factory. Waste catalyst, dirt containing cyanogen and copper sludge belong to dangerous solid waste and should be safely disposed. In the present project, the waste catalyst is sent back to the manufacturer for recycling. The dirt containing cyanogen and copper sludge can be sold.

6.1.5 Environmental protection issues in the present project and the treatment strategy of combining the new with the old

(1)Environmental protection issues in the present project

According to the project analysis and the monitoring result of the present pollution sources, main environmental protection issues in the present project include the over-limits of discharged production waste water and life sewage, the over-limit of the noises in the boundaries, the failure to safely dispose dangerous solid waste, the failure to implement whole closing as the current coal site closely adjoins the residential district, the serious pollution of the second dust to the surroundings, the failure to meet requirements of the health protection distance and the many potential risks as there are many sensitive objects within the health protection distance.

(2)Treatment strategies of “combining the new with the old”

After the implementation of the technical restructuring, the current gas making waste water sources will be eliminated. Meanwhile, the present facilities used for treating sewage containing oil are transformed. SBR biochemical treatment facilities will be newly built to treat the organic production waste water with high concentration and the life sewage and discharge to the outside after the requirements are met, ensuring the long-term and stable compliance with the standard of discharged water. After the technical restructuring, the out-of-date equipment will be replaced in the current factory and the influence of the present highly noisy equipment on the boundaries will be greatly lessened. After the technical restructuring, the technique of copper ammonia washing will be eliminated and the small amount of copper sludge will be removed. The dirt containing cyanogen will be sent to the newly built storage site of dangerous waste for safe disposal. After the technical restructuring, the semi-closed coal site will be transformed to wholly closed, alleviating the impact on the surroundings. As to the issue that the present health protection distance can not meet the requirement, the Zhumadian Urban Planning Bureau will take more measures.

6.2 Projects under construction

Projects under construction in Junma Group produce methanol of 150,000 t/a. At the same time, in the adjacent refined chemical industrial area, there is the melamine project with an annual output of 30,000 tons and the DMF project with an annual output of 20,000 tons. The reports of the projects under construction have been approved, so the evaluation does not include discussions in this regard. The pollution prevention and treatment measures in the projects under construction can be seen in Table 6.2-1.

Table 6.2-1 List of Pollution Prevention and Treatment Measures in the Project under Construction

Category	Pollution sources	Treatment measures	Treatment effects	Note

Methanol under construction	Waste gas	Methanol synthesis without air	Transmitted to gas making combustion stove to burn (after the technical restructuring, first delivered to gas cabinet, then to boiler to burn)	Qualified discharge of smog and SO_2	Engineering design
		Methanol rectification without condensing			
		Methanol rectification with flashed vapor			
	Waste water	Cooling waste water of the system	Oil removal, side filtering, electrostatic treatment, cooling in the cold water tower	Cycling use of waste water in the methanol synthesis and rectification section	Engineering design
		Remaining liquid of methanol rectification	Transmitted through pipelines to gas making jacket boiler to burn (delivered to the sewage treatment station after the technical restructuring)	Not discharged to the outside, recycling the heat	Engineering design
		Discharged waste water	A/O biological denitride treatment	Qualified discharge of water to the outside	Evaluation and suggestion
	Solid waste	Waste catalyst	Recycled by the manufacturer	Total disposal of solid waste	Engineering design
Melamine	Waste gas	Smog in molten salt furnace	Venturi granite water film dedusting machine	Qualified discharge of smog and SO_2	Evaluation and suggestion
		Waste gas in the top of the storage warehouse	Dedusting by whirlwind at the second level and bags	Qualified discharge	Engineering design
		Gas discharge from the inert washer	Discharged through exhaust funnel		
		Ammonia-carbon separation tower	Discharged through exhaust funnel		
	Waste water	Accidental emission when driving and stopping cars	Dilute ammonia water is delivered to the current sewage treatment station after ammonia is recycled by the recycling device.	Qualified discharge	Engineering design
		Condensed liquid of carbamide	Current device for deep hydrolysis of carbamide hydrolysis liquid		Engineering design
		Other waste water	Current sewage treatment station		Engineering design
	Solid waste	Ash in molten salt furnace	Comprehensive use	Total disposal of solid waste	Engineeri

<table>
<tr><td></td><td></td><td>Waste catalyst</td><td>Recycled by the manufacturer</td><td></td><td>ng design</td></tr>
<tr><td rowspan="3">Methylamine project</td><td colspan="2">Waste water</td><td>Sprayed into high temperature gas making stoves to burn</td><td>Not discharged to the outside</td><td>Engineering design</td></tr>
<tr><td colspan="2">Processed waste gas</td><td>Absorption at low temperature, discharged through exhaust funnel</td><td>Qualified discharge</td><td>Engineering design</td></tr>
<tr><td colspan="2">Solid waste</td><td>Burial</td><td>Total disposal of solid waste</td><td>Engineering design</td></tr>
<tr><td rowspan="6">DMF project</td><td colspan="2">Waste water</td><td>Anaerobic digestion</td><td>Qualified discharge</td><td>Evaluation and suggestion</td></tr>
<tr><td rowspan="2">Waste gas</td><td>Gas discharge from the stripping tower</td><td>Discharged through exhaust funnel after condensation</td><td>Qualified discharge</td><td>Engineering design</td></tr>
<tr><td>Processed waste gas in the reactor</td><td>Delivered to the boiler room to burn</td><td>Not discharged to the outside</td><td>Engineering design</td></tr>
<tr><td rowspan="2">Solid waste</td><td>Liquid in the kettle</td><td>For sale</td><td rowspan="2">Total disposal of solid waste</td><td>Engineering design</td></tr>
<tr><td>Waste catalyst</td><td>Recycled by the manufacturer</td><td>Engineering design</td></tr>
<tr><td rowspan="3">Compound fertilizer project</td><td colspan="2">Waste water</td><td>Gas making sewage treatment system</td><td>Qualified discharge</td><td>Engineering design</td></tr>
<tr><td rowspan="2">Waste gas</td><td>Smog in the boiler</td><td>Desulphurization within the boiler, electrostatic dust removal in three electric fields, discharged through 100m funnel</td><td>Qualified discharge</td><td>Engineering design</td></tr>
<tr><td>Exhaust emission of compound fertilizer</td><td>Dedusting by whirlwind and water spraying, discharged through 40m exhaust funnel</td><td>Qualified discharge</td><td>Engineering design</td></tr>
</table>

6.3 Technology Transformation

6.3.1 Waste Gas

6.3.1.1 Dust Gas from Coal Crushing & Handling System

The dust gas emission of the coal crushing & handling system used for this project is $4000Nm^3/h$. Bag type dust collector (high efficient, long bag & low pressure pulse collector) shall be adopted for dust collection, with a dust-collecting efficiency of 99.99%. The dust content of the treated waste gas shall be less than 80 mg/Nm^3, meeting the requirements (dust emission concentration being $120mg/m^3$) of *Table 2 in Integrated* Discharge *Standard of Air Pollutants*(GB16297 - 1996), grade II. It shall be discharged through a 35m high exhaust funnel.

Currently, domestically adopted coal powder segregating and collecting methods are: multilevel dust-collecting system through fine powder segregator and multi-clone bag type dust collector; dust-collecting system through gas box type pulse bag dust collector; dust-collecting system through long bag low pressure pulse & high concentration bag collector. For comparison of these three types of dust-collecting system please refer to Table 6.3-1:

Table 6.3-1 Dust-Collecting Efficiency Comparison

Main Equip.	Fine powder segregator and multi-clone bag type dust collector	Gas box type pulse bag dust collector	Long bag low pressure pulse & high concentration bag collector
Process Procedures	Long	Simple	Simple
Equip. Qty.	Many	Few	Few
Resistance	Big	Low	Low
Exhaust Emission	Hard to reach standards	Discharge after reaching standards; dust concentration of the exhaust being less than $100mg/Nm^3$	Discharge after reaching standards; dust concentration of the exhaust being $80mg/Nm^3$

The long bag low pressure pulse & high concentration bag collector for this project is characterized by high dust collecting efficiency, small equipment resistance and low injection pressure, with a filter-bag life of 2 years. There are more than 30 sets of this type have being used for PCI systems of steel companies, which function well. The dust content of the treated waste gas from long bag low pressure pulse & high concentration bag collector shall be less than 80 mg/Nm3, greatly improving the operational environment and reducing environment pollution, meeting the requirements for clean production. Therefore, this proposal is assessed to be feasible.

6.3.1.2 Effluent Gas from Pulverized Coal Bunker

Effluent gas emission from the top of pulverized coal bunker shall be 2000 Nm^3/h. The design adopts high efficient bag dust collector for treatment of the effluent gas. Dust content shall be less than 100 mg/Nm^3 after treatment. It shall be discharged through a 75m high exhaust funnel, consistently meeting relative standards.

This treatment technology is mature and widely applied. Therefore, this proposal is assessed to be feasible.

6.3.1.3 Acid Waste Gas from Conversion Device

The acid waster gas emission from stripping tower of conversion device shall be 100Nm^3/h, of which H_2S takes up 9%(Vn), NH_3 takes up 16%(Vn)and HCN takes up 2% (Vn) . They shall be sent back to CLAUS sulfur recovery process. To prevent NH_4CN from coming into being and blocking the pipe during transferring process, heat preservation measures shall be taken for the transfer piping.

H_2S, NH_3 and HCN contained in this type of waste gas are all flammable or combustible. Their burning points are 260℃, 650℃ and 537℃ respectively. The temperature in CLAUS sulfur recovery combustion chamber can reach 900℃, meeting the combustion requirements for the said materials. Therefore, this proposal is assessed to be feasible.

6.3.1.4 Waste Gas Produced by Opening and Closing of Coal Gasifier

The non-conforming coal gas produced by opening and closing of coal gasifier mainly consists of CO, H_2 and H_2S, etc., which are sent to the flare of coal gasification assembly and emitted at 60m high altitude after burning treatment.

This is a common practice of the industry. Therefore, this is assessed to be feasible.

6.3.1.5 Acid Waste Gas from Desulphurization Work-stage

H_2S emission produced during desulphurization work-stage is 1600Nm^3/h, including H_2S : 27% (Vn). It shall be sent back to sulfur recovery unit for CLAUS sulfur recovery treatment. The sulfur-recovered exhaust shall be discharged through a 35m high exhaust funnel after reduction and absorption processes. Process flows please see engineering analysis section.

Feasibility Analysis:

There are a variety of sulfur recovery processes. But most of them are developed on the basis of CLAUS technology. These include Claus method, Clinsulf method, Sulfreen process, MCRC sulfur recovery process and Super Clause sulfur recovery process, etc.

Claus method is the main current method for sulfur recovery of by-product acid gases from refinery gas and natural gas and other H_2S inclusive gases. Its most distinguishing characteristics is that it has a simple process flow, with few equipments, little space, less investment and high purity of recovered sulfur.

In China, Claus sulfur recovery technology was firstly introduced from other countries, and then localized by Chinese enterprises. Our design and research institutes have been studying and researching Claus sulfur recovery technology all the time. Now our Claus sulfur recovery technology and catalyst manufacturing technology have reached the advanced level internationally. Sure, Claus tail gas treatment technology still needs to be improved. Currently, main Claus tail gas treatment technologies include: reduction & absorption; selective oxidation; inner-cooling reactor; near dew point; oxidation absorption, etc. To discharge desulfurized end gas after reaching emission standards, the desulfurized end gas should undergo treatment. After comparison, it is recommended that reduction & absorption method be adopted for treatment of desulfurized end gas. This method has already been adopted both at home and abroad. Their assemblies have been put into operation, as in Wuhan Petro-chemical, Qilu Petro-chemical, etc. Practice has proved that this technology is already mature.

By adopting three-reactor Claus sulfur recovery technology and desulfurized end gas reduction & absorption method, this project shall obtain a 99.5 % above desulfurization efficiency, with 2331.4t/a recovered sulfur.

6.3.2 Waste Water

6.3.2.1 Waste Water from Gas-making System

According to the feasibility study, this project shall cycle use the water that is separated from the slag after three-stage flash distillation treatment of the waste water from gas-making system.

A brief of this treatment process: hot graywater from gasifier and washing tower enters into sedimentation tank after condensation via high and low pressures and vacuum flash distillation; add flocculating agent into the water to accelerate sedimentation process; fine slag powders at the bottom of the sedimentation tank are pumped to the feeding trough of the filter; pressurize the feed pump of the filter and send it to vacuum filter for dewatering. The slag cake is a kind of dangerous solid waste; it must be sent to the temporary storage yard of the plant. The high pressure gas from flash distillation will go through the graywater heater for heating recovery; the condensed fluid will be segregated by a gas-liquid segregator; then enter into the stripping tower of conversion workstage.

The low pressure gas from flash distillation will be directly sent to the feeding trough of the washing tower; clear water at upper part of the sedimentation tank will overflow to the graywater tank and be sent to the feeding trough of the washing tower by graywater pump; a small quantity of graywater will be discharged after treatment at the sewage treatment station of the plant.

The water of the feeding trough of the washing tower will be pressurized via feed pump and undergo heat exchange process with the hot gas from high pressure flash drum, and then sent to washing tower for cycle use.

This treatment process is technically mature. It is generally adopted for graywater treatment in Taxaco gasification process. It operates well at Huainan Fertilizer Plant. Therefore, this is assessed that this treatment process is feasible.

6.3.2.2 Plant-wide Wastewater Treatment

According to design documents, the wastewater of the plant shall be discharged after being treated by the existing gas-making wastewater treatment system as soon as the transformation project is finished. No new plant-wide wastewater treatment facility shall be constructed. It is realized according to project analysis that the existing gas-making wastewater treatment station can not meet the emission requirement for effluent wastewater, and it does not comply with relevant requirements of Technical Specification for Water Pollution Treatment of Henan's Fertilizer (Chemical Engineering) Industry. The specification requires that each nitrogenous fertilizer manufacturer must build a plant-wide wastewater treatment facility, with a nitrogen rejection facility.

Therefore, it is proposed, after communication and discussion with the design unit, that a new biochemical denitrification facility should be added to Junma Company's plant-wide wastewater treatment facility, on the basis of the existing gas-making wastewater treatment station, to ensure reaching the effluent standard for a long term.

（1）Wastewater Source

The wastewater treatment plant of this project will mainly receive wastewater from the following sources and of the following quality:

Table 6.3 - 2 Wastewater Source and Quality for Junma Company's Wastewater Treatment Station

NO.	Project Name	Type of Wastewater	Water Volume	Water Quality				
			m^3/h	COD_{cr}	BOD_5	NH_3-N	CN^-	Petroleum Type
1	Current Engineering	Gasified wastewater	19	300	200	178	0.5	
2		Wastewater from oil-recovery unit	7	400	280			30
3		Domestic Sewage	8	335	134	0.35		
4		Other effluents	4	200	100	35	2.7	
5	Methanol Device	Floor washing water	5	90		20		
6	Melamine Engineering	Flushing wastewater	14	400	160	150	2.6	1.3
7	Methylamine and DMF	Processing wastewater	3	104		1.8		
		Mixed water	60	306	120	150	0.9	5.0

（2）Treatment Capacity

Designed capacity factor (around 1.2～1.3times that of actual treatment capacity) and relevant requirements of Technical Specification for Water Pollution Treatment of Henan's Fertilizer (Chemical Engineering) Industry should be taken into account; meanwhile, future development of the company should also be considered. So the treatment capacity of the new biochemical wastewater treatment facility is set to be $3000m^3/d$, to satisfy the treatment requirements for plant-wide fluctuating discharging of wastewater.

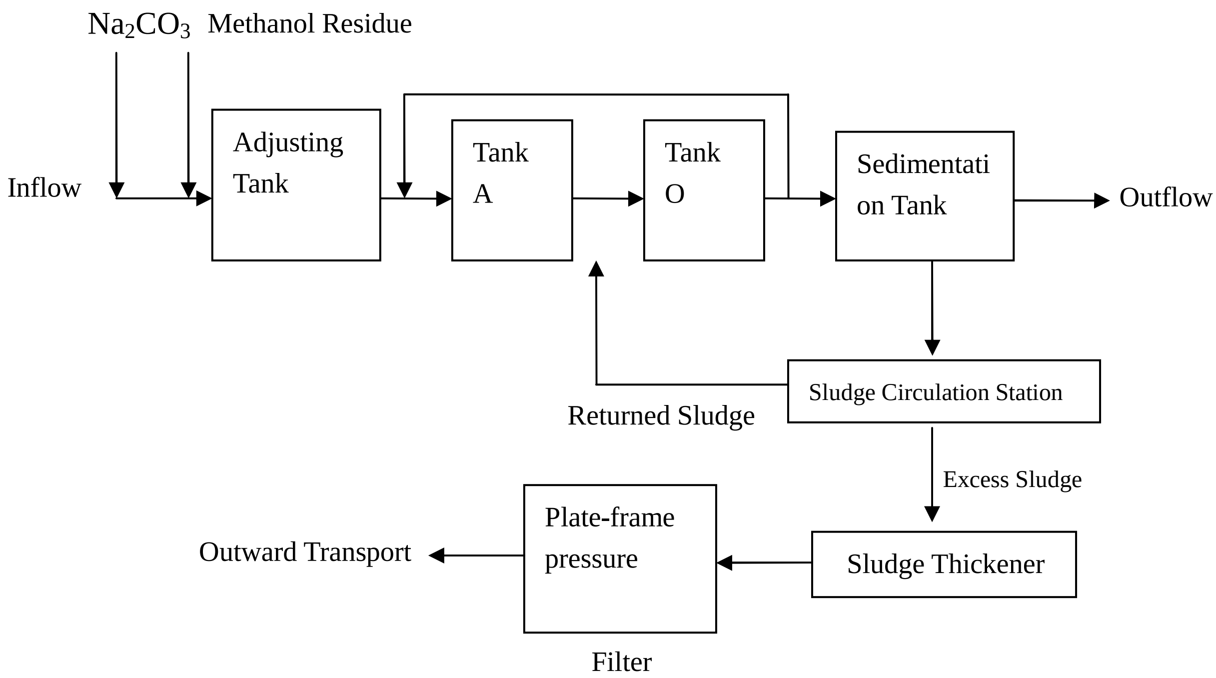
（3）Treatment Plan and Process Flow

From the nature and quality of sewage it can be seen that the sewage enjoys a good biodegradability. Advanced biochemical treatment method can be adopted. According to relevant requirements of Technical Specification for Water Pollution Treatment of

Henan's Fertilizer (Chemical Engineering) Industry, a denitrification facility is required for the wastewater treatment facility; factors such as shockproof load capacity and cyanide removal effect, etc. are considered; and after comparing different plant-wide wastewater treatment facilities of many companies in the trade, we have finally chosen A/O treatment process for our design.

A/O method refers to anoxic / aerobic activated sludge technology. Under anoxic conditions, nitric nitrogen in the sewage is reverted to nitrogen by microorganisms; under aerobic conditions, organic matters in the water are oxidized and degraded by microorganisms and ammonia nitrogen in the water is oxidized into nitric nitrogen by nitrobacteria. The mixed fluid in aerobic section will backflow into the anoxic section, providing nitrogen source for denitrification. This process enjoys higher organic removal rate and ammonia nitrogen removal rate, high shockproof load capacity, easy regulating and control of operating parameters, stable effluent and lower energy consumption.

The process flow is as follows:



Low COD during inflow leads to insufficient carbon source for denitrification. Methanol residue can be used to supplement it; alkalinity can be adjusted by adding Na_2CO_3. First the sewage enters into the adjusting tank, in which a submersible water impeller is installed to make the water evenly mixed and prevent suspended substances from depositing. Effluent of adjusting tank is sent to Tank A by a sewage lift pump; meanwhile, the internal reflux flows back to Tank A, in which there is also a submersible water impeller. Denitrification reaction happens in Tank A, during which most nitrates are oxidized into nitrogen. Effluent of Tank A flows gravitationally into Tank O, in which there is a blast aeration, removing most of the organic pollutants and convert most ammonia nitrogen of the inflow into nitrates, with part of the digested fluid flows back to Tank A. Effluent of Tank O enters into the sedimentation tank, in which solid-liquid separation process takes place. Part of the supernatant fluid enters into recycle water treatment facility and part of it is discharged into the plant drainage system. Sludge flows into the sludge circulation pumping house, with part of it flows back to Tank O, the remaining being pumped to the sludge thickener for thickening or concentration. Then a screw pump is adopted for dewatering at the plate-frame filter. The dewatered sludge cake shall be transported outward for land-filling.

The new plant-wide wastewater treatment plant for the technological transformation project locates at the south of the existing gas-making wastewater treatment facility, the sedimentation tank of which can be used as adjusting tank for A/O treatment process. Equipments for the new wastewater treatment plant are listed in Table 6.3-3.

Table 6.3-3 Equipments for the New Wastewater Treatment Plant

NO.	Equip. Name	Qty. (set)	Type
1	Sewage lift pump	3	$Q = 25m^3/h$, $P = 15m$
2	Submersible water propeller	6	$\varphi = 400mm$
3	Internal return pump	3	$Q = 25L/s$, $P = 15m$

4	Sludge return pump	3	Q = 25m^3/h，P = 15m
5	Excess sludge pump	2	Q = 2.5m^3/h，P = 16m
6	Rots Fan	3	Q = 14.3m^3/min
7	Screw Pump	2	Q = 2m^3/h，P = 20m
8	Plate-frame filter	1	Filter plug volume: 300L
9	Solution tank	1	Volume: 1 m^3

For quality of wastewater before and after treatment please refer to Table 6.3-4.

Table 6.3-4 Quality of Wastewater before and after Treatment

Item	Unit	COD	BOD_5	NH_3-N	CN^-
Mixed sewage quality	mg/L	306	120	150	0.9
GB13458-2001	mg/L	150	★30	70	1.0
Treated Water Quality	mg/L	<80	<20	<30	< 0.3
Treatment Efficiency	%	> 73.8	> 83.3	>80.0	>66.7

Notes: ★BOD_5 Implement as reference to Grade Ⅱ, Table 2, *Integrated Wastewater Discharge Standard*

After taking measures in strict accordance with the assessment suggest, it is deemed that plant-wide wastewater discharge meets the standards.

6.3.2.3 Accident Water Collecting Tank

According to relevant requirements of Technical Specification for Water Pollution Treatment of Henan’s Fertilizer (Chemical Engineering) Industry, each nitrogenous fertilizer manufacturer should establish an accident water collecting tank, into which the fluid from the manufacturing facilities and the equipment washing water are drained during failure or overhaul of manufacturing facilities. The water will be recycled or treated when restart the manufacturing facilities. It is prohibited to directly discharge this water. The volume of accident water collecting tank must be no less than 200m^3. There is no accident water collecting tank with the existing facility, so the assessment suggests that an accident water collecting tank should be established for both old and new plants and that the tank volume should be 300 m^3. The tank will collect and store accident water temporarily, which will be sent back for treatment as soon as the wastewater treatment facility resumes normal conditions. The accident water collecting tank also functions as a rain water collecting tank during raining to ensure plant-wide wastewater discharge reaching standards.

6.3.3 Solid Waste Management and Comprehensive Utilization Measures

Plant-wide solid wastes after technological transformation mainly include gasified flying ashes, waste residues, spent conversion catalysts, spent sulfur recovery catalysts and spent molecular sieves generated in gasification stage; spent synthesis catalysts generated in methanol producing stage; molecular sieves generated in air separation stage and boiler ashes generated by heating system. Plant-wide solid wastes are listed as in Table 6.3-3.

Table 6.3-3 Plant-wide Solid Wastes after Technological Transformation

<table>
<tr><th>Device</th><th>Pollutant Source Name</th><th>Emission</th><th>Main Components</th><th>Treatment Method</th></tr>
<tr><td rowspan="4">Gasification</td><td>Gasifier Slag</td><td>87203t/a</td><td>SiO3,CaO,Fe2O3,C, etc.</td><td rowspan="2">100％ comprehensive utilization; a temporary slag yard is set in the plant.</td></tr>
<tr><td>Spent methanol catalyst</td><td>8t/a</td><td>SiO3,CaO,Fe2O3,C, etc.</td></tr>
<tr><td>Spent conversion catalyst</td><td>56t /2a</td><td>CoO, MoO, etc.</td><td>To be recovered by manufacturer</td></tr>
<tr><td>Spent sulfur recovery catalyst</td><td>44t/2a</td><td>Active carbon, Fe2O3, etc.</td><td>To be recovered by manufacturer</td></tr>
<tr><td>Methanol</td><td>Spent synthesis catalyst</td><td>22t/3a</td><td>CuO,ZnO,Al2O3,etc.</td><td>To be recovered by manufacturer</td></tr>
<tr><td>Air separation</td><td>Molecular sieve</td><td>46t/10a</td><td>Al_2O_3</td><td>To be recovered</td></tr>
<tr><td>Heating</td><td>Boiler ash</td><td>4.4×10^4 t/a</td><td>CaO,C,etc.</td><td>100％ comprehensive utilization</td></tr>
<tr><td>Wastewater treatment</td><td>Cyanide sludge</td><td>1600t/a</td><td>Cyano complex, Cu^{2}+,etc.</td><td>Temporarily stored in the plant after dewatering and finally transported to hazardous waste disposal site.</td></tr>
</table>

6.3.3.1 Classification and Disposal of Plant-wide Solid Wastes after Technological Transformation

Plant-wide solid wastes after technological transformation fall into two categories: general solid wastes and hazardous solid wastes. Spent catalyst belongs to hazardous solid waste; sludge generated from sewage treatment (including gas-making graywater treatment and plant-wide wastewater biochemical treatment) belongs to hazardous waste due to its cyano complex component; others such as slag from gasification process, ashes from heat boiler and spent molecular sieves from air separation process are general solid wastes.

⑴ General Solid Wastes

① Boiler Ashes and Gasified Slag

The total amount of gasified slag and boiler ash plant-wide after technological transformation is 157,000 t/a. According to the agreement (Annex 16) between Junma Company and Henan Yunan Cement Co., Ltd., the latter will be responsible for the comprehensive utilization of the plant-wide slag, mainly used for building materials such as cement. After the transformation, all plant-wide slag can be comprehensively utilized. At the same time, a temporary slag yard will be built to store slag that can not be utilized temporarily.

⑵Spent Molecular Sieve

The main components of spent molecular sieve generated from gasification and air separation stages are Al_2O_3 and SiO_2, which are general solid wastes. According to engineering design, the spent molecular sieve will be recovered by the manufacturer.

⑶ Temporary Slag Yard

We can see from the plant general layout that the temporary slag yard locates at the northeast corner of the transformed plant location, with an area of 100m×100m, a storage capability of 13,000t, which can meet the needs for slag storage for 30 days of the whole plant. There will be no residential area within 800m of the east and north of the plant. Presently, it is all farmland. There is little influence on surrounding residents. The assessment suggests that the location of the temporary slag yard at the middle is reasonable.

Considering that there is no schematic design for the slag yard to date, the assessment suggests that the following points should be included in the design per the requirements of the *Standard for Pollution Control on the Storage and Disposal Site for General Industrial Solid Wastes (GB18599-2001)*, so as to reduce the influence of the slag yard on the environment:

① Anti-seepage: when the coefficient of permeability of the natural basal layer exceeds 1.0×10^{-7}cm/s, natural or artificial materials should be applied for construction of anti-seepage layer, of which the thickness should be equivalent to the coefficient of permeability, i.e. 1.0×10^{-7}cm/s, and the anti-seepage behavior be equivalent to the thickness of 1.5m of the clay layer.

② Build retaining wall for flood control: to prevent the slag and leachate from draining away, a 1m high slag retaining wall should be built around the temporary slag yard. By doing this, the slag won't be washed away by rains and cause pollution to plan environment. In order to prevent the rainwater entering into storage and disposal yards and avoid increasing of leachate, diversion channels should be constructed around the disposal yard.

③ Preventative measures for slag yard dust pollution: spray water periodically to make the water content of the dry ash surface be less than 30%; lay the ash, level and roll it when stacking the slag, with the compaction coefficient being over 90%; periodically check and maintain the slag retaining wall and stream diversion facility to see if there is any damage and take necessary measures to repair it if there is any damage to ensure the normal operation of the slag yard; greening work should be done well surrounding the slag yard to reduce the impact of dust on environment to the maximum extent.

④ Operation management of slag yard: the slag yard can only be put into operation after being inspected and approved by relevant environment administrative departments; each enterprise should strengthen management on slag yard and establish inspection and maintenance procedures; set up environmental protection markers and carry out inspection and maintenance work per GB15562.2 requirements.

The assessment suggests that under the premises of 100% comprehensive utilization of the slag and the above measures being implemented in a strict manner, the slag yard for this project is feasible.

6.3.3.2 Hazardous Solid Wastes

⑴ Cyanide Sludge

Around 1600t/a of cyanide sludge will be generated by gas-making wastewater treatment. According to China Hazardous Waste List (089/1998/MEP), cyanide sludge belongs to hazardous solid waste. A temporary hazardous solid waste storage yard will be built in the plant for storing cyanide sludge, which is suggested by the assessment to be transported to Henan Hazardous Waste Disposal Site for safe treatment after the site is completed.

The geological structure of the temporary hazardous solid waste storage yard is relatively stable, with a seismic intensity of less than seven degrees. The yard boundary should be 800m beyond residential areas and 150m beyond surface waters. There is no underground cavern at this area. It is not apt to be influenced by severe natural disasters such as flood, landslide, mud-rock flow and tide, etc. According to *Standard for Pollution Control on Hazardous Waste Storage*（*GB18597-2001*）, the site of temporary hazardous solid waste storage yard must also comply with the following requirements:

① the bottom of the facility must be higher than the crest stage of underground water;

② it should be built beyond the protective areas of flammables & explosives warehouses and high voltage transmission lines.

③ the facility foundation must be of anti-seepage type. The impermeable layer should be of 1m clay layer (with coefficient of permeability being less than 10-7cm/s) or 2mm thick HDPE or other artificial materials with a minimum thickness of 2mm and a coefficient of permeability of less than 10-10 cm/s.

Hazardous waste storage facility (warehouse) should be constructed complying with the requirements of the *Standard for Pollution Control on Hazardous Waste Storage*（*GB18597-2001*）, which are specified as the following:

① The ground and skirt must be constructed with solid and water-tight materials; building materials must be compatible with hazardous wastes.

② Leak collecting unit, gas outlet and gas cleaning unit must be developed.

③ There must be safety lighting facilities and watch windows in the plant.

④ Places storing loading fluid and hazardous semisolid wastes must be with hardened corrosion–resistant floor, without any cracks or seams.

⑤ Skirt should be design to block leakages; the ground-skirt enclosure volume should be no less than 1/5 of the maximum storage capacity or gross reserve of the biggest vessel.

⑥ Incompatible hazardous wastes must be separately stored in each compartment.

The *Standard for Pollution Control on Hazardous Waste Storage（GB18597-2001）*has the following requirements for stacking of hazardous wastes:

① Stacking height of hazardous wastes should be determined according to the ground bearing capacity.

② The lining should be set on a foundation or a base, covering areas hazardous wastes or leachate may reach. And lining materials must be compatible with the hazardous wastes.

③ On the lining a leachate collecting & cleaning system should be designed and constructed.

④ A run-off drainage system should be designed and constructed to ensure preventing rainwater of a 25-year rainstorm from entering into the hazardous wastes.

⑤ In the hazardous waste yard a rainwater collecting pool should be designed to collect rainwater of a 25-year rainstorm in 24-hour manner.

⑥ The hazardous waste stockpiles must be wind-proof, rain-proof and sun-proof.

⑦ Large quantity of hazardous wastes can be stored in bulk in the waste stockpiles complying with the above requirements.

⑧ Incompatible hazardous wastes can not be stacked together; they must be stored or stacked in different areas separated by impermeable compartments, each with a leakage-proof skirt or spill catcher tray. The material of the leakage-proof skirt or spill catcher tray should be compatible with hazardous wastes.

Operation and management of hazardous waste storage facility must comply with the following requirements of the *Standard for Pollution Control on Hazardous Waste Storage（GB18597-2001）*.

① Examine the hazardous wastes before storing them to ensure they are the scheduled wastes. All the incoming wastes must be registered.

② Labels complying with the Annex A, *Standard for Pollution Control on Hazardous Waste Storage（GB18597-2001）*and filled per requirements must be shown.

③ Hazardous wastes of the same type in the container can be stacked up.

④ Between stacks there should be a passage for handling activities.

⑤ Incompatible wastes must not be mixed or bind together.

⑥ Status of hazardous wastes must be recorded, including the name, source, quantity and nature of the waste, the type of container, warehousing date, warehouse name, waste outgoing date and name of receiving unit.
The record and cargo list of hazardous waste should be kept for another three years after it has been taken back.

⑦ Periodical inspections should be carried out on all hazardous waste packages, containers and facilities; if any damage is found, timely measures should be taken to clean it or change it.

⑧ Leakage, leaner and leachate can only be discharged after meeting the requirements of GB8978; gases dismissed from the gas outlet must undergo treatment and comply with the requirements of GB16297 and GB14554.

The safety protection and monitoring of hazardous waste storage facility must comply with the following requirements of the *Standard for Pollution Control on Hazardous Waste Storage（GB18597-2001）*.

① Safety Protection

（1.1）Warning marks should be set for hazardous waste storage facilities per requirements of the GB15562.2.

（1.2）Enclosing walls or safety fences should be set for surroundings of hazardous waste storage facilities.

（1.3）Telecommunications equipments, lighting facilities, safety protective clothes and tools should be equipped for hazardous waste storage facilities; emergency protective facilities should also be established.

（1.4）Leakages removed from the hazardous waste storage facilities will be treated as hazardous waste.

② Monitor the hazardous waste storage facilities per national pollutant source management requirements.

Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste has been issued and come into force on April 1st 2005. According to the requirements specified in Chapter Four (Special Provisions on Prevention and Control of Environment) of this Law, the assessment suggests that the owner take the following preventative measures:

⑴ A separate area should be drawn for the temporary storage yard, which will be of totally enclosed type (with necessary air windows). Because cyanide absorbs water to produce an extremely toxic substance, hydrocyanic acid, the temporary storage yard must be water-proof and damp-proof. The capacity should be calculated for two years' production. The owner should transport the cyanide sludge generated to the temporary storage yard in time.

⑵ Containers such as plastic buckets are used to contain cyanide sludge. Both containers and wrappers, as well as outside the storage places should be labeled with hazardous waste identification marks. If the cyanide sludge storing container is used for another purpose, it must undergo decontamination processes.

⑶ The cyanide sludge generated from the proposed project must be stored separately. It must not be mixed with other solid wastes. It is strictly prohibited to mix hazardous wastes into non-hazardous wastes.

⑷ The owner should develop preventative measures and emergency plans for incidents or accidents, take immediate measures to eliminate or reduce the impact of accident or incident on environment in case of an accident or incident or any other emergency that may cause severe pollution to environment, alert nearby companies and residents that may be affected by the pollution, and report to environment administrative departments at county level or above and relevant authorities.

⑸ The owner should develop hazardous waste management plans per relevant national stipulations, take active measures to reduce the production and hazardness of cyanide sludge.

⑹ The owner should be responsible for safety education of cyanide sludge cleaners and handlers, get them understand the toxic property of cyanide sludge and learn necessary preventative measures and first aid measures. Workers who are on duty must wear long rubber gloves and rubber shoes; avoid cut skins contact with the cyanide sludge.

⑺ Cyanide sludge belongs to hazardous waste. It is only stored in the plant temporarily. According to the requirements of Clause 58 of *Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste*, preventative measures up to national standards for environmental protection must be taken for storing hazardous wastes, with a storing period of less than one year; if the storing period needs to be prolonged, it must be reported to relevant environment administrative departments for approval of business licenses. If the provincial hazardous waste center is still uncompleted one year later and no licensed unit is to collect the wastes, the company may, as per provisions, apply to the original environment administrative department issuing business licenses for prolong the storing period, until the provincial hazardous waste center is completed and begins receiving cyanide sludge.

Where hazardous waste storage facility is to be closed as necessary, the following requirements of the *Standard for Pollution Control on Hazardous Waste Storage （GB18597-2001）* must be complied:

（1）Submit a shutdown proposal before closing the hazardous waste storage facility; implement the shutdown after the proposal is approved.

（2）Take necessary measures to abate pollutions.

（3）Equipments, soils and walls containing pollutants that can not be removed shall be treated as hazardous wastes and transported to the operating hazardous waste disposal site or other storage facilities.

(4)Warning marks can be take off and personnel can be withdrawn when monitoring results from the monitoring department show no existence of pollutants.

Above measures taken, the impact of cyanide sludge at the temporary yard on environment can be effectively controlled, ensuring that the cyanide sludge shall have no influence on both people and environment when it is stored at the temporary yard.

The cyanide sludge is just stored in the plant temporarily. It will finally be transferred to the hazardous waste landfill yard for final treatment. Presently, Henan Hazardous Waste Landfill Yard is under development. After completion, all the cyanide sludge generated by this project will be transported to the Yard. According to the provisions of Clause 59 of *Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste,* the following requirements should also be followed during transferring of hazardous wastes: "Unit transferring hazardous wastes must fill in the Hazardous Waste Transfer Form per national regulations and apply to the environment administrative departments of the local people' government at city level or above for transferring the hazardous wastes out of the local region." "Where the hazardous wastes is transferred via administrative regions other than places of reject and receipt, the environment administrative departments of the local people' government (city level or above) of the place of reject of hazardous wastes should timely notice those of the regions passed by."

⑵ Spent Catalyst

There is total 2222.7t/a of spent catalyst generated by the technological transformation project. According to the agreement between the recycling company and Junma Company's catalyst-manufacturing subsidiary, all the spent catalyst generated plant-wide shall be recycled by the recycling company. This is a common practice of chemical plants. By this, wastes can be changed into resources. Therefore, the assessment suggests that it is feasible.

6.4 Other Suggested Measures for Environmental Protection

6.4.1 Waste Gas Monitoring

All waste gas exhaust funnels must be equipped with pollution source monitoring ports and pollution source monitoring platforms according to the pollution source monitoring scope, for the convenience of pollution source monitoring and control during operation period.

6.4.2 Main Drain Gauging and Online Monitoring

There is no automatic gauge and pollution source online monitoring facility for the existing main drain, which does not comply with drain outlet standardization requirements. The assessment suggests that standardization of the main drain outlet be considered for the technological transformation, with enterprise drain outlet marks, automatic gauge and (COD, NH3-N) online monitoring devices being installed.

6.4.3 Renovation of Ammonia & Hydrogen Recovery Devices in Ammonia Synthesis System

Update the rectifying column and overhead condenser and renovate the hydrogen extraction blocking device and process pipelines to reduce fugitive emission of ammonia.

6.4.4 Close of Feed Coal and Bunker Coal Yards

Part of feed coal yard in the transformed plant is for open storage. Therefore, if the wind blows with a higher speed, there would be a lot of secondary fugitive dusts, which may have an impact on surrounding environment to a certain extent. To reduce the impact of secondary fugitive dusts on surrounding environment, the assessment suggests that the open storage area in the feasibility study be changed into semi-closed coal yard and that spray facility be arranged at the coal yard to abate fugitive dusts.

6.4.5 Strengthen Management, Reduce Evaporating, Emitting, Dripping or Leaking of Fluid

There are some shortcomings in management of the existing production. A relatively severe evaporating, emitting, dripping or leaking phenomenon exists in the production process, leading to a higher concentration of pollutants in cooling water (NH_3-N: 60mg/L), thus, causing a phenomenon, i.e. clear water is not clear at all. The assessment suggests that after the transformation the following measures be taken to reduce or even to stop the evaporating, emitting, dripping or leaking and abnormal discharge of fluids during production process.

①Strengthen field management of production operations; strengthen management on rate of consumption and education in environmental protection; link the rate of consumption to production cost assessment; enhance environmental consciousness and cost consciousness of the operators.

② Strictly control the number of static and dynamic seal points in each synthesis and ammonia processing department, reduce or even stop evaporating, emitting, dripping or leaking phenomenon from the point of management and system.

③ Carry out periodical inspections on equipments and pipelines in use to rule out unsafe factors and leakage factors in advance.

④ Establish a patrol inspection system. The operator should inspect once a day the static and dynamic seal points to discover any leakage in due time and solve it to avoid the problem from developing.

6.5 Measures for Environmental Protection of the Technological Transformation Project

Pollution control measures for the technological transformation project please refer to Table 6.5-1.

Table 6.5-1 Measures for Pollution Prevention of the Technological Transformation Project

Category	Pollutant Source		Treatment Measures	Treatment Effect
Technological Project	Waste gas	End gas from coal crushing process	Bag de-dusting, efficiency: 99%	Up to standard discharge of outgoing waste

		Effluence gas from coal bunker	Bag de-dusting, efficiency: 99%		gas
		Gas-making flashed vapor	Flare burning		
		Effluence gas from gas furnace			
		Acid waste gas from shift device	Claus sulfur recovery + reductive absorption		
		Acid gas from fine de-sulfur process			
		Ammonia synthesis tank degassing	Sent to fuel pipe network via ammonia & hydrogen recovery devices		
	Waste water	Sewage from gas-making system	Three-stage flash evaporation; settling tank for sedimentation	Biochemical wastewater treatment station	Up to standard discharge after treatment
		Oily sewage	Grease trap, flotation		
		Domestic sewage	Biochemical wastewater treatment station in the plant		
	Solid waste	Cyanide sludge	Temporarily stored at the hazardous waste storage yard in the plant		All solid wastes disposed
		Spent catalyst; spent molecular sieve	Recovered by the manufacturer		
		Gasified slag; boiler ash	100% comprehensive utilization, mainly used as raw material for cement production; set a temporary slag yard in the plant		
	Noise		Select and use low noise equipment; take measures such as sound isolation, sound elimination, reasonable arrangement and boundary greening, etc.		Satisfying criteria
	Greening		Plant open spaces: greening 100%		Abate fugitive dusts
	Environmental management and monitoring		Increase managerial staff for environmental protection; develop a monitoring plan complying with environmental protection requirements		
"Using New Method to Improve the Old One" Project	Domestic sewage		Drained into biochemical sewage treatment station in the plant		
	Accident water		Construct 2 accident water collecting tanks of 300m3 capacity		Accident water: all treated or recovered
	Renovation of existing coal yard and slag yard		Totally-closed coal yard; pray facility be arranged at the coal yard		Abate fugitive dusts

	Renovation of ammonia & hydrogen recovery devices in ammonia synthesis	Update the rectifying column and overhead condenser and renovate the hydrogen extraction blocking device and process pipelines	Reduce fugitive discharge of ammonia

7 Clean Productions

7.1 Industrial Policies and Environmental Protection Regulations for Chemical Industry

7.1.1 Industrial Policies for Chemical Industry

7.1.1.1 Guidelines for Development of Chemical Industry

On August 19th 1996, Ministry of Chemical Industry issued the Guidelines for Development of Chemical Industry ([1996]575), which

- Underlined the focal points for development of chemical industry.

Stable development of agrochemicals can ensure satisfying the needs for agricultural production.

Vigorously develop petrochemical industry; speed up the production and development of organic materials, organic intermediates, composite materials and fine chemicals.

Industriously develop high and new technologies in chemical engineering and new industries; actively develop chemical products with high added value, technology content, market share and capacity to earn foreign exchanges through exports.

It specifies that,

Chemical enterprises should seriously implement the development strategy of saving resources; strengthen management on energies; reduce consumption and comprehensively utilize resources.

Chemical enterprises should actively adopt new energy-saving technologies and equipments for technological transformation; gradually phase out technologies and equipments with high energy consumption; promote the step-down of the energy-consumption level in chemical industry.

Competent authorities of chemical industry should periodically publish the energy consumption quota for main chemical products according to the level of technological development; for enterprises with quota exceeding the specified ones, they must make corrections within a fixed period of time until reaching standards; energy consumption of newly built projects must comply with the specified quota.

7.1.1.2 The Tenth Five-Year Plan for Chemical Industry

Focal points of Tenth Five-Year Plan:

(1) Continue to put the development of agrochemicals at an important place

Carry forward vigorously the adjustment of industrial structure; pace up the adjustment of raw material lines and technical lines; reduce the production cost of basic fertilizers. For nitrogen fertilizer industry, the key points would be large and medium-sized enterprises for saving energy, increasing production and realizing technological transformation by reducing costs, enhancing technical merits and product quality.

(2) Speed up Spreading and Application of New Technologies

For fertilizers the new gasification technologies should be spread and promoted; for large-scale MDEA and NHD, desulfuration and decarburization technologies should be promoted and applied…..

(3) Eliminate, Reduce or Limit the Outdated Products and Production Processes

For phased-out products and production processes: rinsing decarburization, normal-pressure transfer and triple tube ammonia synthesis processes for ammonia synthesis.

7.1.2 Provisions for Environmental Protection Management of Chemical Industry

On December 21st 1990, the original Ministry of Chemical Industry issues the *Provisions for Environmental Protection Management of Chemical Industry (781/1990/MCIP)* which specifies that:

For expansion, renovation, potential-tapping and upgrading projects on the basis of existing enterprises, the "Using New Method to Improve the Old One" principle must be followed to dispose the "three wastes" in both old and new processes.

Take effective measures for waste gas, soot and dust; effectively manage the waste water from production process under the premises of diversion of clear and waste streams; it is strictly prohibited to discharge wastewater by sewage pit, lacuna, solution cavity or dilution; the best raw material lines and advanced processes with high resource utilization rate and low discharge of "three wastes" must be adopted for technological transformation projects; new equipments and devices with low or non-pollution, low noise, little vibration and high efficiency should be applied; raw materials and catalyst with low or no toxic actions should be adopted; improve the product structure, develop new products with little or no impact on environment, and employ advanced, feasible, economic and reasonable facilities for purification of the "three wastes".

The *Decision on Further Strengthen Environmental Protection of Chemical Industry (234/1997/MCIP)* issued in 1997 pointed out that:

Take *discharging pollutants after reaching standards* as the essential requirements for environmental protection of chemical enterprises; and pace up the management of the "three wastes".

Strictly enforce each procedure; strengthen management and control new pollutions. All chemical projects must comply with the requirements for overall control, "Using New Method to Improve the Old One" principle, discharge after reaching standards and clean production. Strictly control new pollutants.

Develop vigorously comprehensive utilization of resources and promote clean production in an all-round manner.

7.1.3 The Project and Industrial Policies

This project will use the local cheap coals instead of coals from Jincheng of Shanxi Province as the raw materials for gasification; advanced technologies and processes will be adopted; obsolete processes and equipments will be phased out; meanwhile, the "Using New Method to Improve the Old One" principle will be followed for existing projects. By this, the project can realize energy-saving, consumption-reducing and pollution-abating drastically, in compliance with the Tenth Five-year Plan and the Provisions for Environmental Protection Management of Chemical Industry. This project has been listed into the Pilot Project List for Adjustment of Raw Material and Dynamical Structure of Nitrogenous Fertilizer Industry in China (2004-2005).

7.2 Clean Production Analysis

Clean productions refers to reducing pollution from the source, raising the efficiency of utilizing the resources, reducing or avoiding the production and emission of pollutants in the process of production, services and using products by means of incessantly improving designs, using clean energy and raw materials, adopting advanced techniques, technologies and equipments, improving management, making comprehensive utilizations, and other measures so as to alleviating or eliminating the harm done to the health of the human being and the environment.

Article 18 of the *Law of the People's Republic of China on Promoting Clean Production* stipulates that for the projects of new building, rebuilding and expanded building, appraisals shall be made with regard to the effects upon the environment, analytical argumentations shall be made about the use of raw materials, consumption of resources, comprehensive utilization of resources, and the generation and disposal of pollutants, etc., and priority shall be placed on the adoption of clean production technologies, techniques and equipments that have high use rate of resources and generating few pollutants. And Article 19 stipulates that enterprises shall, in their technological renovations, adopt the following clean production measures:

ⅰUsing the raw materials that are innocuous and harmless or slightly noxious and harmful to replace the raw materials that are seriously noxious and harmful;

ⅱUsing the techniques and equipments that have high use rate of resources and generate few pollutants to replace the techniques and equipments that have low use rate of resources and generate plenty of pollutants;

ⅲMaking comprehensive or recurrent use of the waste things, waste water, and waste heat, etc. produced in the process of production;

ⅳ Using the pollution-preventing technologies that have come to the national or local standards about the emission of pollutants and the indexes for controlling the total emission of pollutants.

In conclusion, this assessment has analyzed the following aspects of clean production according to the requirements and provisions of *Law of the People's Republic of China on Promoting Clean Production* and *Clean Production Standard in Nitrogenous Fertilizer Manufacturing Industry (A Draft for Comment)*.

7.2.1 Analysis on Clean Production of Raw Materials

There are a variety of raw materials for synthetic ammonia and methanol, including coal, natural gas, petroleum and coke, etc. Both synthetic ammonia and methanol devices are energy-consuming ones. Different raw materials have different impacts on the processes and production costs. Therefore the selection of raw material lines is the basis for design of synthetic ammonia and methanol devices. The considerations for selection of raw material lines are: low price, good quality and stable supply. China is not very rich in oil and gas. Oil reserve is only 2.4% of the world's total exploitable reserve; gas reserve, less than 1%. The cost is high if taking oil and gas as the raw materials for production of synthetic ammonia and methanol, and there is no guarantee for a stable supply. However, China enjoys abundant coal resources, being the second largest coal producing country of the world. China enjoys 765 billion tons of proved coal reserves, with an annual production of 1.4 billion tons. Henan is one of the main coal producing provinces. So coal resources for synthetic ammonia production of this project can be guaranteed. Therefore, taking coal as the raw material for this project is much more feasible from the angle of resource protection, and it complies with the resource structure features of Henan province, China. It also follows the industrial policies and development direction of China's chemical industry.

Coals for this project are produced at Yima City of Henan Province instead of coals produced at Jincheng of Shanxi Province. The coals will be supplied by means of train and truck transportation. Coal requirement for this project will be 435,000 t/a. Yima Coals are anthracites. The analytical data (as received) of Yima Coals and the existing Jincheng Coals are compared in Table 7.2-1.

Table 7.2-1 Quality Comparison of Coals Used before and after Transformation

Name	Place of production	Carbon content	Ash content	Fugitive content	Sulfur content
Currently used coals	Jincheng, Shanxi	74.96	15	7.5	0.8
Coals used after transformation	Yima, Henan	65.0	17	32.3	0.58

We can see from the Table that both coals are quality coals with high carbon content and low sulfur content. However, the transportation distance for Yima Coals is shorter than that for Jincheng Coals, greatly reducing pollution and energy-consumption during transportation. Therefore, Yima Coals are used as raw materials for this project instead of Jincheng Coals, complying requirements for clean production.

7.2.2 Clean Production Analysis of Technological Process

7.2.2.1 Coal Preparation Facility

(1) Preparation for Coal as Fired

Coal as fired for Texaco gasification process needs water, additives and latent solvent to be added into the coal, which is ground into water-coal-slurry with water content being 65%. However, for Shell gasification process the coals are pulverized with a coal pulverizer, producing plenty of dusts which cause pollution to the surroundings during preparation process. In comparison with Shell gasification process, coal preparation for this project generates much less dusts, reducing the impact on environment.

(2) Coal Powder Separating and Collecting Means

A certain amount of coal powder will be generated during pulverization and transportation. Currently, domestically adopted coal powder segregating and collecting methods are: multilevel dust-collecting system through fine powder segregator and multi-clone bag type dust collector; dust-collecting system through gas box type pulse bag dust collector; dust-collecting system through long bag low pressure pulse & high concentration bag collector.

The long bag low pressure pulse & high concentration bag collector recommended for this project is characterized by high dust collecting efficiency, small equipment resistance, low injection pressure and low space requirement. There are more than 30 sets of this type have being used for PCI systems of steel companies, which function well. The dust content of the treated waste gas from long bag low pressure pulse & high concentration bag collector shall be less than 50 mg/Nm^3, greatly improving the operational environment and reducing environment pollution, meeting the requirements for clean production. Therefore, this proposal is assessed to be feasible.

7.2.2.2 Coal Gasification Process

In respect of producing synthesis gas with coal as its raw material, anthracites or coking coals are generally used in China as the raw material for normal pressure fixed bed gasification process. This process is technically mature and reliable. All equipments are domestically manufactured. So it needs less investment. Presently, 90% of small nitrogenous fertilizer and methanol factories in China adopt this process. Junma Group also keeps this process for its existing production line. However, this process has low gasification efficiency, small gas output of a single furnace, high energy consumption and coal quality requirements. Anthracites are needed for this process. It has a low resource utilization rate. During windy days it will cause severe environmental pollution. The air emission of each ton of ammonia may reach 2800～3100m^3. Therefore this technology has already been dropped abroad. Many years ago, some research institutions in China have also developed K-T furnaces and skull-melting furnaces using pulverized coals as raw materials. And oxygen-rich fixed bed continuous gasification process was also adopted for normal pressure fixed bed gasification furnace. But for some reasons, these technologies were not widespread for industrialization.

Gasification technologies in other countries had been industrialized as early as in 1950s. Currently they have successfully developed a new generation of gasification process which adapts to various types of coals, with high pressure for gasification, big production capacity, high gasification efficiency and little pollution. Gasification methods taking coal as raw material in other countries are: fixed bed gasification, fluidized bed gasification and entrained flow gasification, etc.

Fixed bed gasification: It has been widely employed in China. Lurgi Gasification has built 3 sets of devices in China. It can carry out continuous pressure gasification, but produces plenty of methanols in the generated gas because of low gasification temperature, producing substances that are hard to dispose such as benzene, phenol and tar, etc., prolonging the purification process. In particular, this technology only employs crushed coal but not pulverized coal, resulting in low utilization rate of the raw material. Therefore, a great amount of screened pulverized coals have to be treated with coal burning boiler. This technology is good for production of city gas, but not so suitable for synthesis gas.

Fluidized bed gasification: mainly including Winkler Gasification in German. It is with lower pressure and a device producing fuel gas. But currently there is no device for production of synthesis gas.

Entrained flow gasification: mainly including American Texaco water-coal-slurry gasification process and Netherlands Shell pulverized coal gasification process.

Texaco water-coal-slurry gasification process was developed by an American company, Texaco, on the basis of oil gasification technologies. Additives, latent solvent and water are added into the coals, which are ground into water-coal-slurry and injected into the gasification furnace after being pressurized to burn with pure oxygen and have partial oxidation reaction. The gasification temperature is 1300～1400℃. There is no rotatable component with the gasification furnace. The gasification process flow falls into two types: chilling chamber process and waste heat boiler process. Most gasification furnaces producing synthesis gas adopt chilling chamber process, so does this project. Chilling chamber process: chill the gas in gasification furnace with water and clean the dust; no vapor needs to be added at shift work-stage because there is much vapor in the gas from gasification furnace; due to low temperature in the gasification furnace, less investment is required for the gasification equipments and work load for maintenance is small.

Characteristics of Texaco water-coal-slurry gasification process:

——Big coal handling capability for a single furnace, with large production capacity; gasification pressure of a single furnace currently in operation is 3.0MPa, and daily coal handling capability can reach 2000t.

——Gasification temperature is around 1400～1600℃; coal conversion rate up to 99%; the product gas is clean without heavy hydrocarbon and little methanol content; effective gas ($CO+H_2$) content is high, reaching 90% or so, which is suitable for synthesis gas.

——Adaptable to a wide range of coals. Pulverized coal can be employed; the utilization rate of the raw material is high.

—— For this technology, there are 7 sets of devices in operation worldwide, most of them are in China. Currently, Lunan Chemical Fertilizer Factory, Cogeneration Project of Shanghai Coking Co., Ltd. and Huainan Chemical Fertilizer Factory have been using this technology for many years. Hao Lianghe Chemical Fertilizer Factory has also renovated its intermittent gas-making process by applying Texaco water-coal-slurry gasification technology, and put it into operation in July 2004.

Shell pulverized coal gasification process is an advanced gasification technology developed by a Netherlands company, Shell. This technology applies pure oxygen and vapor for gasification. Dry powders are fed; the gasification temperature is 1400～1700℃; the carbon conversion rate can reach 99%; the effective gas content is more than 90% ($CO+H_2$). With slag tapping and special water wall gasification furnace, the service life of it can be prolonged. Waste heat boiler process is employed, so high pressure vapor will be a byproduct. Dry powder gasification consumes little oxygen. But the nitrogen needs to be sealed and the gasification pressure can not be too high as to produce synthesis ammonia. In comparison with water-coal-slurry gasification process, this process enjoys higher compression efficiency. The gasification furnace has a complex structure so the equipment cost and patent fee are high. Currently there is only one set of device of this technology in operation, which is used for IGCC. There is little industrial experience. The technology all depends on import. Domestic support for this process is rare. So there exists some risk.

According to surveys and information reference, detailed comparisons between large-scale gasification processes of home and abroad are shown in Table 7.2-2.

7.2.2.3 Conversion Device

Carbon monoxide conversion technology develops with the progress of conversion catalyst. The performances and heat recovery methods for conversion catalyst have determined the process flow and advancement of the conversion process.

（1）Selection of Catalyst

The operating temperature for conversion process of Fe-Cr shit catalysts is 320～500 ℃, which is called medium (high) temperature conversion process. Due to high operating temperature, the feed gas still contains 3% (v, dry-basis) of CO after conversion at water-air ratio. The sulfur and toxic resisting capability of Fe-Cr shit catalysts is relatively low, but the steam consumption is high. It has a minimum requirement for water-air ratio.

Table 7.2-2 Comparison between Large-scale Gasification Technologies

Item	Texaco Gasification Technology	Shell Gasification Technology	Lugri Gasification Technology
Gasification pressure	2.7～8.7		
Gasification temperature	1300～1400		
Max capacity of a single furnace	500～2000		
Type of gasification furnace	Hot wall furnace, single nozzle	Cold wall furnace, four nozzles	Hot wall furnace
Coal-feeding means	Water-coal-slurry concentration＞60％; being pumped	Pulverized coal transported with nitrogen, Grain size: 90％＜90μm	Feeding by crushed coal dry method
Heat recovery mode	Chilling chamber, Waste gas boiler	Waste gas boiler	Waste gas boiler
Slag-off	Slag tapping	Slag tapping	Dry ash extraction
Carbon conversion rate	96－98	＞99	90
Effective content （CO+H2）	Higher ＞80％	High ＞90％	68％
Oxygen consumption	High	Lower	Lower
Number of industrial devices	13	1	Several
Industrial device operating in China	5	/	3
Industrial device under construction in China	6	3	/

The operating temperature for conversion process of Cu-Zn shit catalysts is 190～280

℃, which is called low temperature conversion process. This process requires little temperature change for conversion. It is usually in series connection with the medium (high) temperature conversion process, reducing 3～5% (v, dry-basis) of CO to 0.3% (v, dry-basis) or less. The sulfur and toxic resisting capability of Cu-Zn shit catalysts is very low, suitable for gases with a total sulfur content of 0.1ppm. So it is required that the conversion takes place after desulfurization of the feed gas.

The operating temperature for conversion process of Co-Mo shit catalysts is 240～480℃, which is called wide temperature sulfur resistant conversion process. Wide temperature conversion catalyst enjoys a wide operating temperature. The CO in feed gas may be reduced to 1.0% or even less after conversion. If the Co-Mo conversion process is in series connection to the medium temperature conversion process, it is generally called sulfur resistant low temperature conversion. The operating temperature for sulfur resistant low temperature conversion catalyst is usually between 180～240℃. The CO in feed gas may be reduced to 0.3% (v, dry-basis) or even less after conversion. The sulfur and toxic resisting capability of Co-Mo shit catalysts is extremely strong. It has no upper limit for total sulfur content and for water-air ratio.

The property of feed gas will influence the selection of conversion catalyst. This project employs Texaco gasification process. CO content in the gas reaches 67.10% (v, dry-basis), CO_2 reaches 3.84% (v, dry-basis), and the total sulfur content 2800mg/Nm^3. The nature of the gas is special. So selection of catalyst becomes very important. Energy consumption during conversion depends on the water-air ratio required by catalyst and the operating temperature. For the above three conversion processes, conversion processes using Fe-Cr and Co-Mo conversion catalysts are suitable for this project. And conversion process using Co-Mo conversion catalyst enjoys lower water-air ratio and operating temperature than Fe-Cr conversion catalysts, thus, having an advantage of low energy consumption.

According to the features of Texaco gasification process, this project employs Co-Mo sulfur resistant wide temperature conversion process, which enjoys the following major advantages:

a. Co-Mo sulfur resistant wide temperature catalyst is applicable to feed gas with higher sulfur content; it has only lower limit for sulfur content in feed gas but no upper limit, so the purification process will be much simpler.

b. Co-Mo sulfur resistant wide temperature catalyst activates at a lower temperature; the lowest temperature is 200℃ and the highest is 480℃. By adopting reasonable sulfur resistant conversion catalyst the conversion reaction can be controlled, to reduce the temperature of bed hotspots of the conversion furnace.

c. Generally, Co-Mo sulfur resistant catalyst will not be limited by the minimum water-air ratio; usually the conversion reaction can be controlled by adjusting the quantity of added steam.

d. Co-Mo sulfur resistant low temperature conversion catalyst activates at a lowest temperature of 180℃, operating under a low temperature 30℃ lower than the dew point temperature, which is propitious to conversion reaction, saving large quantity of steams.

（2）Surplus Heat Recovery

CO content in the feed gas is high, so there is a lot of surplus heat. To reasonably utilize the surplus heat, the heat needs to be recovered stage by stage. According to the balance of heat supply plan-wide, the high temperature surplus heat from the conversion process can be used for the saturated vapor, which is the byproduct of overheated SHELL gasification device, and for conversion reactions; the low temperature surplus heat can be used for by-producing 0.5MPa low pressure steam and preheat demineralized water. The discharged condensate fluid from conversion process will be sent to the Texaco gasification device as the washing water for wetcleaning of gas.

From this it can be seen that compatibility with Texaco gasification process and energy-saving are taken into account for selection of conversion process for this project, as well as compliance to the requirements for clean production.

7.2.2.4 Desulfurization and Decarburization

This project employs NHD method to remove acid gas from the feed gas.

Main tasks for removal of acid gas includes: first, remove the H_2S content and a small quantity of organic sulfur from the feed gas; secondly, remove CO_2.

Currently, there are three types of purification methods for synthesis gas in the world: chemical absorption method, physical absorption method and physical-chemical absorption method.

Chemical absorption method refers to the process in which certain components of the gas have chemical reactions with the active constituents of the absorbent producing chemical compounds which are decomposed later, releasing active constituents and gases. Physical absorption method: because certain components of the gas are soluble to water or organic solvents, non-electrolytes or organic solvents can be used as absorbents. Physical-chemical absorption method is one that employs both chemical and physical methods during absorption process.

Which acid gas removal method shall be used depends on the nature of feed gas and requirements for synthesis gas. This project employs Texaco pulverized coal gasification process. The conversion gas is characterized by high sulfur and CO_2 contents and high partial pressure. When adopting common chemical or physical absorption method, the circulating load of solvent is heavy, with high energy consumption. Therefore, high efficiency and low energy consumption absorption method is required for desulfurization and decarburization.

According to the process features of conversion gas for this project, the facility employs physical absorption method for desulfurization and decarburization. The advantages of this method are represented by the following aspects:

⑴ For chemical absorption method, the circulating load of solvent is in proportion to the acid gas content in feed gas, so the exorbitant CO_2 content will make circulating load of solvent and consumption of steam increase drastically, resulting in the cost increase of the system; while for physical absorption method, the circulating load of solvent is in approximate proportion to the absorbed gas, so it is good for physical absorption by increasing the operating pressure of the system; reducing the circulating load of solvent is very important for cutting energy consumption and operating cost, especially for big facilities.

(2) Presently most physical-chemical absorption methods can not selectively remove H_2S from the process gas containing H_2S and CO_2, resulting in a more complex process flow, causing inconveniencies in operation management. However, by physical absorption method, H_2S and CO_2, can be selectively removed by just applying one kind of absorbent.

Physical absorption method falls into hot method and coal method according to the absorption temperature. In China, most chemical fertilizer factories employ cold method for desulfurization and decarburization. The cold method falls into NHD Process and Rectisol Process. NHD purification process was appraised by the Ministry of Chemical Industry in 1984. This process has a higher selectiveness for absorption of H_2S, with a higher absorbing capacity for H_2S and CO_2. Currently, NHD purification process has been successfully employed by tens of large and medium-sized chemical fertilizer manufacturers. Rectisol Process uses methanol as absorbent. Methanol is used to remove the acid gas from feed gas because it enjoys a high solubility of acid gases. This process is characterized by high gas purification, good selectiveness and wide application.

In the feasibility study, further comparison between NHD process and Rectisol Process has been carried out. The comparative results please see Table 7.2-3.

Table 7.2-3 Energy Consumption Comparison between NHD Process and Rectisol Process

NO.	Item	Unit	NHD Process	Rectisol Process
1	Chilling (standard condition)	kW	55	125
2	Low pressure saturated vapor	t	0.4	0.36
3	Medium pressure saturated vapor	t	/	0.08
4	Power	kWh	30	32
5	Cooling water	m^3	15	8
6	Low pressure nitrogen	$N\ m^3$	285	280

From the above analysis it can be seen that Rectisol Process operating under low temperature needs more chilling consumption, and patented technologies, process packages and essential equipments for this process should also be imported from abroad, thus a higher investment and a more complex process flow than NHD process, but a close operating cost to NHD process. As for overall energy consumption, NHD process is lower than Rectisol Process, in better compliance with the requirement for clean production.

7.2.2.5 Refining of Synthesis Gas

Junma's existing refining process is the combined methanol plus copper washing process. Copper washing process not only consumes cuprammonia but also causes severe environmental pollution. Therefore, this project employs methanol-methanation process for refining of synthesis gas instead of the existing refining process.

The methanol-methanation process is a process for refining of synthesis gas that developed at home and abroad in recent years. By using of this process, not only a certain amount of methanol can be generated as a byproduct, but also can enhance economic benefits. The $CO+CO_2$ content in the methanolized gas is far less than that in conversion gas and decarburized gas. Therefore, the H_2 consumption for methanation can be reduced and the effective utilization of synthesis gas can be enhanced.

Presently, the methanol-methanation processes in China mainly include constant & medium pressure methanolization-hydrocarbylation process, constant & high pressure methanol-methanation process and non-constant pressure methanolizing-methanation process. The synthesis pressure for this project will be 15MPa, so only constant & medium pressure methanolization-hydrocarbylation process or constant & medium pressure methanolizing- methanation process is feasible. There is no selling line for alcohol ether generated during methanolization-hydrocarbylation process, so this project will finally employ the constant & medium pressure methanolizing-methanation process.

7.2.2.6 Compression

The synthetic gas compressor unit is the key equipment to synthesize ammonia, the unit's efficiency and operation reliability has a direct impact on the ammonia production and the factory’s cost effectiveness.

The model selection and device size of the compressor is closely related to the synthesis loop pressure; small and medium sized ammonia plants commonly use reciprocating compressors to compress raw coal gas and hydrogen-nitrogen synthetic gas, while large ammonia plants use centrifugal compressors. Reciprocating compressors is suitable for smaller gas flow, which is generally motor-driven. The cycle of the continuous operation of reciprocating compressors is normally not more than 2 months, so it is generally necessary to set a spare one or operating more than one unit, occupying large area and resulting in many wearing parts.

The project intends to add a large steam-driven centrifugal nitrogen-hydrogen compressor with a cycle section, and eliminate all the reciprocating hydrogen-nitrogen compressors in the existing synthetic ammonia device with disadvantages of small stand-alone capacity, outdated equipment, loud noise, high power consumption and high maintenance costs. The synthetic gas compressor of this project will adopt the fully domestically made technology - domestically designed and manufactured technology, which will enable the energy consumption level of the compressor unit to meet the level of the world in the nineties.

7.2.2.7 Air Separation Device

As the water-coal-slurry gasification requires oxygen, this project should be equipped with an air separation device. In accordance with the volume of pure oxygen gasification needs, the oxygen production capacity of the air separation device is 40000Nm3 / h. The air separation process adopts the compressor process characterized by low pressure, air turbine expansion, air pre-cooling, molecular sieve adsorption, inner compression (LOX) to add nitrogen. The device has been industrialized, and it has been used on the production devices at home and abroad, so it is technically advanced and reliable.

According to different media used, it is divided into such two kinds as air expansion and nitrogen expansion. The air expansion is to send the compressed air to an expander for expansion refrigeration; and the nitrogen expansion is to compress the pumped nitrogen in a nitrogen compressor and then send into an expander for expansion and refrigeration.

Air expansion, characterized by large amount of expansion, flexible process organization and strong adaptability, is widely used in the air separation device, especially the device to produce liquid products; and nitrogen expansion is conducive to expansion and upper-tower distillation, but because the sucking rate is subject to the restriction of lower-tower distillation process, foreign large-scale air separation devices usually adopt air expansion, and this project also adopts air expansion.

Nitrogen compression can be divided into such two patterns as liquid nitrogen pump compression and nitrogen compressor compression. The nitrogen products of this project involve several users, and the pressure is different, while the liquid nitrogen pump used in the air separation sends out nitrogen with only one type of pressure, and then the nitrogen compressor will still be used; if the liquid nitrogen pump is used, the power of the nitrogen compressor would be reduced, but the quantity of cold the device requires will increase, and the power consumption for the air increasing pressure will rise; and if the nitrogen compressor process is adopted, the required quantity of cold will be reduced, and the total energy consumption will be reduced. Comprehensive comparison of the two processes is shown in Table 7.2-4.

Table 7.2-4 Comparison of two kinds of nitrogen gas compression process

Item	Liquid oxygen pump + nitrogen compressor	Liquid oxygen pump + liquid nitrogen pump + nitrogen compressor
Investment in equipment	1	Increase by 5%
Power consumption	1	Increase by 5%
Maintenance	1	1
Comprehensive comparison	1	> 1

The above technical and economic analysis shows that using the nitrogen compression technology of liquid oxygen pump + nitrogen compressor requires less investment and lower energy consumption, in line with the requirements of clean production.

7.2.2.8 Equipment Level

The project mainly adopts the domestic technology with mature operating experience of many domestic large and medium-sized synthetic ammonia plants, the equipment design of this project is conducted on the basis of summing up the design, manufacturing and production experience of domestic fertilizer plants and absorbing the same kind of device technology at home and abroad, and the design and manufacturing of the equipment is based on domestic resources, and the adopted process technology and equipment are advanced and reliable.

The main equipment the project will introduce is as follows:

⑴ Pump: Coal slurry pump, desulfurization hydraulic turbine, decarbonization hydraulic turbine.

⑵ Material: It is necessary to introduce gasification-required Incloy, SA387 and other special material.

⑶ Pipe fitting: It is necessary to introduce key lock slag valve, slurry valve, oxygen valve, some regulating valves and coal slurry flow meter and other valves and meters that can not be resolved domestically.

⑷ Air separation equipment: Air compressor / compressor machine, expander, high-pressure plate-typed heat exchanger, liquid oxygen pump, some instruments, valves and analytical instruments.

7.2.2.9 Clean production level of production technology and equipment

By referring to the requirements of Table 1 in the Clean Production Standard (Nitrogen Fertilizer Manufacturing Industry) (draft) and comparing with related indicators of this project, the result is shown in Table 7.2-5.

Table 7.2-5 Table for clean production level evaluation in terms of production technology and equipment requirements

<table>
<tr><td colspan="5">Table 1Requirements for production technology and equipment in the Clean Production Standard (Nitrogen Fertilizer Manufacturing Industry) (draft)</td><td>Transformation project</td></tr>
<tr><td colspan="2">Indicator</td><td>Level 1</td><td>Level 2</td><td>Level 3</td><td></td></tr>
<tr><td colspan="2">Preparation of raw gas</td><td>Pressurized continuous gasification - DCS control</td><td>Pressurized gasification - computer control</td><td>Atmospheric pressure gasification - conventional instrument control</td><td>Level 1</td></tr>
<tr><td rowspan="4">Purification of raw gas</td><td>CO conversion</td><td>DCS control</td><td>Computer control</td><td>Conventional instrument control</td><td>Level 1</td></tr>
<tr><td>Desulfurization</td><td>With a sulfur recovery unit Running well Automation</td><td>With a sulfur recovery unit</td><td>With a sulfur recovery unit Running well</td><td>Level 2</td></tr>
<tr><td>CO2 removal</td><td>DCS control</td><td>Computer control</td><td>Conventional instrument control</td><td>Level 1</td></tr>
<tr><td>Refining</td><td>DCS control</td><td>Computer control</td><td>Conventional instrument control</td><td>Level 1</td></tr>
<tr><td colspan="2">Compression of raw gas</td><td>Steam-driven turbine compressor</td><td>Reciprocating compressor 3.6-7.5m3/min</td><td>Reciprocating compressor 1.6-4.0m3/min</td><td>Level 1</td></tr>
</table>

Ammonia synthesis	Synthetic pressure	≤15.0MPa	20-32MPa		Level 1
	Recycle of dilute ammonia	Closed-loop water recycling	Recycle of dilute ammonia	NH HCO production, adding a little to gradually concentrate	Level 2
Urea production	Production process	Steam stripping of ammonia or carbon dioxide	Aqueous solution total recycle		Level 2(existing)
	Desorption solution treatment process	Urea desorption solution treatment process Deep hydrolysis Running well	Steam stripping of urea desorption solution Running well		Level 2(existing)

From the comparison results, the equipment and technology indicators of the technical transformation project have reached the domestic advanced level of cleaner production, and some indicators have reached the international advanced level of clean production.

7.2.3 Energy Saving and Comprehensive Utilization of Resources

7.2.3.1 Energy-saving measures

oal gasification technology to produce ammonia and methanol from coal, while using domestic advanced technology, we’ve taken a comprehensive consideration about the energy utilization of the whole plant, and the main energy-saving measures are as follows:

⑴ Under the conditions of determining core technology, we optimize the overall process of the whole plant, so that the choice of other technologies, in general, meet the processes optimization requirements of the plant.

⑵ Gasification uses the coal-slurry pressurizing gasification process of the chilling flow, because this process is characterized by high rate of carbon conversion, high content of effective gas in the coal gas and low consumption of raw materials; compared with the atmospheric pressure gasification process, it also has major energy-saving advantages such as low power consumption for synthetic gas pressurizing and no need to add steam before conversion.

⑶ The air separation unit adopts the processes of all low pressure, turbine expansion, air pre-cooling, molecular sieve adsorption and inner compression (LOX). This technology is now widely used in domestic and international large-scale air separation devices, with the advantages of low energy consumption and high oxygen extraction ratio.

⑷ The conversion section adopts the wide temperature sulfur-tolerant conversion energy-saving technology, and overcomes the hot-and-cold problem of the three-catalyst purification system, characterized by simple process and obvious energy saving effect. In addition, it takes advantage of 1.4t of steam by-product of waste heat per ton of ammonia. Among the conversion gas, all levels of condensate water is air-lifted and then returns to coal gasification as the washing water of gasification.

⑸ Byproduct steam 128 t / h of the synthesis and conversion devices.

⑹ Other energy-saving measures

Heat exchanger adopts the high-efficiency low-pressure decreasing heat exchanger to improve efficiency and reduce energy consumption; as to the pumps, we select high-performance pumps to improve equipment efficiency.

The use of advanced automatic control system enables the systems to operate in an optimum condition, to improve the energy use level of the whole plant.

Strengthening heat insulation and thermal insulation of the equipment and piping, we adopt the high-temperature equipment and piping all made of high-quality thermal-insulation material, to reduce heat dissipation and improve heat recovery rate of devices and systems.

7.2.3.2 Comprehensive Utilization of Resources

(1) Rational utilization of water resources and water-saving evaluation

The technical transformation project has taken a lot of water-saving measures, and we adopt recycled water as far as possible as the major industrial water and cooling water of each device of this project, to achieve water reuse and conservation of water resources. The technical transformation project uses a total of 27776.3t / h of industrial water, 626.3t / h of fresh water only and 27150t / h of circulating cooling water, wherein, circulating water accounts for 97.7% of the total water consumption.

⑵ Recycling of industrial waste gas

The desulfurization device produces high concentrations of sulfur emissions, so we set the sulfur recovery unit to recover sulfur to produce brimstone, and the system's sulfur resource utilization rate is about 90%.

Waste combustible gas generated by production devices is sent to the fuel gas system for recovery.

⑶ Comprehensive utilization of solid waste

Coal gasification residues will be sent to building material factories to be used as building materials;

Waste catalyst and waste molecular sieve will be recycled by manufacturers;

The ash discharged from the boiler is high in activity, with a prospect of utilization, as it is good raw material to pave the way and producing cement. According to the comprehensive utilization agreement, the ash generated in this project will be shipped to the building material plants to be used as an admixture of building material.

7.2.3.4 Resources and Energy Utilization Indicators

By referring to the requirements of Table 4 in the *Clean Production Standard (Nitrogen Fertilizer Manufacturing Industry) (draft)* and comparing with related indicators of this project, the result is shown in Table 7.2-6.

Table 7.2-6 Table for clean production level evaluation in terms of resources and energy utilization indicator requirements

Table 4 Requirements for resources and energy utilization indicators in the *Clean Production Standard (Nitrogen Fertilizer Manufacturing Industry) (draft)*				Transformation project
Indicator	Level 1	Level 2	Level 3	
Comprehensive energy consumption GJ / t ammonia	≤38.0	≤48.0	≤53.0	Level 3 (48.2)
Fresh water consumption t / t ammonia	≤20.0	≤40.0	≤60.0	Level 1 (16.5)
Ammonia utilization rate%	≥98.0	≥96.0	≥94.0	Level 2 (97.6)
Water cycling rate%	≥95.0	≥90.0	≥85.0	Level 1 (97.7)

From the comparison results, the resources and energy utilization indicators of the technical transformation project have reached the domestic advanced level of clean production (Level 2), but some indicators show that clean production work can be further improved.

7.2.4 End-of-pipe Treatment and Pollutant Emission

The technical transformation project uses a series of pollution prevention and control measures to achieve industrial pollution end-of-pipe treatment, including the newly built production wastewater deep biochemical treatment measures, the newly built incident drainage collection pool, etc. Please see Chapter VI Analysis of Environmental Protection Measures for details.

By referring to the requirements of Table 2 and Table 6 in the Clean Production Standard (Nitrogen Fertilizer Manufacturing Industry) (draft) and comparing with related indicators of this project, the result is shown in Table 7.2-7 and Table 7.2-8.

Table 7.2-7 Table for clean production level evaluation in terms of waste recycling requirements

Table 2 Requirements for waste recycling in the *Clean Production Standard (Nitrogen Fertilizer Manufacturing Industry) (draft)*					Transformation project
Indicator		Level 1	Level 2	Level 3	
Waste water	Cyanide-contained wastewater recycling rate	90%	80%	60%	Level 1
	Ammonia -contained wastewater recycling rate	98%	95%	90%	—
	Oily wastewater recycling rate	90%	80%	70%	—
	Sulfur-contained	98	95	90	Level 1

	wastewater recycling rate				
Waste gas	H2S-contained gas recycling rate	98	98	95	Level 1
	CO resurgent gas recycling rate	100			Level 1
Waste residue	Coal ash treatment and disposal rate	100			Level 1
	Cyanide-contained sludge treatment and disposal rate	100			Level 1
	Precious-metal-contained waste catalyst treatment and disposal rate	100			Level 1

Table 7.2-8 Table for clean production level evaluation in terms of pollutant generation indicator requirements

Table 6 Requirements for pollutant generation indicators in the *Clean Production Standard (Nitrogen Fertilizer Manufacturing Industry) (draft)*					Transformation project
Indicator		Level 1	Level 2	Level 3	
Waste water	Waste water volume m^3/t of ammonia	≤10.0	≤30.0	≤50.0	Level 1
	Ammonia nitrogen in wastewater kg / t of ammonia	≤0.6	≤3.6	≤6.0	Level 1
	COD in wastewater kg / t of ammonia	≤1.5	≤6.0	≤9.0	Level 1
	Cyanide in wastewater kg / t of ammonia	≤0.003	≤0.01	≤0.02	Level 1
	Suspended solids in wastewater kg / t of ammonia	≤0.7	≤3.0	≤7.0	Level 1
	Oil in wastewater kg / t of ammonia	≤0.1	≤0.2	≤0.3	Level 1
	Volatile phenol in wastewater kg / t of ammonia	≤0.002	≤0.003	≤0.005	—
	Sulfide in wastewater kg / t of ammonia	≤0.01	≤0.02	≤0.03	Level 1
	Wastewater pH	≥6，≤9			Level 1
Waste gas	Ammonia nitrogen in waste gas kg / t of ammonia	98	Level 1	95	Level 1
	Particulate matter kg / t of ammonia	100			Level 1

From Table 7.2-7 and Table 7.2-8, we can see that the waste recycling requirements and pollutant generation indicators of the technical transformation project have reached the international advanced level of clean production (Level 1).

By adopting the above-mentioned clean production technology, waste utilization measures and pollution end-of-pipe treatment measures, the technological transformation project will control the emission volume of pollutants at a lower level.

7.2.5 Clean production Evaluation in terms of Environmental Management Requirements

The environmental management requirements in Table 3 in *the Clean Production Standard (Nitrogen Fertilizer Manufacturing Industry) (draft)* is seen in Table 7.2-9.

Table 7.2-9 Table for clean production level evaluation in terms of environmental management

<table>
<tr><td colspan="5">Table 3 Requirements for environmental management in the Clean Production Standard (Nitrogen Fertilizer Manufacturing Industry) (draft)</td></tr>
<tr><td colspan="2">Indicator</td><td>Level 1</td><td>Level 2</td><td>Level 3</td></tr>
<tr><td colspan="2">Environmental laws and regulations</td><td colspan="3">in line with national and local environmental laws and regulations relating to emission of pollutants to achieve the national and local emission standard total emission control and emission permit management requirements</td></tr>
<tr><td colspan="2">Organization</td><td colspan="3">setting up a specialized environmental management organization and full-time management personnel</td></tr>
<tr><td colspan="2">Environmental audit</td><td>carrying out clean production audit in accordance with standard procedures, and establishing and running the environmental management system in accordance with ISO14001, with complete program files and operating documents for environmental management manuals</td><td>carrying out clean production audit in accordance with standard procedures, auditing the environmental management system and improving the original records, with complete and effective statistics</td><td>carrying out clean production audit in accordance with standard procedures, auditing the original records of the environmental management system, with basically complete statistic data</td></tr>
<tr><td rowspan="3">Environmental management in the process of production</td><td>Consumption and mass of raw materials</td><td>There are strict inspection automatic measurement and control measures</td><td>There are quite strict inspection measurement and control measures</td><td>There are inspection measurement and control measures</td></tr>
<tr><td>Production process operation and management</td><td>Trouble-free running, equipment intact rate up to 99</td><td>Trouble-free running, equipment intact rate up to 98</td><td>Trouble-free running, equipment intact rate up to 96</td></tr>
<tr><td>Job training</td><td>All production positions are subject to rigorous training on a regular basis</td><td>Major production positions are subject to rigorous training</td><td>All production positions are subject to rigorous training</td></tr>
</table>

	Production equipment management	There is a sound management system, and it is strictly implemented	There is a specific management system for major production equipment management, and it is strictly implemented	There is a specific management system for major production equipment management, and it is implemented
	Water, electricity and gas management	There are automatic measuring instruments, and the system of quantitative assessment is strictly executed	There is are automatic measuring instruments for key links, and the system of quantitative assessment is strictly executed	Measurement for key links
	Emergency treatment	There is a strict emergency response plan	There is quite a strict emergency response plan	There is an emergency response plan

Table 7.2-9 Table for clean production level evaluation in terms of environmental management (continued)

Environmental management department	management system	Complete and improve it and incorporate it into the daily management to strictly implement	Complete and improve it and incorporate it into the daily management	Quite complete and sound
	management plan	Formulate short-term and long-term plans and supervise the implementation	Formulate short-term plans and supervise the implementation	Formulate daily plans and supervise the implementation
	Environmental protection facility operation management	Record operational data in a detailed manner and set up a environmental protection record	Record operational data and set up a environmental protection record	Record operational data and make statistics
	Pollution source monitoring system	Major pollution sources and pollutants are equipped with the automatic monitoring capability	Major pollution sources and pollutants are equipped with the monitoring capability	Water-gas pollution sources and pollutants are equipped with the monitoring capability
	Exchange of information	with the computer network management system	with the computer management system	regular exchange

Related party environmental management	Raw and accessory material supplier, cooperator and service supplier	The service agreement explicitly states the health and safety and environmental protection requirements for raw and accessory materials in the process of packaging, transportation and loading and unloading	Explicitly state the health and safety and environmental protection requirements for raw and accessory materials in the process of packaging, transportation and loading and unloading	Explicitly state the health and safety and environmental protection requirements for raw and accessory materials in the process of packaging, transportation and loading and unloading
	Transfer of and prevention against hazardous waste	Strictly implement in accordance with requirements, and establish the accounting book for periodic inspection	Establish the accounting book in accordance with requirements for periodic inspection	Implement in accordance with requirements, and establish the accounting book

For the advanced technology and production scale of the technological transformation project, the evaluation recommends that the company should effectively strengthen construction of rules and regulations, and strengthen management in accordance with the environmental management requirements of the clean production standards.

7.2.6 Clean Production Evaluation of Technical Transformation Project Products

Table 5 Requirements for Product Indicators in the *Clean Production Standard (Nitrogen Fertilizer Manufacturing Industry) (draft)* refers to the indicators of urea and NH HCO, which is shown in Table 7.2-10.

Table 7.2-10 Table for clean production level evaluation in terms of product indicators

Table 5 Product Indicators in the *Clean Production Standard (Nitrogen Fertilizer Manufacturing Industry) (draft)*					Existing project
Indicator		Level 1	Level 2	Level 3	
Urine	Nitrogen content (on dry basis)	46.2	46.0	46.0	Level 1 (existing)
	Biuret content	1.0	1.5	1.5	Level 1 (existing)
	H2O content	0.5	1.0	1.0	Level 1 (existing)
NH HCO	Nitrogen content	17.1	16.8	16.8	Level 1 (existing)
	H2O content	3.5	5.0	5.0	Level 1 (existing)

We can see from Table 7.2-10 that the product indicator requirements of the technical transformation project have reached the international advanced level of clean production (Level 1).

7.2.7 Clean Production Evaluation Conclusion for the Technical Transformation

Project

The above analysis and comparison shows that technical transformation project's production process and equipment requirements, resources and energy utilization indicators, product indicators, pollutant generation indicators and waste recycling indicators have significantly improved compared with the existing production level, basically achieving the advanced or moderate upper level in the domestic nitrogen industry. The evaluation recommends the technical transformation project to strengthen environmental management system construction, so as to meet the relevant regulatory requirements and fully achieve clean production. On the whole, the evaluation has found that the technological transformation project adopts the effective end-of-pipe treatment measures, and it will comply with clean production requirements after strengthening environmental management (see the chapter on analysis of environmental protection measures).

8 Environmental Risk Assessment

8.1 Purpose and Scope of Evaluation

Environmental risk assessment is to point out the accident prevention measures and emergency response measures after the accident for the potential causes of accidents (accident sources) in the process of project construction and operation based on analyzing the probability of an accident and forecasting the degree of impact of the accident, so as to minimize the impact of project construction environmental risks, so that the degree of risk of the project can reach an acceptable level.

One of the main conditions for environmental risk assessment to differ from safety assessment is: the scope of environmental risk assessment is the regional environment, including natural environment, social environment and ecological environment, so in most cases, it will assess the impact of the transfer of pollutants on the regional environment after the occurrence of sudden pollution accidents, and the evaluation will cover all kinds of pollution-affected areas outside the factory; while the scope of safety evaluation is the personnel and property damage within the scope of exposure to the accident after the device safety accident, and the blasting of equipment is usually limited in the boundary of the factory. Therefore, the scope of environmental risk assessment is the area with environment affected after the occurrence of sudden pollution accidents.

According to the requirements of the Environmental Protection Agency (90) No. *057 Notice on Conducting Environmental Risk Assessment on Major Potential Accidents*, it is necessary to carry out environmental risk assessment on the project's production and storage units, with a view of recognizing the degree of risk of the planned project, dangerous links and the impact of the accident consequences, so as to increase awareness of risk management, take necessary preventive measures to reduce environmental hazards, and propose emergency response measures and plans to achieve safe production and economic development.

Project environmental assessment relates to the existing project, the under-construction and the off-site technological transformation project of Henan Junma Chemical Industry Co., Ltd. When the technical transformation project is completed, it will adopt the Texaco gas generating device to replace the existing fixed bed gas generating device, and the new synthetic ammonia devices and the ammonia storage tanks of the technical transformation project plant replace the synthetic ammonia devices and the ammonia storage tanks of the existing project plant, and the under-construction project makes use of the synthetic gases of the technical transformation project to produce methanol. The project involves the synthetic gases (H_2, CO), NH_3 and methanol are dangerous chemicals, so environmental risk assessment is necessary. The synthetic ammonia and synthetic gases generated from the technical transformation project are delivered by pipelines to the existing project and the under-construction methanol project to produce urea and methanol, and the gas generating device of the existing project is eliminated; because the ammonia storage tanks of the existing project have also been moved to the technological transformation project plant, the major hazard sources include the ammonia plant tanks of the technical transformation plant, the methanol storage tanks of the under-construction project and the urea devices retained in the existing project.

8.2 Risk Assessment of Technical Transformation Project and Existing Project

8.2.1 Risk Identification

8.2.1.1 Identification of hazardous substances

The hazardous chemicals the technical transformation project mainly relates to refer to H_2, CO and NH_3 involved in production, processing, transport, use or storage of the technical transformation project, and the hazardous chemical the existing project mainly relates to is NH_3 used in the urea production process. According to its MSDS (Material Safety Data Sheet) data analysis (see Table 8.2-1), it can be seen that (1) NH_3, CO and H_2 have a risk of blasting, (2) CO and NH_3 are toxic.

Based on the risk assessment guidelines in Appendix A.1, NH_3 and CO are consistent with the "toxic substance determination standard number 3", being generally toxic; and NH_3, CO and H_2 are consistent with Appendix A.1 "flammable substance and explosive substance standards", being dangerous substances for fire and explosion.

8.2.1.2 Identification of hazardous sources

Based on the risk assessment guidelines, a dangerous substance in production, processing, transport, use or storage whose quantity is equal to or exceeds the critical amount of functional units is defined as a significant hazard.

In accordance with Significant Hazard Source Identification (GB18218-2000), we can identify the gas generating unit and the ammonia storage unit of the technical transformation project and the urea unit ammonia transmit pipeline of the existing project should be significant hazard sources.

Table 8.2-1 MSDS data of major chemicals

Substance / Category		Ammonia	CO	Hydrogen
Physical and chemical properties	Appearance	Colorless and odorless gas	Colorless gas with pungent odor	Colorless and odorless gas
	Molecular weight	28.01	17.03	2.01
	Melting point (℃)	-199	-77.7	-259.2
	Boiling point (℃)	-191	-33.5	-252.8
	Density	0.79	0.82/-79℃	0.07/-252℃
	Saturated vapor pressure (kPa)	Insignificance	506.62/4.7℃	13.33/-257.9℃
Toxicity	Toxicity grade *	Level Ⅱ(high hazard)	Level Ⅲ (moderate hazard)	——
	Toxicity index	LC50 1807mg/m3	LD50 350mg/kg	No data
Blasting	Flash point (℃)	<-50	No data	<-50
	Self-ignition point (℃)	610	651	400

	Explosion limit (v/v)	12.5~74.2	15.7~27.4	4.1~74.1
	Fire insurance rating	B	B	A
Risk characteristics		When it is mixed with air, explosive mixture is formed; naked flame and high heat can cause burning and explosion; In case of high heat, the pressure within the container is increased, causing the risk of cracking and explosion. Low concentration has an irritant effect on the mucous membrane; high concentration can cause tissue lytic necrosis, causing chemical pneumonia and burns; and ammonia can cause reflex respiratory arrest. The splashing of ammonia into eyes can cause lens opacity, cornea perforation and even blindness.	When it is mixed with air, explosive mixture is formed; naked flame and high heat can cause burning and explosion; In case of high heat, the pressure within the container is increased, causing the risk of cracking and explosion. This product combines with hemoglobin in the blood, causing tissue hypoxia and even death in case of in-depth poisoning; and long-term inhalation of a certain amount of CO can cause damage to nerves and blood vessels.	When it is mixed with air, explosive mixture is formed; naked flame and high heat can cause burning and explosion; as this gas is lighter than air, in case of indoor use and storage, the leaked gas rises and occlude the roof, causing difficulty in discharging, and explosion could happened when it is exposed to sparks. In case of very high concentrations, the reduction of normal partial pressure of oxygen can cause suffocation, and paralysis can occur in case of very high partial pressure.

Emergency response to leakage	Immediately evacuate personnel from the leak-contaminated area to a windward place, and immediately isolate for 150m, and strictly restrict ingress and egress. Cut off the fire source. It is better for the emergency personnel to wear self-contained positive-pressure breathing apparatus and anti-static clothing. Cut off the source of leakage as much as possible. Implement reasonable ventilation to accelerate diffusion. For the area with high concentration of leakage, spray fog-like water containing hydrochloric acid to neutralize, dilute and dissolve. Build a causeway or dig a pit to take in large volume of wastewater. If possible, use an exhaust fan to send the residual gas or leaked gas into the washing tower or the fume hood connected with the tower. It is better to set dilute-acid spraying facilities in the area with storage tanks. Leaking containers should be properly handled and could not be used until repaired and tested.	Immediately evacuate personnel from the leak-contaminated area to a windward place, and immediately isolate for 150m, and strictly restrict ingress and egress. Cut off the fire source. It is better for the emergency personnel to wear self-contained positive-pressure breathing apparatus and anti-static clothing. Cut off the source of leakage as much as possible. Implement reasonable ventilation to accelerate diffusion. Spray fog-like water to neutralize, dilute and dissolve. Build a causeway or dig a pit to take in large volume of wastewater. If possible, use an exhaust fan to send the residual gas to an open place or install an appropriate spray nozzle to burn it, or use pipelines to lead it into the furnace and mulde to burn it. Leaking containers should be properly handled and could not be used until repaired and tested.	Immediately evacuate personnel from the leak-contaminated area to a windward place, and immediately isolate, and strictly restrict ingress and egress. Cut off the fire source. It is better for the emergency personnel to wear self-contained positive-pressure breathing apparatus and anti-static clothing. Cut off the source of leakage as much as possible. Implement reasonable ventilation to accelerate diffusion. If possible, use an exhaust fan to send the residual gas to an open place or install an appropriate spray nozzle to burn it. Leaking containers should be properly handled and could not be used until repaired and tested.

* Toxicity classification is based on *Harmful Level Classification of Occupational Exposure to Poison* (GB5044-85) and the WHO acute toxicity classification table.

Table 8.2-2 Critical amount of *Significant Hazard Source Identification*

Type	Name of substance	Standard critical amount（t）		Actual measurement（t）	
		Production	Storage	Production	Storage
Toxic substance	ammonia	40	100	32.5	621
	CO	2	5	＞2	＞5

Flammable substance	Hydrogen	1	10	> 1	> 10

* Hour online generation amount

8.2.1.3 Evaluation Level

Based on the risk assessment guidelines, the determination results of the substance risks of the evaluation project and the significant hazard sources of functional units, as well as environmental sensitivity and other factors, the environmental risk assessment work is divided into Level 1 and Level 2 as in Table 8.2-3.

Table 8.2-3 Evaluation Level (Level 1, Level 2)

	Toxic substance	Hazardous substance	Combustible and flammable substance	Explosive substance
Major hazard source	Level 1	Level 2	Level 1	Level 1
Non-major hazard source	Level 2	Level 2	Level 2	Level 2
Environmentally sensitive area	Level 1	Level 1	Level 1	Level 1

NH_3 and CO are consistent with "toxic substance determination standard number 3", being generally toxic; and NH_3, CO and H_2 are consistent with Appendix A.1 "flammable substance and explosive substance standards", being dangerous substances for fire and explosion; the gas generating units and the ammonia storage units of the technical transformation project are among the major hazard sources, and the ammonia production units are non-major hazard sources; it can be judged that the technical transformation project risk assessment rating is Level 1.

In the technical transformation project, the synthetic gases (CO, H_2) are intermediate products, production and consumption are concurrent, and the main danger of the gas generating device is blasting, which is concentrated within the plant, therefore, the environmental risk assessment in this chapter will mainly considerate the ammonia storage units.

The primary consideration of the existing project is the fire and explosion hazards resulting from pipeline damage during the pipeline transmit of NH_3.

8.2.1.4 Accident Statistics Analysis

(1) China's chemical industry enterprise accidents

According to the statistics of China Chemical Industry Safety and Health Technology Association, the casualties of China's medium-sized chemical enterprises from 1949 to 1995 are seen in Table 8.2-4 and Table 8.2-5.

Table 8.2-4 Table for statistics of posts subject to casualty

Item	Number of accident case	Serious injury	Death
Total	922	766	303
others	378	308	99
boiler	43	39	12
Raw material	58	44	24
Gas generating	146	128	53
desulfurization	17	10	10
Conversion	24	27	7
decarbonization	19	18	6
refining	3	3	8
compressing	21	16	5
Synthesizing	76	58	32
ammonia system	13	6	10
urea	35	33	13
NH HCO	29	23	7
Soda	8	7	1
ammonium nitrate	49	41	15
formaldehyde methanol	3	3	1

Table 8.2-5 Table for statistics of casualties in various accidents

Category	Number of accident case	Serious injury	Death
Total	922	766	303
Object crash	101	87	16
Wheel injury	77	59	21
Mechanical injury	191	169	23
Hoisting injury	83	71	13
Electric shock	39	17	26
Drowning	2	0	2
Fire	12	14	11
Burning	53	63	23
High falling	205	157	52
Collapse	14	19	6
Physical explosion	17	14	12
Chemical explosion	46	39	48
Poisoning and suffocation	44	24	45
Others	38	33	5

It can be seen that gas generating and synthesis posts within the scope of risk assessment see a higher accident rate, together accounting for about 24% of the accident statistics; and physical explosion, chemical explosions and poisoning and suffocation among the accident types account for about 33%. These incidents will lead to spread of CO, NH_3, CH_3OH and other harmful toxic substances, leading to environmental pollution.

(2) Oversea chemical incidents

According to report, among the sudden onset of chemical incidents registered in 95 countries between 20 to 25 years before 1987, the proportion of ammonia accidents is 16.1%, ranking the second; among the accident source, the storage and transportation accidents reach up to 66.9 %, with mechanical failure and crash as the main part, shown in Table 8.2-6.

Table 8.2-6 Classification of chemical accidents

Category	Name	Percentage %
Category of chemicals	LPG	2.53
	Gasoline	18.0
	Ammonia	16.1
	Kerosene	14.9
	Chlorine	14.4
	Crude oil	11.2
Physical form of liquid chemicals	Liquid	47.8
	LPG	27.6
	Gas	18.8
	Solid	8.2
Accident sources	Transport	34.2
	Process	33.0
	Storage	23.1
	Transport	9.6
Accident causes	Mechanical failure	34.2
	Crash accident	26.8
	Human Factors	22.8
	External factors (earthquake, lightning)	15.2

According to statistical analysis of large accidents with losses of more than 10 million U.S. dollars device by device distribution (Table 8.2-7), the area with storage tanks sees the highest rate of accidents, being 16.8%.

Table 8.2-7 Large incidents by device distribution

Number category	Tank area	polyethylene	ethylene processing	Natural gas transmission	ethylene	hydrogenation	Catalytic air	alkylation
Ratio(%)	16.8	9.5	8.7	8.4	7.3	7.3	7.3	6.3
Device type	Oil tanker	coking	distillation	solvent deasphalting	rubber	Synthetic ammonia	Power plant	
Ratio(%)	6.3	4.2	3.16	3.16	1.1	1.1	1.1	

Through the analysis of large accident causes by device (Table 8.2-8), we can see that valve and pipeline leak is the main cause of the accidents, followed by equipment failures and operational errors.

Table 8.2-8 Classification and proportion of accident causes

No.	Classification of accident causes	Proportion %
1	valve and pipeline leak	35.1
2	pump equipment failure	18.2
3	operational error	15.6
4	meter and electric appliance malfunction	12.4
5	response out of control	10.4
6	lightning and other natural disasters	8.2

(3) Typical cases of accident

According to the information query, the typical cases of accidents related to the technical transformation project are listed in Table 8.2-9.

Table 8.2-9 Typical cases of accident

No.	Time and place	Accident type	Consequences of the accident	Causes of the accident	Data sources
1	1987.10.31, a fertilizer plant in Guizhou Province	Ammonia was leaked, and blasting occurred	Environmental pollution	fatigue fracture of the ventilation pipe of the synthetic cycle machine,	Chemical Equipment Accident Analysis and Prevention
2	2003.9.6, Changchun Changying Highway	A heavy tanker carrying more than 20 tons of liquid ammonia was toppled	The plants within 2 km were damaged to varying degree, 1 dead and 4 injured.	Violation of the provisions of transport	Internal information

3	1991.1.26, a factory in Benxi	The middle slot of the ammonia spherical tank was over-pressed and blasted, leaking 10 tons of ammonia	Environmental pollution, and the on-site operator was choked to death	Operation error	Internal information
4	1987.10.31, a fertilizer plant in Guizhou	Ammonia was leaked, and blasting occurred	Environmental pollution	fatigue fracture of the ventilation pipe of the synthetic cycle machine,	Chemical Equipment Accident Analysis and Prevention

The accident statistical analysis shows that, as far as the contents of this project, the source of the major environmental risk accidents lies in storage and transportation and production, and the cause of the accident is highlighted by material wearing, illegal operation, overloading transport and equipment failures, resulting in serious consequences and even malignant accidents.

8.2.2 Determining the most credible accident of the project

(1) Accident tree analysis

From the above accident source analysis and accident statistics analysis, it can be seen that for chemical companies, the blasting and toxic properties of major hazardous substances determine the possibility that chemical projects cause fire, explosion and environmental pollution. Different accidents vary in causing factors, injury mechanism, time of hurting and space scales, and interplay ad influence with each other, as shown in Figure 8.2-1. The tree analysis of the type of accident caused by material leak of the chemical project is seen in Figure 8.2-2.

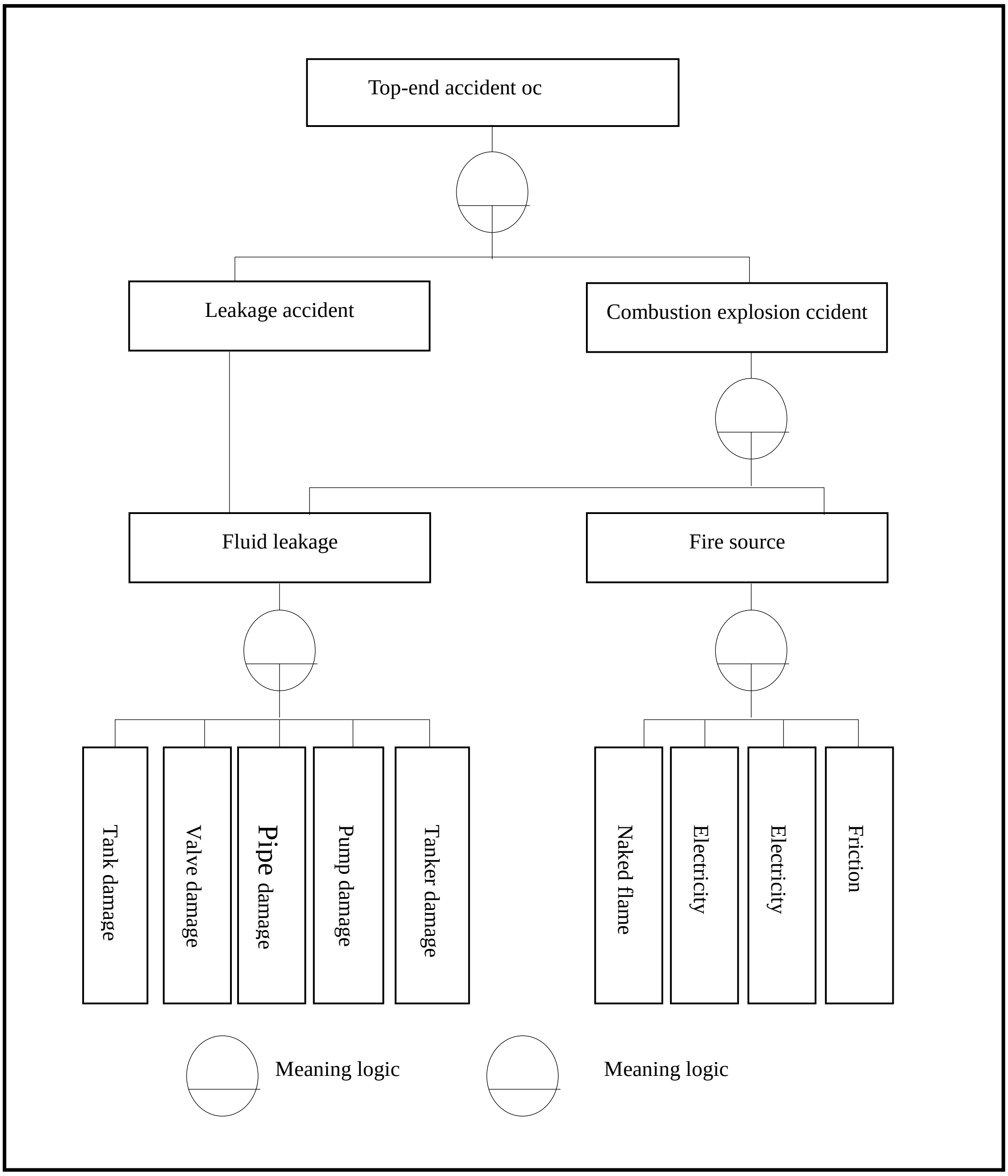


Figure 8.2-1 Correlation between top-end accident and basic event

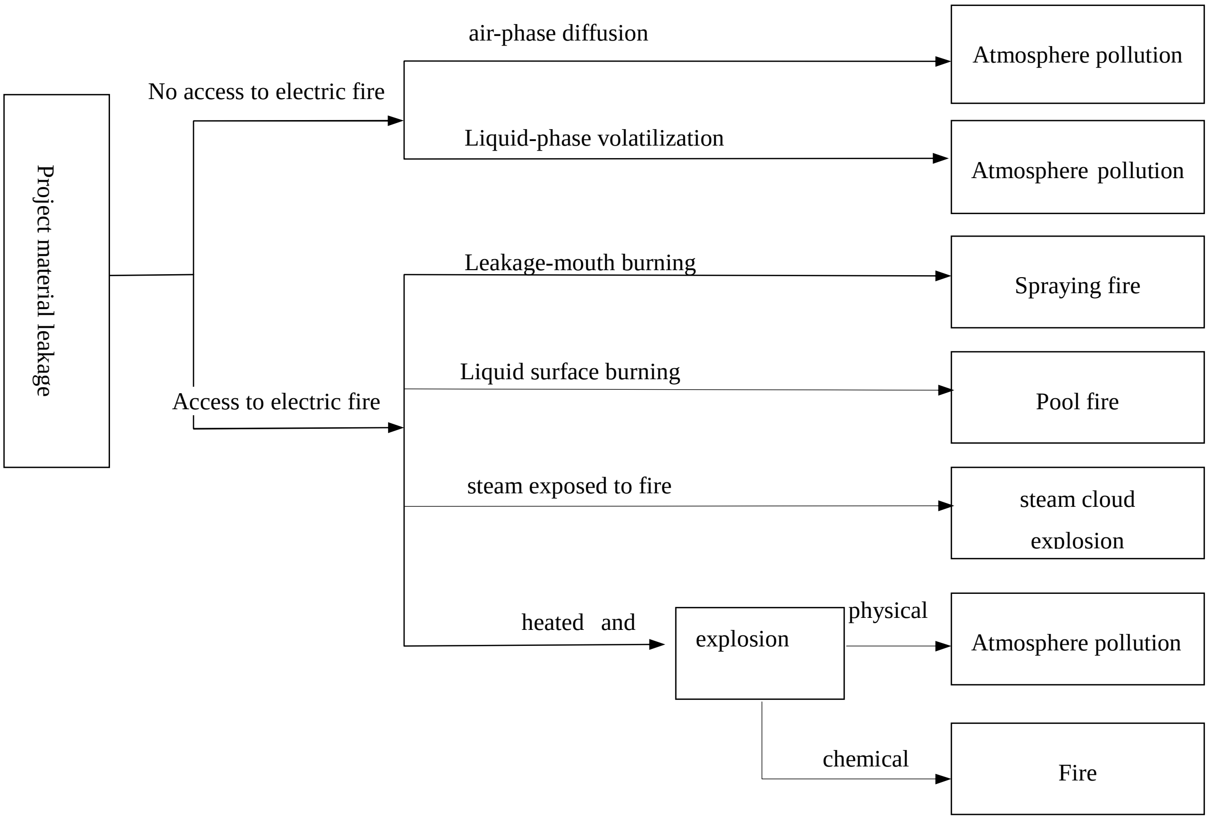


Figure 8.3-2 Accident type tree figure

(2) Accident probability analysis

According to information report, we summarize the probability of occurrence of varying degree of accidents caused by accident units of chemical enterprises and measure requirements as seen in Table 8.2-10.

Table 8.2-10 Probability of occurrence of varying degree of accidents and countermeasures

Name of accident	Probability of occurrence (times / year)	Frequency of occurrence	response reaction
Small leakage accidents resulting from damage of pipes, pumps, valves and tank cars	10-1	Probably occur	Must take measures
Leakage accidents resulting from rupture of pipelines, storage tanks and reaction kettles	10-2	Occasionally occur	Need to take measures
Pipelines, valves, tanks and other serious leakage accidents	10-3	Occasionally occur	Take countermeasure

			s
Tanks and other major explosion and bursting accidents	10-4	Seldom occur	Concern and prevent
Accidents caused by major natural disasters	10-5—10-6	Almost never occur	Pay attention and concern

It can be seen that the probability of major accidents resulting from pipelines, valves, tanks and so is Level 10-3 and below. After taking a more secure storage device, the accident probability can be reduced to 10-4 / year.

(3) Determining the most credible accident of the project

The basic event correlation and fault tree analysis show that the environmental risk accident that may be caused by the technological transformation project is atmospheric pollution, and the key for resulting in pollution accidents lies in material leakage. Whether the basic event is material defect, mechanical collision, or operational errors and other reasons, material leakage will eventually lead to the top-end accident.

As a result, risk evaluation of the technological transformation project and the existing project will be mainly based on material leakage; by incorporating accident probability of gas-generating units, ammonia storage, transport units, etc., seriousness of consequences of the accident and other factors, according to the characteristics of environmental risk assessment, we determine the most credible accidents of the technical transformation project as follows:

(1) Serious leakage of liquid ammonia caused by ammonia spherical tank rupture;

(2) Ammonia spherical tank valve pipeline leakage.

The most credible accidents of the existing projects are:

(1) Ammonia pipeline leakage.

8.2.3 Source Term Analysis for the Technical Transformation Project

(1) Ammonia leakage rate calculation

Ammonia storage of the project is to store ammonia at room temperature and pressure conditions, being the pressurized liquefied gas, and its leakage rate is calculated according to the liquid leakage rate formula:

Q=Cd×Ar×ρ[2(ΔP/ρ)+2gh]0.5

Wherein: Q-leakage rate, (kg / s)

Ar-discharge area, m2. The material leaking points on the storage tank due to corrosion, welding and external bumping are more concentrated where the storage tank is connected with the feeding and discharging pipes, with an area of 20% -100% of the diameter.

Cd-emission factor, generally 0.60-0.64

ρ-fluid density, kg/m3

ΔP-storage pressure and atmospheric pressure difference, N/m2

g-acceleration due to gravity, m/s2

h- height from the liquid level in the storage tank to the discharge point, m.

Storage of hazardous substances is seen in Table 8.2-11.

Table 8.2-11 Main parameters of the storage of hazardous substances

Material name	temperature / pressure	vessel size (mm)	adapter caliber	storage container
Ammonia	room temperature /1.7MPa	φ6200	φ80	Spherical tank

he calculation results of the accident leakage source strength are shown in Table 8.2-12.

Table 8.2-12 Accident leakage source strength

Scale of leakage accident	medium-scale	large-scale	supers-scale
Leaked substance	ammonia	ammonia	ammonia
Leakage source	Piping systems	Piping systems	spherical tank
Leakage caliber	20% of the caliber	100% of the caliber	rupture
Storage parameters	1.7Mpa/ room temperature	1.7Mpa/ room temperature	1.7Mpa/ room temperature
Leakage state	Continuous leakage for 10 minutes	Continuous leakage for 10 minutes	sudden rupture
Leakage source strength	26.51kg/s	133.18kg/s	complete leakage

Leakage state is set by accident analog investigation, project accident prevention design measures and emergency handling capacity of the factory. Generally, after the storage tank leakage accident can be controlled 10 minutes after giving an alarm, plugging, spraying and other measures, completing disposition of the leaked substances.

(2) Liquid volatilization calculation of ammonia leakage

Normally, the liquid volatilization after the leakage is divided into flash, thermal evaporation and mass evaporation in accordance with its mechanism, and its total volatilization is equal to the sum of such three evaporations.

Flash

As ammonia is a liquefied gas stored in pressurized container at room temperature, the liquid boiling point (-33 ℃) is far lower than the ambient temperature, the liquid is suddenly evaporated (flash evaporation occurs) due to decrease of pressure when it flows across the crack. Its flash coefficient is calculated with the following formula:

$$F = C_p \frac{T_L - T_b}{H}$$

Wherein, Cp - constant pressure specific heat of the liquid, J/(kg·K);

TL - liquid temperature before leakage, K;

Tb - liquid boiling point at atmospheric pressure, K;

H - vaporization heat of the liquid, J / kg.

In fact, at the time of leakage, the directly evaporated liquid forms in the form of small fogs into clouds, and mix with air to absorb heat and evaporate. If the heat the air passes to the liquid fogs is not enough to enable it to evaporate, some liquid fogs will condense into liquid droplets to fall to the ground, and form a liquid pool with the liquid that is not evaporated. According to experience, when F> 0.2, they generally do not form a liquid pool; when F <0.2, there is a linear relationship between F and the taken-away liquid ratio, and usually the amount of substance staying in the steam is 5 times the amount of flash, that is, the emission produced by flash of superheated liquid can be calculated by the following formula:

Qf = 5 F • WT

Wherein, Q1 - flash capacity, kg / s;

WT - liquid leakage rate, kg / s;

F - flash coefficient

Calculated according to the above formula, the flash coefficient of ammonia F = 0.15, the emission produced by flash at the time of leakage is 75% of the leakage rate.

(B) Thermal evaporation

As the ammonia flash coefficient F = 0.15, when it is less than 0.2, the liquid flash is not complete, based on the above calculation result, part (25% of the leakage) of the fluid flows on the ground and absorb the heat on the ground to gasify and evaporate, and the evaporation rate is determined by the following formula:

$$Q_2 = \frac{\lambda AS \times (T_0 - T_b)}{H\sqrt{\pi \alpha t}}$$

Wherein, Q2 – thermal evaporation, evaporation rate, kg / s;

T0 - ambient temperature, k;

Tb - boiling point temperature; k;

S - area of the liquid pool;

H - liquid vaporization heat; J / kg;

λ - thermal conductivity coefficient of the surface (see Table 8.2-13), ω / m • k;

α - thermal diffusivity coefficient of the surface (see Table 8.2-13), m2 / s;

t - evaporation time, s.

Table 8.2-13 Nature of some of the ground heat transfer

Condition of the ground	λ (ω/m·k)	α (m2/s)
Cement	1.1	1.29×10-7

(C) When the ground surface heat transfer stops, heat evaporation is over, converting to air movement of the liquid pool surface so as to evaporate the liquid, and this process is called mass evaporation.

Based on the above formula for calculating estimates of thermal evaporation, the ammonia thermal evaporation is faster, that is, due to flash and thermal evaporation, all the ammonia quickly volatile into gases within a short time after the leakage, rather than mass evaporation. Therefore, the speed of ammonia leakage is approximately equal to its evaporation rate.

8.2.4 Consequence Forecasting

8.2.4.1 Forecasting model

(1) Forecasting model and diffusion parameters

According to sudden property of the substance leakage and mobility of toxic vapor diffusion, the evaluation adopts the multi-puff superposition model to forecast the down-wind ground-level concentration, that is, we treat the pollutants discharged within Δt time as a transient puff, and its emission is θi • Δt = θ, in order to obtain the down-wind ground-level concentration of the continuous source, we can treat the down-wind ground-level concentration caused by continuous emission within the T period as the superposition of concentration caused by a number of instant puffs within Δt time at this point. The multi-puff model for calculating the down-wind ground-level concentration is as follows:

$$C_i = \frac{2\theta_i}{(2\pi)^{3/2}\sigma_x\sigma_y\sigma_z} \exp\left\{-\frac{\{X-u(t-t_{io})\}^2}{2\sigma_x^2}\right\} \cdot \exp\left(-\frac{Y^2}{2\sigma_y^2}\right) \cdot \exp\left(-\frac{H^2}{2\sigma_z^2}\right)$$

$$C(x,t) = \sum_{i=1}^{n} C_i(x, t-t_{io})$$

Wherein: θi --- the mass of the ith puff, mg

C (x, t-ti0) – contribution of the ith puff to the concentration x meters down wind at t time, mg/m3

σxσyσz- puff diffusion parameter, m

t-tio - puff running time, s

tio - the beginning time for the ith puff to release

n - number of released puffs

x - down-wind axis distance from the down-wind ground-level concentration point to the puff discharging point, m

u - average wind speed of the height of puff emission, m / s

H - effective emission height, m

The puff model diffusion parameter adopts the data in Table B6, Article B3 of Appendix B Atmospheric Stability and Diffusion Parameters in HJ/T2.2-93 Environmental Impact Assessment Technical Guideline (Atmospheric Environment).

(2) Weather conditions for the accident occurrence

The weather conditions of the area where the project is located is seen in Chapter 5.1.1.1.

(3) Population distribution around the plant

The population distribution around the technical transformation project plant is seen in Table 8.2-14.

Table 8.2-14 The population distribution around the technical transformation project plant

No.	Name	Direction to the accident source	Distance to the accident source (m)	Population (persons)
1	Dongliuli Village	N	1100	1000
2	Niu Village	E	100	200
3	Zhouwan Village	W	800	2000

* Niu Village will be moved, as seen in Annex 10

The population density within the technological transformation plant is 500 / km) ^{2}.

8.2.4.2 Technical transformation project forecasting calculation results and analysis

(A) Forecasting calculation results

Considering the probability of accident, hazard level and the most effected area, etc., as a conservative calculation, we use the adverse weather conditions (U <1m / s) to forecast the impact on the surrounding sensitive spots.

Table 8.2-15 The maximum down-wind axis ground-level concentration (mg/m3) after the ammonia accident of the technical transformation project

Down-wind distance（m）	20% of the pipe diameter is broken				100% of the pipe diameter is broken				Ammonia tank is damaged			
	Atmospheric stability				Atmospheric stability				Atmospheric stability			
	A-B	D	E	F	A-B	D	E	F	A-B	D	E	F
100	2141.24	12249.14	12040.52	28320.3	10742.55	61453.61	60429.3	142082.2	161668.118	675175.11444	702516.000	1381067
200	521.24	2909.76	2848.42	6606.20	22615.04	14598.21	14295.2	33143.12	22857.2	91566.91	95040.1	184948.4
400	117.86	602.76	595.56	1306.59	591.31	3022.60	2989.4	6555.15	3010.11	11640.91	12137.9	23432.0
500	70.61	345.15	344.20	736.04	354.29	1731.36	1727.1	3692.71	1546.50	5968.85	6231.2	12016.5
550	56.42	270.04	270.31	572.08	283.04	1354.77	1356.5	2870.11	1165.66	4490.17	4679.1	9035.1
700	31.25	142.21	143.71	296.62	156.79	713.45	721.1	1488.17	567.58	2180.30	2276.2	4385.95
800	22.27	98.61	100.22	204.27	111.73	494.72	503.3	1024.82	380.41	1461.14	1525.2	2939.38
950	14.20	61.00	62.36	125.42	71.26	306.04	312.8	629.25	227.53	873.07	911.2	1756.04
1000	12.31	52.76	54.01	108.27	62.16	264.69	271.1	543.19	195.15	748.45	781.3	1505.61
1150	8.49	35.38	36.37	72.31	42.57	177.54	182.5	362.77	128.35	492.32	514.4	990.19
1500	4.04	16.38	16.93	33.26	20.31	82.19	84.99	166.87	57.89	221.93	231.5	446.30
1900	2.06	8.18	8.49	16.56	10.34	41.05	42.60	83.05	28.50	109.21	114.2	219.63
1950	1.91	7.58	7.86	15.32	9.59	38.02	39.46	76.91	26.36	101.04	105.1	203.17
2050	1.65	6.53	7.30	13.22	8.30	32.80	36.63	66.30	22.36	86.96	97.7	174.96
2200*	1.35	5.31	6.79	10.71	6.76	26.61	27.65	533.76	18.36	70.36	90.1	141.48
3000	0.54	2.11	5.51	4.25	2.73	10.59	11.02	21.35	7.24	27.75	73.5	55.80
4000	0.23	0.89	2.19	1.80	1.16	4.49	4.68	9.03	3.05	11.70	12.3	23.54
4200	0.20	0.77	0.93	1.56	1.00	3.88	4.04	7.80	2.64	10.11	10.1	20.33
5000	0.12	0.46	0.81	0.93	0.60	2.30	2.15	4.63	1.57	5.99	6.26	12.06
5500		0.35	0.48	0.67	0.45	1.73	1.81	3.37	1.18	4.50	4.70	8.89
6000		0.27	0.36	0.45	0.35	0.98	1.39	2.29	0.91	3.46	3.62	6.35
6500		0.20	0.28	0.29	0.27	0.68	1.09	1.44	0.71	2.64	2.84	4.20
7000		0.09	0.22	0.17	0.22	0.45	0.88	0.85	0.57	1.91	2.28	2.59
7500		0.06	0.17	0.09	0.18	0.28	0.71	0.47	0.46	1.30	1.85	1.49
8000						0.16	0.58	0.23	0.38	0.84	1.53	0.80
8500							0.46	0.11	0.32	0.52	1.27	0.40
9000							0.36	0.05	0.26	0.30	1.07	0.19
9500							0.28	0.02	0.22	0.16	0.77	
10000							0.20	0.007	0.19	0.08	0.60	

(Continued) Table 8.2-15 The maximum down-wind axis ground-level concentration (mg/m3) after the ammonia accident of the technical transformation project

Down-wind distance (m)	20% of the pipe diameter is broken				100% of the pipe diameter is broken			
	Atmospheric stability				Atmospheric stability			
	A-B	D	E	F	A-B	D	E	F
100	1563.10	8941.87	8789.58	20673.82	7842.06	44861.14	44113.39	103720.01
200	380.51	2124.12	2079.35	4822.53	16508.98	10656.69	10435.50	24194.48
400	86.04	440.01	434.76	953.81	431.66	2206.50	2182.26	4785.26
500	51.55	251.96	251.27	537.31	258.63	1263.89	1260.78	2695.68
550	41.19	197.13	197.33	417.62	206.62	988.98	990.25	2095.18
700	22.81	103.81	104.91	216.53	114.46	520.82	526.40	1086.36
800	16.26	71.99	73.16	149.12	81.56	361.15	367.41	748.12
950	10.37	44.53	45.52	91.56	52.02	223.41	228.34	459.35
1000	8.99	38.51	39.43	79.04	45.38	193.22	197.90	396.53
1150	6.20	25.83	26.55	52.79	31.08	129.60	133.23	264.82
1500	2.95	11.96	12.36	24.28	14.83	60.00	62.04	121.82
1900	1.50	5.97	6.20	12.09	7.55	29.97	31.10	60.63
1950	1.39	5.53	5.74	11.18	7.00	27.75	28.81	56.14
2050	1.20	4.77	5.33	9.65	6.06	23.94	26.74	48.40
2200*	0.99	3.88	4.96	7.82	4.93	19.43	20.18	389.64
3000	0.39	1.54	4.02	3.10	1.99	7.73	8.04	15.59
4000	0.17	0.65	1.60	1.31	0.85	3.28	3.42	6.59
4200	0.15	0.56	0.68	1.14	0.73	2.83	2.95	5.69
5000	0.09	0.34	0.59	0.68	0.44	1.68	1.57	3.38
5500		0.26	0.35	0.49	0.33	1.26	1.32	2.46
6000		0.20	0.26	0.33	0.26	0.72	1.01	1.67
6500		0.15	0.20	0.21	0.20	0.50	0.80	1.05
7000		0.07	0.16	0.12	0.16	0.33	0.64	0.62
7500		0.04	0.12	0.07	0.13	0.20	0.52	0.34
8000						0.12	0.42	0.17
8500							0.34	0.08

9000							0.26	0.04
9500							0.20	0.01
10000							0.15	0.01

The forecasting calculation results at different stabilities under the conditions of light winds after the ammonia accident are shown in Table 8.2-15.

(2) Analysis of the consequences

(2.1) Hazardous threshold value of the concentration

The relationship between ammonia and its reaction to the human body and the hazardous threshold of the ammonia concentration are shown in Table 8.2-16 and Table 8.2-17.

Table 8.2-16 Relationship between ammonia and its reaction to the human body

Concentration（mg/m3）	Time (min)	Reaction of human body
3500-7000		may cause immediate death
1750-4500	30	may be life-threatening
700		immediately cough
553		a strong incentive phenomenon, tolerating for 1 minute
175-350	28	cause nose and eye irritation, with breathing and pulse speeding up
140-210		can still work, but feel obviously uncomfortable
140		discomfort in eyes and upper respiratory, nausea, headache
70-140	30	can normally work
70		breathing slows down, skin resistance is reversed
67.2		a sense of irritation in the nasopharynx
9.8	45	No irritation effect
3.5		can identify the gas
0.7		can feel the smell

Table 8.2-17 The hazards corresponding to different ammonia concentration threshold values (mg/m^3)

Substance name	fatal dose	Extremely hazardous	Moderately hazardous	Lightly hazardous	threshold limit value MAC	threshold odor value	Factory boundary standard	Density of the residential area
Ammonia	3500-7000	4500-1750	700	140	20	3.8	1.5	0.2

(2.2) Analysis of the accident consequences

Because the acute toxicity of ammonia is believed as highly toxic, in the event of serious leakage accident (100% of the caliber ruptures and the ammonia tank bursts), the technological transformation project may have an impact of causing extreme injury or resulting in casualties on the residential areas 400m and 550m from the project construction site, exceeding the density of the residential area in short term within 10000m. The existing project may have an impact of causing extreme injury or resulting in casualties on the residential areas 400m and 550m from the project construction site, exceeding the density of the residential area in short term within 9500m.

Table 8.2-18 The degree of impact of ammonia incidents at different levels of stability on the down-wind distance (unit: m)

Accident type	Item	atmospheric stability			
		A-B	D	E	F
Leakage from 20% of the pipe diameter	Death	0	100	100	100-200
	Severely hazardous area	100	200	200	200-300
	Moderately hazardous area	100-200	200-300	200-300	300-500
	Slightly hazardous areas	400	700	700	950
	Reaching the threshold limit value	950	1500	1500	1900
	Olfactory threshold value	1500	3000	4000	3000
	Reaching the factory boundary standard	2000	4000	4200	4200
	Reaching the residential concentration	4200	6500	6500	7000
Leakage from	Death	100-200	100-200	100-200	100-400
	Severely hazardous area	200-300	200-500	200-500	400-700

100% of the pipe diameter	Moderately hazardous area	300-400	500-700	500-700	700-950
	Slightly hazardous areas	700	1150	1150	1500
	Reaching the threshold limit value	1500	3000	3000	3000
	Olfactory threshold value	3000	4200	5000	5500
	Reaching the factory boundary standard	4000	5500	6000	6500
	Reaching the residential concentration	7000	8000	10000	8000
Rupture of spherical tank	Death	100-200	100-400	100-500	100-550
	Severely hazardous area	200-500	400-700	500-800	550-950
	Moderately hazardous area	500-700	700-1000	800-1000	950-1400
	Slightly hazardous areas	1150	1500	1900	2200
	Reaching the threshold limit value	2050	3500	4000	4200
	Olfactory threshold value	4000	6000	6000	7000
	Reaching the factory boundary standard	5000	7500	8000	7500
	Reaching the residential concentration	8000	9500	10000	9000

(Continued) Table 8.2-18 The degree of impact of ammonia incidents at different levels of stability on the down-wind distance (unit: m)

Accident type	Item	atmospheric stability			
		A-B	D	E	F
Leakage from 20% of the pipe diameter	Death	0	73	73	73-150
	Severely hazardous area	73	146	146	150-220
	Moderately hazardous area	73-150	150-220	150-220	220-350
	Slightly hazardous areas	292	511	511	693.5
	Reaching the threshold limit value	693.5	1095	1095	1387
	Olfactory threshold value	1095	2190	2920	2190

	Reaching the factory boundary standard	1460	2920	3066	3066
	Reaching the residential concentration	3066	4745	4745	5110
Leakage from 100% of the pipe diameter	Death	73-150	73-150	73-150	73-300
	Severely hazardous area	146-220	150-350	150-350	300-500
	Moderately hazardous area	220-300	350-500	350-500	500-700
	Slightly hazardous areas	511	839.5	839.5	1095
	Reaching the threshold limit value	1095	2190	2190	2190
	Olfactory threshold value	2190	3066	3650	4015
	Reaching the factory boundary standard	2920	4015	4380	4745
	Reaching the residential concentration	5110	5840	7300	5840

(3) Accident risk value

(3.1) Calculation of death rate after the accident

After the accident occurs, the percentage of death caused by toxic gases is related with toxic gas property, toxic gas concentration and exposure time. It is represented by the probability of impact caused by people's exposure to a certain concentration in a certain time (Y), and the relationship between Y and toxic gas concentration and exposure time is calculated by the following formula

Y = At + BtLn [Cnte]

Wherein: At, Bt, n – substance coefficient, depending on the nature of the poison;

C-toxic gas concentration, (ppm);

te-exposure time;

Cte-toxic load min).

The relationship between the probability Y and the death rate can be found from the following Table 8. 2-19.

Table 8. 2-19 Conversion between probability and death percentage

Death percentage (%)	0	1	2	3	4	5	6	7	8	9
0		2.67	2.95	3.12	3.25	3.36	3.45	3.52	3.59	3.66

10	3.72	3.77	3.82	3.87	3.92	3.96	4.01	4.05	4.08	4.12
20	4.16	4.19	4.23	4.26	4.29	4.33	4.26	4.39	4.42	4.45
30	4.48	4.50	4.53	4.56	4.59	4.61	4.64	4.67	4.69	4.72
40	4.75	4.77	4.80	4.82	4.85	4.87	4.90	4.92	4.95	4.97
50	5.00	5.03	5.05	5.08	5.10	5.13	5.15	5.18	5.20	5.23
60	5.25	5.28	5.31	5.33	5.36	5.39	5.41	5.44	5.47	5.50
70	5.52	5.55	5.58	5.61	5.64	5.67	5.71	5.74	5.77	5.81
80	5.84	5.88	5.92	5.95	5.99	6.04	6.08	6.13	6.18	6.23
90	6.28	6.34	6.41	6.48	6.55	6.64	6.75	6.88	7.05	7.33
99	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	7.33	7.37	7.41	7.46	7.51	7.58	7.58	7.65	7.88	8.09

According to the World Bank Environmental Impact Training Material, we can find ammonia At =- 9.82, B = 0.71, n = 2.0, thus we can calculate the death percentage caused by ammonia leakage accidents at different down-wind places, with results seen in Table 8. 2-20, and the calculation results show that no deaths occur 600m away from the technological transformation project. No deaths occur 400m away from the existing project.

Table 8. 2-20 Death percentage caused by ammonia leakage accidents at different down-wind places

Accident type		Ammonia tank ruptures				100% of the caliber leaks for 10 minutes			
Stability		B	D	E	F	B	D	E	F
Down-wind distance（m）	100	99	100	100	100	11	89	89	99
	200	43	97	97	99	0	21	22	64
	400	0	13	14	44	0	0	0	3
	500	0	0	2	14	0	0	0	0
	550	0	0	0	7	0	0	0	0

(Continued) Table 8. 2-20 Death percentage caused by ammonia leakage accidents at different down-wind places

Accident type		100% of the caliber leaks for 10 minutes			
Stability		B	D	E	F
Down-wind distance（m）	100	8	65	65	73
	200	0	15	15	45
	400	0	0	0	2
	500	0	0	0	0
	550	0	0	0	0

(4) Sensitive point risk analysis

The impact of the accident risks on the sensitive points of the technical transformation project is shown in Table 8.2-21. It can be seen that Zhouwan and Dongliuli Village are within the moderately hazardous area.

Table 8.2-21 The biggest impact of the technical transformation project after the ammonia accident on various sensitive points (mg/m^3)

plant boundary	Meteorological characteristics			ammonia	
	Wind direction	Wind speed (m/s)	stability	Concentration value	harmful level
Zhouwan	E	<1	E	721.1	within the moderately hazardous area
Dongliuli Village	S	<1	E	503.3	within the moderately hazardous area

After Niu Village is removed, Zhouwan Village which is the nearest to the ammonia storage tanks of the technical transformation project is 800m. The safety distance could be set at 1000m, with consideration of 1000m of health protection distance, the safety health protection distance is 1000m. The evaluation believes that the technical transformation project site shall be further moved 200m eastward, so that Zhouwan is more than 1000m of safety health protection distance away from the ammonia storage tanks. The evaluation recommends no setting of new residential areas, hospitals and other sensitive points within 1000m around the factory. The environment overview around the technological transformation factory is seen in Figure 8.

The surrounding of the existing project, with many environmentally sensitive points, does not meet the safety health protection distance requirement. The evaluation recommends that local authorities should, according to the formulated planning, gradually implement the within-health-protection-distance relocation measures around the factory, so that the safety health protection distance can meet the environmental protection requirements.

8.2.5 Technical Transformation Project Risk Management

8.2.5.1 General layout and construction safety measures

1) Ring channels are arranged between the various functional areas, to facilitate safe evacuation and fire fighting. The buildings and structures are designed according the fire danger rating, some steel structures are treated with fire protection, and some floors and grounds are treated with anti-corrosion.

2) The general layout has set off the explosion hazardous area according to the provisions, use explosion-proof instruments, electrical appliances and communications equipment in the explosion risk area.

3) Overall ventilation is combined with local exhaust, to avoid accumulation of harmful substances caused by dead ends, and dust collectors are set up for the processes with dust emission.

8.2.5.2 Safety measures for hazardous chemical storage

1) The main hazardous chemicals of this project include ammonia, CO and hydrogen; except pipelines, the storage areas should be set up, such as gas tanks, ammonia storage tanks and other storage tank areas.

2) The storage tank area should be set up with a cofferdam, to collect the leaked chemicals from the accident and to prevent the spread of chemicals, and thus minimizing the impact of the accident. Around the cofferdam, a drainage ditch, a water catchment or a sewage treatment system should be arranged.

3) The storage tank area should be equipped with manual alarm buttons, fire alarms, portable and trolley fire extinguishers and fire hydrants. The ammonia storage tank area should be equipped with dilute-acid spraying (fog) facilities. Use foams to cover to lower vapor disasters.

4) The storage tank area is designed to, in strict accordance with the provisions, adopt explosion-proof electrical equipment and instruments

5) In the event an accident, you should collect and transfer the leaked chemicals as much as possible, such as water spray for dilution. Contaminated water may not be discharged into storm sewer conduits, but into the 300m3 accident storage reservoir or wastewater treatment system, and only after it is treated and reaches the required standard can it be discharged into the water environment. At the same time, a retaining dam is set up 50m in front of Liuli Gou into Huangyou Rive, so as to stop flow in a timely manner when a serious pollution accident happens, and the water may not be discharged until its quality is normal, in order to ensure no impact on downstream water quality.

6) The pressure vessels such as ammonia storage tanks and reactors should be tested on time in accordance with relevant provisions, and the equipment and parts failing to meet safety requirements should be promptly repaired or replaced, to fix it before they break.

8.2.5.3 Process design and mechanical equipment safety measures

1) According to the specifications, adopt reliable fire protection measures for the load-bearing steel frames, frames and pipe racks, etc. to enhance the fire resistance of steel structures.

2) The equipment, piping, valves with direct contact with the craft materials should be made of appropriate corrosion-resistant materials, and anti-corrosion should be considered for electrical machines and instruments. Buildings and structures should be designed to adopt corrosion-resistant building materials and coatings.

3) The production device explosion-proof area should be designed to have electrostatic grounding, the workplace with fire and explosion hazards, as well as static danger to

personal safety and metal utensils should be designed to have electrostatic grounding. Tall equipment and plants should be equipped with lightning protection devices.

4) Adopt burning-prevention and insulation facilities for high-temperature equipment and pipes, to prevent human body from exposure to these high-temperature facilities and thus causing burns. Install operating platforms for the heightened equipment, and set up crash barriers and other facilities for equipment platforms and ladders, etc.

5) In the process design, implement remote control and monitoring on the temperature, pressure and flow of key materials, reactors within the devices and other major equipment, so that the industrial production can run safely in the best condition; and once an exception occurs, automatically and immediately give an alarm to ensure timely adjustment.

8.2.5.4 Fire fighting, fire and explosion prevention measures

1) According to the analogy survey, the probability of general accidents of the technical transformation project such as valve pipeline equipment leakage is 10-1 / year, that is, it may occur within the life time of the device. Establish a sound device management and maintenance, fire, explosion and fire fighting safety precaution system.

2) The installed equipment, pipelines, buildings and structures of the technical transformation project should be spaced with a certain fire fighting distance. The structural form and material of the buildings and structures with a risk of fire and explosion should meet the fire and explosion protection requirements, the production facilities with combustible gas and flammable gas should be equipped with static grounding systems, and the production equipment and pipes with a fire and explosion risk should be designed with safety valves, bursting panels, water seal, flame arresters and other explosion-proof and fire retardant facilities. In addition, the compression plants, distillation pumping plants and tank areas should be equipped with combustible gas, toxicity and other warners.

3) The layout of production devices and buildings and structures should take full advantage of natural light. The working areas with a hazard of fire, explosion and toxic dust should be designed to have emergency lighting that can extend the working hours in accident conditions, and hazardous environments such as humidity and high temperatures within the device should adopt safe voltage.

4) Each plant is reasonably set with stairs, walkways, and fire safety exits according to provisions in order to facilitate an emergency evacuation of staff in case of fire.

5) A low-pressure fire-fighting system should be set up in the ammonia storage tank area.

6) An appropriate number of combustible gas or toxic gas detection alarms should be set in the control rooms of the compression area, synthesis area, distillation area, middle tank area, product tank area and compression plant.

8.2.5.5 Sound safety environment management system

1) Establish and improve the health / safety / environmental management system, and

strictly implement it.

2) Strictly enforce China's norms and standards concerning labor safety, environmental protection and industrial hygiene, to remove hidden dangers of accidents as much as possible; in the event of an accident, take effective measures to reduce losses and environmental pollution caused by the accident.

3) Strengthen safety and environmental protection management of the factory and workshop, give safety and environmental protection education and training to the workers of the whole factory, and implement the induction certification system.

4) Establish the contingency plan and link up with the local emergency plans; once an accident occurs, you can take advantage of social assistance, so as to reduce loss and environmental pollution to a minimum degree.

5) Regularly inspect the tank equipment in the storage tank area, to eliminate hidden dangers of accident and lower accident probability. Regularly inspect and replace hazardous chemical transportation equipment, to ensure no accident caused by equipment occurs within its lifetime.

8.2.6 Emergency Plan

Accident emergency-response plan includes determination and distribution of the emergency plan area (the major risk source), emergency prevention objectives, emergency response organization, emergency evacuation, emergency facilities, communications, emergency devices and emergency monitoring, etc.

8.2.6.1 Determination and distribution of the emergency plan area

The factory should, based on species, quantity, hazardous nature and the possibility of causing major accident of the hazardous chemicals the factory produces, uses and stores, determine the emergency plan area, and map their distribution, so that in the event of an emergency incident, you can quickly identify their position and take a timely action. The project’s emergency plan area primarily includes:

a) the liquid ammonia storage tank area

b) the production device area

8.2.6.2 Emergency Organization

(1) The factory’s emergency organization

The factory sets up an emergency headquarter composed by the factory director and the persons in charge of production, safety, equipment, security, environmental protection and other departments, to be responsible for the overall command of the scene, and explicit respective responsibilities and division of labor; the factory also sets up a professional rescue team, and the rescue staff should be divided into specialized duties with the principle of suitable position for the major, facilitating leading and facilitating assembly, and after the accident, they can immediately take charge of incident control, rescue and rehabilitation treatment, and at the beginning of each year, the factory would make organizational adjustment according to changes in personnel, to ensure the implementation of the relief organization.

(2) Regional emergency organization

In the event of an accident, timely contact the local chemical accident emergency service departments, promptly report and request the local community rescue center or Civil Air Defence Office to organize rescue.

8.2.6.3 Emergency protection objectives

According to the size of the accident, identify the emergency protection objectives; in the event of a major breakdown of the ammonia storage tank, within 1,000 meters around the factory should be regarded as the emergency protection objective.

8.2.6.4 Emergency Alarm

When a sudden large leakage or fire and explosion accident occurs, the unit or on-site personnel must promptly report the accident to the authorities in addition to actively organizing self-help. The on-site alarm and response system are shown in Figure 8.2-3.

8.2.6.5 Emergency response plan

Upon receipt of the accident alarm, promptly organize the emergency rescue team; and the rescue team should, on the basis of doing a good job in self-protection, rapidly implement rescue, control the accident development, and do a good job in evacuation and hazardous material removal. Waiting for the emergency team or the outside assistance will make a minor accident turn into a catastrophe, so everyone should receive basic training as the emergency plan requires, so as to take a correct action in the event of an accident.

(1) Disposal methods for a large number of ammonia leakage caused by the pipeline rupture and the spherical tank rupture

1) Inform the synthesis tower of emergency stop, cut off the ammonia separator and the condensate tower separator ammonia release valve. This post should wear gloves, protective clothing and oxygen breathing apparatus to operate, open the reserve tank ammonia import valve, to prevent suppression of the ammonia import pipeline.

2) Close the liquid ammonia feeding import (export) valve of the accident tank, and open the air valve, to release pressure and reduce the leaking amount of the breach.

3) Cut off connectivity between the accident tank and other tanks and the connecting valve between the accident tank and the outside world.

4) The emergency staff must wear chemical protective clothing (complete isolation) and wear positive-pressure self-contained breathing apparatus. Open the accident water valve (fog-like water that should contain hydrochloric acid) to neutralize, dilute and dissolve.

The dilute water is sent into the accident storage tank or the wastewater treatment system, and is treated to reach the required standard before discharge. At the same time, as the case may be, set a containing dam 50m in front of Liuli Gou into the Huangyou River, so that in case of a serious pollution accident, stop flow in time, track and monitor the water quality and discharge it until it is normal, in order to ensure no impact on the water quality downstream.

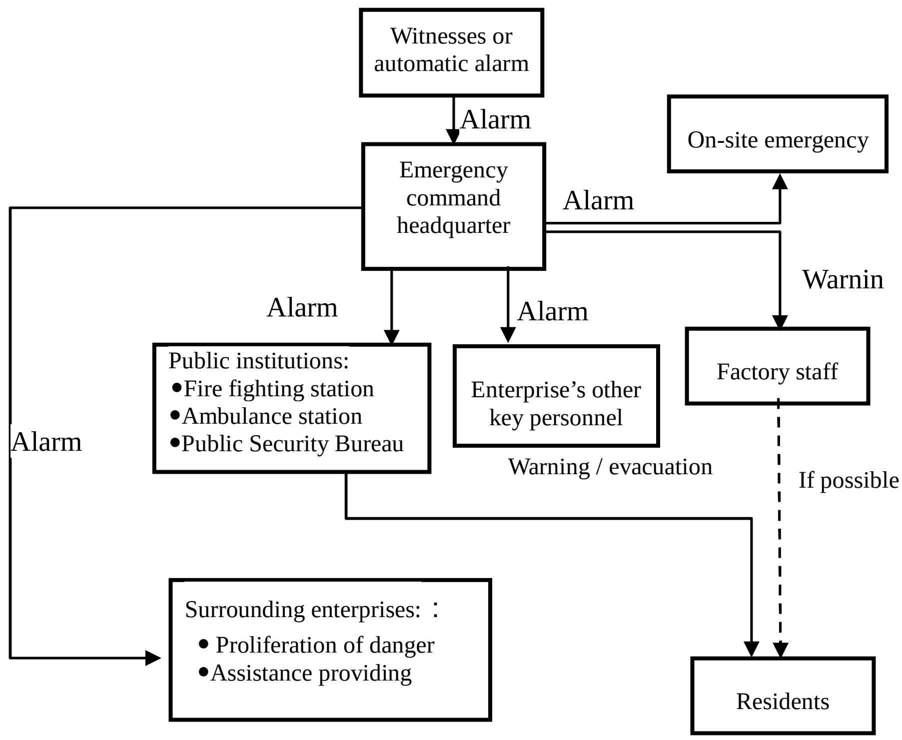


Figure 8.2-3 The on-site alarm and response

5) Strong ventilation is required in indoor place, or an exhaust fan is used to send the residual gas or leaked gas to the washing tower for washing.

6) Pay attention to the wind direction, and timely transfer the redundant personnel.

7) Inform the production scheduling room and related positions, and contact the protection station and fire fighting team for emergency treatment.

(2) Disposal methods for the leakage caused by valve and pipeline rupture

If the leakage is relatively small due to rupture of ammonia valves and ranks, according to the conditions of the unit's project and equipment, strive to use the method of plugging reversing line and reversing tank, to reduce the loss of ammonia of the accident tank, and open the accident water valve for dilution.

(3) Fire handling and control measures

In order to prevent the fire from threatening adjacent facilities, the following protective measures should be taken:

1) Timely take cooling and protection measures for the surrounding facilities;

2) Rapidly evacuate the under-fire-threat supplies;

3) The fire-fighting personnel should make full use of the on-site ready-made shelter body or maximize the use of low-lying posture to shoot water, and take self-protective measures as much as possible. Fire trucks should not stop at the water source close to explosive wastes.

4) In the event of an explosive fire, quickly judge and identify the possibility and danger of the recurrence of explosion, tightly grasp the opportune after the explosion and before the recurrence of explosion, take all possible measures to spare no effort to stop the occurrence of another explosion. Avoid using sandy soil to cover, to avoid increasing the power of the explosion of the explosive wastes.

5) If the fire-fighting personnel find the risk of another explosion, they should report immediately to the on-site command, and the on-site command should immediately make an accurate judgment; and if there are indeed signs or risks of another explosion, he should immediately issue a withdrawal order. After the fire-fighting personnel see or hear the evacuation signal, they should promptly withdraw to a safety zone, and should lie down on site in case of no enough time to withdraw.

8.2.6.6 Emergency evacuation

According to the conditions of the accident, establish the warning area, and quickly evacuate the personnel who have nothing to do with the incident handling in the warning area.

The following points should be noted in emergency evacuation:

1) The warning area boundaries should be set up with warning signs and guarded by specially-assigned persons.

2) Except the fire fighting and emergency response personnel, other persons are prohibited from entering the warning area.

3) Transfer in the windward direction; explicit guiding by specially-assigned persons and escort the evacuated persons to safe areas.

4) Do not stay in the lower-lying areas.

5) Find out if someone stay in the contaminated area and the fire area.

6) To enable the evacuation to proceed smoothly, each workshop section should have at least two unobstructed emergency exits, and have clear signs.

7) For the area outside the factory, the command headquarter should, based on the accident conditions and the prevailing wind direction and wind speed, determine and inform the mass evacuation within the proliferation area, and do a good job in evacuation and road control.

8.2.6.7 Emergency facilities and equipment

1) The tank area should be set up with dilute acid spraying (fog) facilities. It should be equipped with spare tanks and collection pools.

2) Certain number of fire safety equipment should be provided, such as foam and carbon dioxide fire extinguishers and water spray cooling facilities.

3) Certain number of gas masks and chemical protective clothing should be provided.

4) Means of alarm communication, means of notification and transportation security under a state of emergency should be stipulated.

8.2.6.8 Emergency medical and rescue organization

Emergency medical and rescue organization includes the factory medical and rescue organization and the medical institutions outside the factory, to be responsible for control of emergency dosage against poisons for the people in the accident scene and the accident-affected areas adjacent to the factory and the public, and evacuation organization plan and rescue.

Actively rescue injured and trapped persons, and limit the scope of combustion. It is very easy for toxic-material fires to cause casualties, so fire-fighting personnel should be devoted immediately into searching and rescuing injured and trapped persons after taking protective measures.

8.2.6.9 Emergency environmental monitoring and post-accident assessment

A professional team, equipped with some on-site accident monitoring equipment, is responsible for detecting and monitoring the accident site, timely and accurately detecting accident disasters, assessing the nature of the accident and the parameter pre-consequence, and providing basis for decision-making of the command sector.

The monitoring factors of the ambient air type accident monitoring factor are methanol and ammonia, and the monitoring scope is the area surrounding the factory location; the surface water type monitoring factors are methanol, ammonia and cyanide, and the monitoring sections are Liuli Village and the downstream dam; and the groundwater type monitoring factors are methanol, ammonia and cyanide, and the monitoring scope is the villages along the route.

In case of an accident, fire-fighting water consumption is estimated by 100—300m3/min, and the generated fire-fighting water volume when the accident occurs can be estimated by 10000-30000 m3,; in order to prevent pollution of the environment when the risk accident occurs, the evaluation recommends anti-seepage treatment should be made at Liuli Gou, which is about 3m wide, 1.5m deep and 3 kilometers long, and the volume of the constructed dam section is about 12000 m3. That can basically meet the needs of drainage in case of fire incidents. During the accident risk period, Liuli Village should be temporarily supplies with living water; and after the accident risk, the sewage is recollected into the sewage treatment device of the factory for treatment, and it cannot be discharged into the Huangyou River until it reaches the required standard.

Meanwhile, a retaining dam is set up 50m in front of Liuli Gou into Huangyou Rive, so as to stop flow in a timely manner when a serious pollution accident happens, and the water may not be discharged until its quality is normal, in order to ensure no impact on downstream water quality. As ammonia can be easily absorbed by the microorganisms and crops in the soil, it would be naturally attenuate under normal circumstances, having little impact on the environment.

8.2.6.10 Termination of the emergency state and recovery measures

The procedures for termination of the emergency state, the problem handling of scene of the accident, recovery measures, the lifting of alarms for the neighboring areas and restoration measures after the accident should be stipulated.

The problem handling of scene of the accident is an important part of the emergency plan. The rehabilitating plan is related to prevention of the expansion of pollution and the prevention of further development of the accident, so it must be attached importance to.

The rehabilitating plan should include further security check of the scene of the accident, especially the hidden dangers left during the accident or emergency rescue, to check the possibility of further development of new incidents.

The rehabilitating plan includes accident cause analysis, lesson learning, measure improvement and summary, writing the accident report and reporting to the relevant departments.

8.2.6.11 Staff training and drills

Organize rescue training and drills on a regular basis, each team is divided with different work according to its major and trained twice a year, to improve the level of command and rescue capabilities. The whole factory workers should be given regular contingency knowledge education.

8.2.6.12 Public education and information

Implement public education, training and dissemination of relevant information in the areas adjacent to the factory, and prepare relevant brochures for standby.

8.2.6.13 Others

The emergency plan includes the following documents:

1) The physical and chemical properties of ammonia

2) The emergency rescue command sequence diagram for the chemical accident in the technological transformation plant

3) The dangerous objective map and rescue route map for the technological transformation plant

8.3 Under-construction Project Risk Assessment

8.3.1 Under-construction project risk identification

8.3.1.1 Identification of hazardous substances

The under-construction project mainly relates to such hazardous chemicals as CO, H_2 and CH_3OH. According to their MSDS (Material Safety Data Sheet) data analysis (see Table 8.3-1), it can be seen that (1) CO, H_2 and CH_3OH have blasting risk, (2) CO and CH_3OH are toxic, and CO> CH_3OH according to the order of the poison degree.

Table 8.3-1 MSDS data of major chemicals

Category	Substance	Methanol	CO	Hydrogen
Physical and chemical properties	Appearance	Colorless liquid with pungent odor	Colorless and odorless gas	Colorless and odorless gas
	Molecular weight	32.04	28.01	2.01
	Melting point (℃)	-97.4	-199	-259.2
	Boiling point (℃)	64.8	-191	-252.8
	Density	0.79	0.79	0.07/-252℃
	Saturated vapor pressure (kPa)	13.33/21.2℃	No significance	13.33/-257.9℃

Toxicity	Toxicity grade *	Level Ⅲ (moderate hazard)	Level Ⅱ(high hazard)	——
	Toxicity index	LD50 5682mg/kg	LC50 1807mg/m3	No data
Blasting	Flash point (℃)	11	<-50	<-50
	Self-ignition point (℃)	385	610	400
	Explosion limit (v/v)	5.5~44.0	12.5~74.2	4.1~74.1
	Fire insurance rating	A	B	A
Risk characteristics		Steam and air form the explosive mixture, and naked flame and high heat can cause burning and explosion, and a strong reaction can occur when it is mixed with an oxidant; steam is heavier than air, it can spread to a distant place at a lower point, and can burn again when exposed to the fire source. It has a stimulating effect on the respiratory and gastrointestinal mucosa, and a toxic effect on the nervi vascularis, causing blood vessel spasm an forming congestion or bleeding, and also has a special selective effect on optic nerve and retina, causing retinal necrosis due to lack of nutrition.	When it is mixed with air, explosive mixture is formed; naked flame and high heat can cause burning and explosion; In case of high heat, the pressure within the container is increased, causing the risk of cracking and explosion. This product combines with hemoglobin in the blood, causing tissue hypoxia and even death in case of in-depth poisoning; and long-term inhalation of a certain amount of CO can cause damage to nerves and blood vessels.	When it is mixed with air, explosive mixture is formed; naked flame and high heat can cause burning and explosion; as this gas is lighter than air, in case of indoor use and storage, the leaked gas rises and occlude the roof, causing difficulty in discharging, and explosion could happened when it is exposed to sparks. In case of very high concentrations, the reduction of normal partial pressure of oxygen can cause suffocation, and paralysis can occur in case of very high partial pressure.

Emergency response to leakage	Immediately evacuate personnel from the leak-contaminated area to a windward place and immediately isolate, and strictly restrict ingress and egress. Cut off the fire source. It is better for the emergency personnel to wear self-contained positive-pressure breathing apparatus and anti-poison clothing. Do not direct contact with the leakage. Cut off the source of leakage as much as possible, and prevent access to sewers, flood discharge trenches and other restrictive spaces. In case of small leakage: use sandy soil or other non-combustible materials to adsorb, or use a lot of water to rinse, and the lotion is sent into the wastewater system after diluted. In case of large leakage: build a causeway or dig a pit to take in; use foams to cover, to lower the vapor disasters. Use the explosion-proof pumps to transfer it to the tank car or into the exclusive collector. Recycle or ship it to the waste disposal site.	Immediately evacuate personnel from the leak-contaminated area to a windward place, and immediately isolate for 150m, and strictly restrict ingress and egress. Cut off the fire source. It is better for the emergency personnel to wear self-contained positive-pressure breathing apparatus and anti-static clothing. Cut off the source of leakage as much as possible. Implement reasonable ventilation to accelerate diffusion. Spray fog-like water to dilute and dissolve. Build a causeway or dig a pit to take in large volume of wastewater. If possible, use an exhaust fan to send the leaked gas to an open place or install an appropriate spray nozzle to burn it, or use pipelines to lead it into the furnace and mulde to burn it. Leaking containers should be properly handled and could not be used until repaired and tested.	Immediately evacuate personnel from the leak-contaminated area to a windward place and isolate them, and strictly restrict ingress and egress. Cut off the fire source. It is better for the emergency personnel to wear self-contained positive-pressure breathing apparatus and anti-static clothing. Cut off the source of leakage as much as possible. Implement reasonable ventilation to accelerate diffusion. If possible, use an exhaust fan to send the leaked gas to an open place or install an appropriate spray nozzle to burn it. Leaking containers should be properly handled and could not be used until repaired and tested.

* Toxicity classification is based on *Harmful Level Classification of Occupational Exposure to Poison* (GB5044-85) and the WHO acute toxicity classification table.

Based on the risk assessment guidelines in Appendix A.1, CO is consistent with the "toxic substance determination standard number 3", being generally toxic; and CH_3OH, CO and H_2 are consistent with Appendix A.1 "flammable substance and explosive substance standards", being dangerous substances for fire and explosion.

8.3.1.2 Identification of hazardous sources

In the under-construction project, the methanol synthesis, synthetic gas transportation and other processes use or produce CO, H_2, methanol and other dangerous substances, but because CO and H_2 are intermediate products, with production and consumption occurring at the same time; by combining with the analysis of the under-construction project, in accordance with Significant Hazard Source Identification (GB18218-2000), we can identify the synthetic gas transmission and the under-construction project's methanol storage units are major hazardous sources.

Table 8.3-2 Critical amount of *Significant Hazard Source Identification*

Type	Name of substance	Standard critical amount（t）		Actual measurement（t）	
		Production	Storage	Production	Storage
Toxic substance	CO	2	5	＞2	＞5
Flammable substance	Methanol	2	20	30	4700
	Hydrogen	1	10	＞1	＞10

* Hour online generation amount

According to the information query, the typical cases of accidents related with the under-construction project are listed in Table 8.3-3.

Table 8.3-3 Typical accident cases

No.	Time and place	Accident type	Consequences of the accident	Causes of the accident	Data sources
1	2004.9.12, Jiantao (Changzhou) Chemical Logistics Co., Ltd.	Explosion and combustion of the methanol storage tanks with about 500 tons of methanol inside	No casualties, direct property loss of about 2.9 million yuan,	Welder's illegal operation, and methanol steam is exposed to naked flame and form deflagration.	
2	2003.11.23, Guangdong northern section of Beijing-Zhuhai Expressway	Rear-end collision of a large truck with 45 tons of methanol and leakage of methanol	3 were killed and 1 suffered minor injuries, and environmental pollution	Violation of the provisions of transport	
3	2004.5.12, Shengda Chemical Factory, west of Yingbin Road, Wensu County, Xinjiang	Methanol leakage at the compressor room, causing explosive fire	1 was burned and 1 severely burned, and 30 cubic meter storage tank, air compressor and power distribution machine and other equipment were destroyed.	Under investigation	

4	2002.3.19, Hunan Hengyang Nitrogen Fertilizer Plant	Explosion of the methanol storage room	1 dead, 2 severely injured	oxygen cutting welding was implemented, causing sudden explosion	
5	1995.5 - 6, a chemical plant 2500 meters west of Lijiajiecun Village, Xingtai City	Methanol leakage accident, with 400 kilograms of methanol seeping under the ground or volatized, water-source pollution	106 people got sick, 77 were severely visually impaired, 27 suffered optic nerve atrophy, 8 completely blind		
6	1987.10.31, a fertilizer plant in Guizhou	Ammonia was leaked, and blasting occurred	environmental pollution	fatigue fracture of the ventilation pipe of the synthetic cycle machine,	Chemical Equipment Accident Analysis and Prevention

The accident statistical analysis shows that, as far as the contents of this project, the source of the major environmental risk accidents lies in storage and transportation and production, and the cause of the accident is highlighted by material wearing, illegal operation, overloading transport and equipment failures, resulting in serious consequences and even malignant accidents. The environmental risk accident caused by the under-construction project is also atmospheric pollution, and the key for resulting in pollution accidents lies in material leakage.

The risk evaluation of the under-construction project will be mainly based on material leakage; by incorporating accident probability, seriousness of consequences of the accident and other factors, we determine the most credible accidents of the under-construction project as follows:

The synthetic gas transmission unit pipeline leakage accident and methanol storage tank unit leakage accident.

8.3.2 Source item analysis

8.3.2.1 Transmission unit of synthesis gas

The synthesis gas shall be transmitted to synthetic ammonia device of Juma Chemical Industry Co., Ltd through pipelines and the transmission distance is about 1km.

The probability of pipeline rupture accident is about 10-2 times/year and measures need to be taken. As density of CO and H_2 is less than air, therefore, materials won't be accumulated when pipelines rupture; however, there is a risk of explosion when they mix with air. Thus, the proposals of this assessment are:

(1) Pipeline shall avoid concentration area of residents, oil depots and the

implementation of high-voltage transmission and distribution, etc.

(2) Safe distance between pipelines and relevant roads and buildings shall be maintained and warning signs shall be posted according to standards.

(3) Flow monitoring devices at both sides of pipelines shall be arranged in order to monitor pipeline leakage without delay.

(4) To ensure safety, the flanges on transmission pipelines shall be as little as possible during design and shall be checked and replaced regularly in order to reduce the possible leakage points.

8.3.2.2 Methanol storage unit

(1) Calculation of leakeage rate

The methanol storage tank is stored at ambient temperature and pressure conditions, and the boiling point for methanol is 64.8℃. Flash evaporation or evaporative heat loss won't take place when leakage occurs as material temperature is almost the same as that of ambient temperature. Liquid pool shall be formed around the leakage and main reason for volatilization is that moving of air flow on the surface of liquid pool makes liquid evaporates. As the liquid expands, volatilizes and spreads after it falls on the concrete terrace, which may cause atmospheric pollution. Based on recommendation in *Industrial Risk Assessment Technical Guidelines* provided by State Environmental Protection Administration, the evaporation rate (Q3) shall be calculated as follows:

$$Q_3 = a \times p \times M / (R \times T_0) \times u^{(2-n)/(2+n)} \times r^{(4+n)/(2+n)}$$

Where Q3——evaporation rate, kg/s;

a,n——atmospheric stability factor, see table 8.3-4;

p——vapor pressure of liquid surface, Pa；

R——gas constant; J/mol·k；

T0——environment temperature, k;

u—— wind rate, m/s；

r——radius of liquid pool, m.

Table 8.3-4 Relationship of a, n factors and atmospheric stability

Atmospheric stability	n	a

Unstable (A-B) Neutral (D) Stable (E-F)	0.2 0.25 0.3	3.846×10-3 4.685×10-3 5.285×10-3

(2) Calculation of methanol evaporation

See table 8.3-5 for storage of hazardous substance.

Table 8.3-5 Storage parameters of main hazardous substances

Material name	Temperature/pressure	Container size (mm)	Adapter tube size	Storage container
Methanol	Ambient temperature/pressure	φ2400×16500	φ80	Vertical tank

See table 8.3-6 for source strength result of leakage accident.

Table 8.3-6 Source strength of leakage accident

Leakage scale	Leakage substance	Leakage source	Leakage size	Storage parameter	Leakage condition	Source strength
Large scale	Methanol	Pipeline system	20% caliber	Ambient temperature/pressur	Leakage for ten mintues	7.14kg/s

Leakage condition is subject to accident investigation, design measures of accident prevention and emergency handling capacity of the factory. In normal cases, the storage tank leakage can be controlled and treated within ten minutes through alarming, plugging and spraying, etc.

Cofferdam area in methanol tank zone is about 4000m^2. The actual volatile area of cofferdam after deducting occupancy area of storage tank is 3500m^2, equivalent radius is 33.6m and cofferdam height is 1.6m. Gutter leading to waste water treatment system and accident water storage tank shall be arranged around the cofferdam. The saturated vapor pressure of methanol at 25℃ is 13.3kPa.

Based on evaporation rate of material, time of the accident occurrence and harm extent of materials to the environment, time from leakage to disposal shall be set as 10 minutes. See table 8.3-7 for evaporation rate of methanol under different atmospheric stability.

Table 8.3-7 Volatilization rate of methanol accident

Leakage substance	Releasing time	Leakage amount	Wind rate	Atmospheric stability	volatilization rate	Discharge height
Methanol	10	4.28	1.0	A-B	1.24	1.6
				D	1.34	

				E-F	1.37	

8.3.3 Impact prediction

8.3.3.1 See table 8.3-8 for population distribution around factory of under-construction project.

Table 8.3-8 population distribution around factory

S/N	Name	Direction from accident source	Direction from accident source	Population (person)
1	Dongliuli village	E	500	1000
2	Fuzhuang village	N	500	200
3	Zhouwancun village	S	700	2000
4	Living quarters of Highway Administration Bureau	N	400	
5	骏马公司家属院 Living quarters of Juma Company	W	450	

Population density in factory is 5000 persons/km^2.

8.3.3.2 Prediction of calculation result

Adverse weather conditions shall be used for predicting the influence on surrounding sensitive subjects with consideration of accident occurrence probability, hazard rating and biggest impact area while conducting conservative calculation of accidents.

See table 8.3-9 for prediction of calculation result under little windy condition when methanol accident occurs.

Table 8.3-9 Maximum ground-level concentration of downwind axes after methanol accident occurs (mg/m^3)

Downwind distance (m)	Type of atmospheric stability			
	A-B	D	E	F
100	116.52	825.83	816.55	2035.94
200	28.58	203.06	200.75	506.23
400	6.60	45.78	44.37	112.35
500	4.00	27.17	26.22	66.02

Downwind distance (m)	Type of atmospheric stability			
	A-B	D	E	F
550	3.21	21.58	20.78	52.19
700	1.80	11.76	11.31	28.11
800	1.30	8.29	7.97	19.71
950	0.84	5.22	5.02	12.33
1000	0.73	4.54	4.37	10.69
1150	0.50	3.08	2.97	7.22
1500	0.24	1.45	1.40	3.38
1900	0.12	0.73	0.71	1.70
1950	0.12	0.68	0.65	1.57
2050	0.11	0.62	0.61	1.45
2200	0.099	0.58	0.57	1.36
3000	0.081	0.48	0.46	1.10
4000	0.033	0.19	0.19	0.44
4200	0.014	0.081	0.079	0.19
5000	0.012	0.070	0.068	0.16

8.3.3.3 Consequences analysis

(1) Hazard threshold value of substance concentration

See table 8.3-10 for hazard threshold value of methanol concentration

Table 8.3-10 Hazards corresponding to different concentration threshold values of methanol

Name	Minimum lethal dose	Extreme hazard	Severe hazard	Moderate hazard	Olfactory coefficient	Threshold limit value	Factory boundary standard	Concentration of residential area
Methanol	86000	50000	>5000	>500	140	50	15	3.0

* Toxic reaction of methanol shall be evaluated with inhalation index, IR=Log (C/MAC)

When IR =1-2, it is defined as moderate hazard, which equals to 10-100 times of MAC;

When IR = 2-3, it is defined as severe hazard, which equals to 100-1000 times of MAC;

When IR>3, it is defined as extreme hazard, which equals to 1000 times of MAC;

(2) Analysis of accident consequenc

As the distance from tank farm to nearest residential area is about 500m, therefore, areas within 100m-2000m outside the production factory shall be mainly analyzed. The prediction result shall be constrasted and analyzed with substance hazard concentration in the above table. See table 8.3-11 for influence degree on different distances of downwind.

Table 8.3-11 Influence degree of methanol leakage accident

Substance	Item	Atmospheric stability			
		A-B	D	E	F
Methanol	Extreme hazard area Severe hazard area Moderate hazard area Meet the threshold limit value Meet the factory boundary standard Meet the concentration of residential area	0 0 0 100m 400m 550m	0 0 100m 400m 700m 1150m	0 0 100m 400m 700m 1150m	0 0 200m 400m 950m 1900m

From above we can see that moderate toxic concentration will occur within 200m and no lethal concentration will generate. The place about 400m from construction site can be up to allowable workshop concentration.

(3) Risk analysis of each sensitive point

See table 8.3-12 for influences of accidents on each sensitive point. From the table we can see that Dongliuli village, Fuzhuang village, living quarters of Highway Administration Bureau and Juma Company are within the threshold limits and the influences are relatively small.

Table 8.3-12 Max influences on each sensitive point after methanol accidents (mg/m^3)

Factory boundary	Characteristics of meteorology			Methanol	
	Wind direction	Wind speed	Degree of stability	Concentration value	Hazard rating
Dongliuli village	W	<1	E	26.22	Lower than threshold limit value
Fuzhuang village	S	<1	E	26.22	Lower than threshold limit value
Zhouwancun village	N	<1	E	11. 31	Lower than factory boundary standard

Living quarters of Highway Administration Bureau	S	<1	E	44.37	Lower than threshold limit value
Living quarters of Juma Company	W	<1	E	44.37	Lower than threshold limit value

8.3.4 Risk management

8.3.4.1 Emergency response

1) Rupture of valves and pipelines of methanol tank may result in leakage, which should be promptly stopped in order to reduce the leakage of methanol. At the same time, foam shall be covered to lower vapor disasters.

2) The methanol has a smaller saturation vapor pressure and is non volatile so that “liquid pool” may be formed on the ground. Thus, the leaked methanol shall be collected possibly in order to reduce evaporation.

3) Rapidly evacuate the personnel in leaked contaminated areas to a safe area, prohibit unauthorized persons from accessing to the contaminated area and quickly cut off the fire source to avoid fire disaster.

4) Contaminated floors shall be diluted with water. The washing water will be sent to the accident storage tank or waste water treatment system and discharged if it is up to standard after being treated.

8.3.4.2 Arrangement of overall layout and safety measures of building

1) General layout is optimized. Main dangerous areas of under-construction project are basically in the central part of factory or at the positions for which there are no residents outside the factory. Offices are arranged near the main road outside the factory so that certain safe distance can be maintained between dangerous areas and surrounding sensitive points. The arrangement of general layout of factory is reasonable.

2) General layout is arranged based on functional areas. There are circular channels between various functional areas to facilitate safe evacuation and fire protection. The constructed structures are designed according to the fire danger rating, some steels have been taken fireproofing treatment and partial floors and grounds have been taken anti-corrosion treatment. Greening and ancillary buildings in the factory must conform to the requirements of safety production. For explosion danger zones, explosion-proof instruments, electric appliances and communication equipments must be adopted.

3) Combination of overall ventilation and partial exhaust shall be considered for under-construction project and dead corner which may result in accumulation of harmful substances shall be avoided. For procedures of dust emission, dust collector shall be arranged.

4) Safety protection distance outside the production areas shall be arranged. Calculated

based on impact degree of leaked methanol, the safety protection distance can be set as 200m.

8.3.4.3 Safety measures for storage of hazardous chemical

1) The hazardous chemicals for under-construction project mainly include methanol, CO and H2. All except pipelines should set up storage areas such as gas cabinets, methanol storage tanks, etc.

2) Cofferdam shall be set up in methanol storage tank area to collect the leaked chemicals from accidents, prevent the spread of chemicals and reduce the accident impact to the minimum. Gutter which is directly connected with 300m^3 accident water storage tanks or sewage treatment system shall be arranged around the cofferdam.

3) The methanol storage tank area should have manual alarm buttons, fire alarms, portable and trolley type fire extinguishers and fire hydrant.

4) Explosion-proof electrical equipment and instrumentation shall be selected strictly according to requirements during design of methanol storage tank.

5) Once accidents arise, the leaked chemicals shall be collected or transferred as soon as possible, such as diluting through water spray. At the same time, foam shall be used for coverage in order to lower vapor disasters. The contaminated water can not be discharged into storm water pipes and should be collected into accident water storage tank or waste water treatment system. Above water can’t be discharged into normal water environment under it is up to standard after treatment.

6) Water retaining dam shall be arranged at 50m before water of Liuligou enters into Huangyou River to ensure timely interception, monitor water quality when serious pollution accidents arise. Water can be discharged until it becomes normal to ensure no impact on downstream water quality.

7) The phreatic water of factory generally flows from northwest to southeast and may be affected when major pollution incidents arise. According to the assessment, water of Liulizhuang in the northern side of gutter shall be supplied for ten days when substantial pollution accidents arise. Water supply of well can be recovered when water quality meets standard through monitoring.

8.3.4.4 Process design and safety measures of mechanical equipment

1) According to the specifications, the load-bearing steel frame, support and pipe racks, etc shall adopt reliable fire protection measures to enhance the fire resistance of steel structures.

2) Equipments, pipes and valves which directly contacts with process material shall be made with proper corrosion-resistant materials. Anti-corrosion shall be considred for motor and instrumentation. Corrosion-resistant building materials and coatings should be adopted during design.

3) Static grounding in explosion-proof area of production device shall be designed. Places where have fire and explosion hazards and metal tools for which static electricity may danger personal safety shall be grounded. Lightning protection devices shall be arranged for tall equipments and workshops.

4) Burning prevention and thermal insulation measures shall be taken for high-temperature equipments and pipelines to prevent person from burns when touching these high-temperature facilities. For heighten equipment, operating platform shall be arranged. Equipment operation platform and ladders, etc shall have fence and other facilities

5) Temperature, pressure and flow, etc of material and reactor in device shall be controlled in remote and monitored in order to ensure safe operation of industry production under optimum state and immediate automatic alarm and adjustment once there are any abnormalities arise.

6) Followings shall be provided: automatic monitoring, alarming, emergency cut off and stop systems; fire proof, explosion proof, anti-poisoning and accident processing systems; emergency rescue facilities and channels; emergency evacuation routes and shelters.

8.3.4.5 Fire-fighting, fire disaster and explosion prevention measures

1) According to investigation, the accident probability for valves, pipelines, and equipment leakage, etc of under-construction project is about 10-1/year, that is, the accident may occur for one time within the service life of equipment. Therefore, management and maintenance & repair of equipment shall be strengthened and fire disaster, explosion prevention and fire-fighting measures shall be taken effectively.

2) The equipments, pipelines and building structures in devices of under-construction project shall keep certain fire distance. Structures and materials in places where there are fire and explosive hazard should conform to requirements of fire and explosion protection; production equipments and pipelines which have fire and explosive hazard shall be arranged with safety valve, rupture disk, water seal and other fire and explosion protection facilities during design. Moreover, combustible gas and toxic gas detection and alarm systems and on-line analysis system are also provided in accordance with different types of hazard.

3) Production devices and structures of building shall fully take natural light. Work areas where there are fire, explosion and toxic dust hazards shall be provided with emergency lighting during design. Wet, high temperature and other dangerous environment in the device shall be provided with safe voltage.

4) Stairs, walkways and emergency exits in each workshop shall be arranged reasonably in order to facilitate emergency evacuation during fire.

5) Low-pressure fire fighting system shall be provided in the methanol storage tank and fixed foam fire-fighting system shall be provided in the car and train loading and unloading platforms.

6) There are automatic and manual fire alarm devices for under-construction project; fire detectors and fire alarm buttons are arranged in the important buildings and tank farms; proper combustible gas or toxic gas detection alarm devices are arranged at the production factory.

8.3.4.6 Establishment of sound and safe environmental management system

1) Sound healthy/safe/ environmental management system shall be established and strictly carried out by the company.

2) Relevant national norms and standards of labor security, environmental protection and industrial hygiene, etc shall be strictly carried out to remove the hidden dangers of accidents minimally. Once accident occurs, effective measures must be taken to reduce losses and pollutions to environment caused by the accident.

3) Safety and environmental protection management of factory and workshop shall be strengthened; operation manual and repair manual for normal, abnormal or emergency operation shall be formulated; operation and maintenance personnel shall be trained; each staff must take his/her post with certificate; safety activities shall be undertaken weekly to improve workers awareness of safety, identify the abnormal conditions prior to the incident and take appropriate measures to avoid serious accidents caused by wrong operation.

4) Emergency operating procedures shall be formulated, for which operation steps, required repair schedule, limitation of accident impact as well as safety issues concerning with pipeline operator shall be presented.

5) Various equipments in tank farm shall be checked periodically to eliminate hidden dangers of accidents and lower accident probability. Transportation equipment of hazardous chemicals shall be checked and replaced as plan and specialized records (include maintenance and repair records) shall be provided to ensure that no accident of equipment will occur within its service life.

6) Emergency plan shall be established combining with local ones so that social assistance can be received once accident occurs and losses and environmental pollutions can be lowered into the minimum.

7) Education and guidance to nearby residents shall be strengthened in order to reduce and avoid accidents losses.

8.3.5 Emergency plan

1) When accident occurs, first, rescue the wounded and then take measures to prevent the spread or expansion of accident. If accident is serious, emergency teams and rescue teams must be organized.

2) Prevent the occurrence of secondary accident: take measures to prevent combustion or explosion of residual dangerous goods; continuous leakage of combustible gas and liquid; fall or collapse of hanging targets.

3) Establish alert areas and warning lines; withdraw unrelated persons; prevent non-rescue personnel from entering; take anti-poison measures for places where toxic substances and combustion gas or liquid leak and cut off traffic.

4) Water retaining dam shall be arranged at 50m before water of Liuligou enters into Huangyou River to ensure timely interception, monitor water quality when serious pollution accidents arise. Water can be discharged until it becomes normal to ensure no impact on downstream water quality. Methanol is degradable in water and the half-life of retrogradation in water is approximately 10-15 days, therefore, it won't result in unrecoverable water effects.

5) Accident surveillance factors; ambient air monitoring factors are methanol and ammonia, and the monitoring range is the region around factory; surface water monitoring factors re methanol, ammonia and cyanide, and monitoring range is Liulizhuang village and downstream dams; groundwater monitoring factors are methanol, ammonia and cyanide, and monitoring range is the villages along the route.

6) Accident fire water consumption is calculated based on 100-300m^3/min and the generated fire water consumption of 10,000-30,000 m^3. In oder to prevent environmental pollution during accident risk, the assessment suggests that Liuligou shall be taken anti-seepage treatment. The width for Liuligou is about 3m, depth is about 1.5m and length is about 3km, the volume of constructed dam is about 12,000 m^3, which can basically satisfy the drainage demands of fire incidents. During accident risk, temporary living water shall be provided for Liulizhuang village. After the accident risk, waste water will be retrieved into waste water treatment device of factory and discharged into Huangyou River after being treated to standard. See Fig. 9 for drainage route.

See table 8.3-13 for content of emergency plan and see Fig 8.3-1 for emergency organization.

Table 8.3-13 Content of emergency plan

S/N	Item	Contents and requirements
1	Emergency planning zone	Device area, tank farm area and adjacent region
2	Emergency organization	Factory and region
3	Emergency status category and emergency response procedures	Stipulate the accident level and corresponding emergency response procedures
4	Emergency facility, equipment and apparatus	Production device and tank farm area, etc
5	Emergency communication, notification and traffic	Stipulate the communication style, notification method and traffic security and control under emergency condition
6	Emergency environmental monitoring and post-accident assessment	Professional teams are responsible for detecting and monitoring the accident site; evaluating the accident character and consequence; providing decision making basis for command departments.
7	Emergency protective measures, leakage control measures and	Accident site; adjacent area; control fire control area; pollution control and anti-pollution measures and

	apparatus	corresponding requirements.
8	Emergency dose control, organization withdrawal plan, medical aid and public health	Accident site; adjacent area; adjacent area personnel affected by accident; public stipulation for toxin emergency dose control; organization removal plan and rescue.
9	Termination and recovery measures of emergency condition	Stipulate termination procedure of emergency condition; rehabilitation of accident site and recovery measures; relieve accident warning and recovery measures after accident in adjacent area.
10	Personnel training and drilling	Arrange personnel training and drilling after emergency plan is formulated.
11	Public education and information	Conduct public education, training and issue relevant information for areas near factory.

8.3-1 Diagram of emergency plan

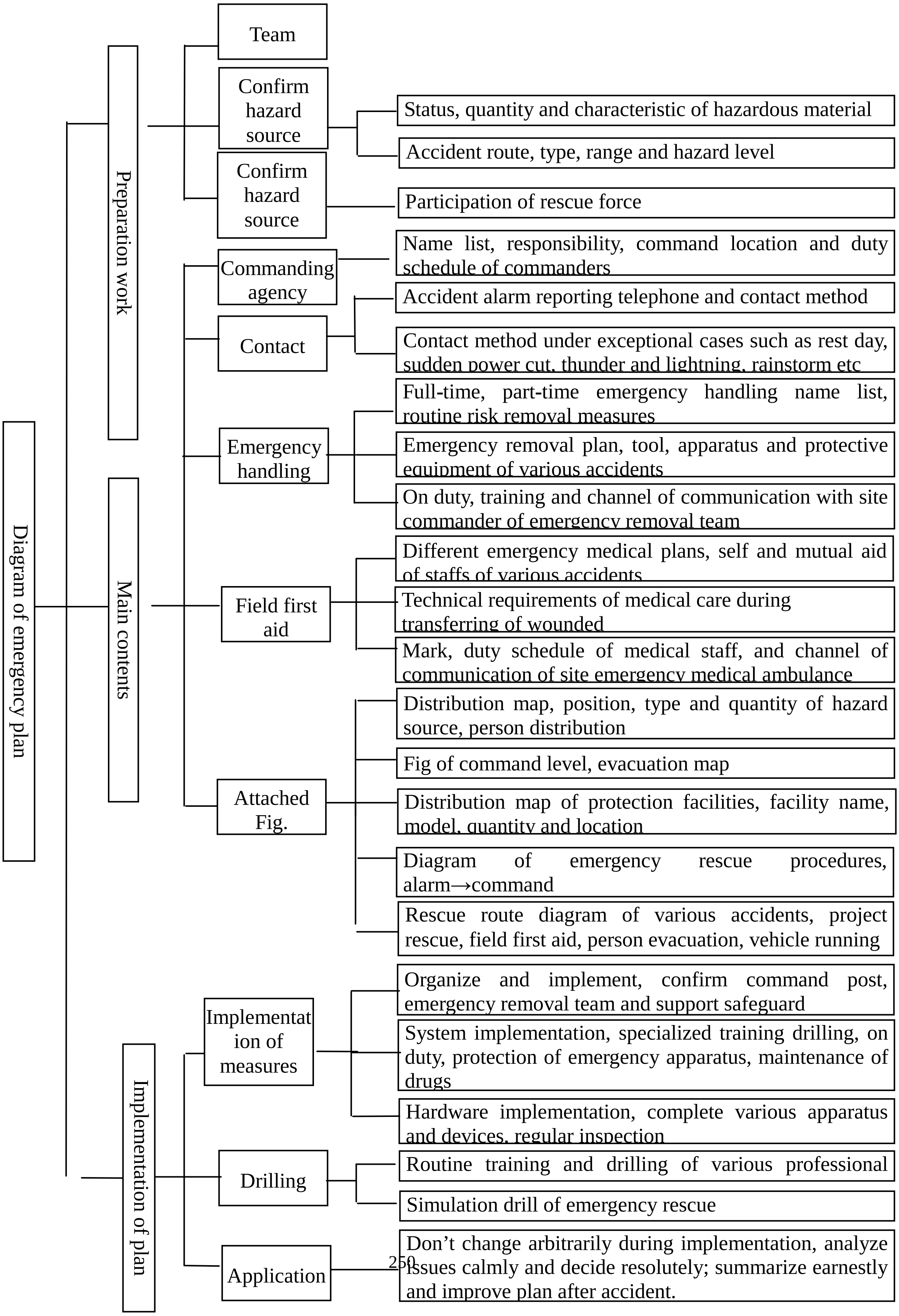


Diagram of emergency plan
Preparation work
Team
Confirm hazard source
Status, quantity and characteristic of hazardous material
Accident route, type, range and hazard level
Confirm hazard source
Participation of rescue force
Main contents
Commanding agency
Name list, responsibility, command location and duty schedule of commanders
Contact
Accident alarm reporting telephone and contact method
Contact method under exceptional cases such as rest day, sudden power cut, thunder and lightning, rainstorm etc
Emergency handling
Full-time, part-time emergency handling name list, routine risk removal measures
Emergency removal plan, tool, apparatus and protective equipment of various accidents
On duty, training and channel of communication with site commander of emergency removal team
Field first aid
Different emergency medical plans, self and mutual aid of staffs of various accidents
Technical requirements of medical care during transferring of wounded
Mark, duty schedule of medical staff, and channel of communication of site emergency medical ambulance
Attached Fig.
Distribution map, position, type and quantity of hazard source, person distribution
Fig of command level, evacuation map
Distribution map of protection facilities, facility name, model, quantity and location
Diagram of emergency rescue procedures, alarm→command
Rescue route diagram of various accidents, project rescue, field first aid, person evacuation, vehicle running
Implementation of plan
Implementation of measures
Organize and implement, confirm command post, emergency removal team and support safeguard
System implementation, specialized training drilling, on duty, protection of emergency apparatus, maintenance of drugs
Hardware implementation, complete various apparatus and devices, regular inspection
Drilling
Routine training and drilling of various professional
Simulation drill of emergency rescue
Application
Don’t change arbitrarily during implementation, analyze issues calmly and decide resolutely; summarize earnestly and improve plan after accident.

8.4 Conclusions of risk assessment

Surroundings of existing project can't meet the requirements of safety and health protection distance and there are many environmentally sensitive points. The assessment recommends local authorities to gradually implement move measures within safety and health protection distance according to the planning formulated in order to make safety and health protection distance meet the environmental protection requirements.

Main toxic and hazardous, flammable and explosive substances during production storage process of Technological Transformation Project are ammonia, for which the storage capacity is large, with certain degree of potential danger. In this assessment, main considerations are: leakage of toxic substances may have influence on environment and person outside the factory boundary. The predication result of accident under set condition shows that when serious leak occurs, residential area at 400m and 550m from construction site will receive moderate damage and the safety protective distance is 700m. At present, the safety protection distance for Zhouwancun which is the nearest village from ammonia storage tank of Technological Transformation Project is 800m. As the heath protection distance of Technological Transformation Project has been identified as 1000m, we think that the factory address of Technological Transformation Project shall be move east for about 200m and make the distance from Zhouwancun village to ammonia storage tank more than the health protection distance of 1000m. We also suggest that no sensitive points of new residential areas or hospitals shall be arranged within 1000m from factory boundary. At the same time, the enterprise shall implement move plan of Zhouwancun village along with planning and city construction departments. Water retaining dam shall be arranged at 50m before water of Liuligou enters into Huangyou River to ensure timely interception and prevent impact on downstream water quality.

The under-construction project involves with toxic and hazardous, flammable and explosive substances and the storage capacity is large; therefore, it has some potential danger. According to the statistics and forecasts, the methanol materials will result in fire accident; however, explosion only takes place in the factory and has little influence on places outside the factory. For leakage accident of toxic substances under set condition, as the specific weight of synthesis gas is lighter than that of air so that partial accumulation won't occur and influence on residential areas outside the factory is less even a small amount of gas is leaked during transmission. For leakage accident of methanol, moderate toxic concentration may occur in the 200m and lethal concentration region won't take place; meanwhile, the influence on residential areas outside the factory is also little..

With consideration of danger of under-construction project, the assessment suggests the safe protection distance outside the production zone is to be set as 400m and no sensitive points of schools or residential areas are to be arranged within the protection range; meanwhile, the clear warning mark also should be arranged. Water retaining dam shall be arranged at 50m before water of Liuligou enters into Huangyou River to ensure timely interception and prevent impact on downstream water quality. Safety distance between pipelines of synthesis gas transmission unit and relevant roads or buildings shall be maintained according to relevant standards and the warning marks shall be arranged. Safe and environmental management and emergency response management shall be improved after being put into operation and shall be supervised and inspected by local government and other relevant departments. According to the assessment, the enterprise shall receive safety assessment, regional assessment of chemical industry park after under-construction project finishes. The risk assessment must be conducted without delay when safe accidents occur.

Probability of hazard risk of under-construction project on residential areas outside the factory will be further lowered when above measures are taken. The environmental risk during methanol production can be treated under predictable, controllable and resolvable conditions. Therefore, factory construction here is feasible.

9. Analysis of Factory Site Environmental Feasibility and Geneneral Layout Rationality

Raw material and power structural adjustment is one important measure of nation to conduct strategic adjustment of nitrogenous fertilizer industry, which may significantly reduce China's fertilizer production cost, thereby lower the fertilizer price and achieve the purpose of indirectly supporting agriculture. The current project is technological transformation of synthetic ammonia route of Junma Company. After the technological transformation finishes, the product scheme and scale remain unchanged. The project which is encouraged and supported by the nation has been listed as selective trial project of raw material and power structural adjustment in nitrogenous fertilizer industry, it conforms to national industrial policy and the construction is feasible.

This project belongs to technological transformation type, that is, technological transformation of the ammonia route. The advanced water-coal-slurry pressurized gasifier is adopted for replacing existing atmospheric pressure fixed bed intermittent gasifier. Corresponding devices for ammonia purification, synthesis, and air separation and relevant auxiliary facilities are provided; current facilities with serious pollution shall be removed or improved; partial environmental protection facilities are provided; generation and discharge amount of main pollutants will be greatly reduced along with adjustment of raw material structure of factory compared to the project before being transformed and the environmental benefits of project are also significant.

This project belongs to poisonous and dangerous chemical engineering and has to meet the requirements of relevant health protection distance. The proposed construction site is about 1km from current factory in order to facilitate transmmison of ammonia. In the meanwhile, the Technological Transformation Projects also fully uses existing production equipment and auxiliary production and living facilities, and develop the capacity of existing equipment to save investment and accelerate the construction speed.

9.1 Analysis of factory site feasibility

According to the relevant provisions of national environmental protection, factory address of construction project must meet the following requirements:

(1) Conform to regional development planning and function zoning of environmental protection

(2) Satisfy requirements of Provisions on Engineering Design of Environmental Protection of Chemical Industry Project concerning about factory site selection;

(3) Meet the requirements of health protection distance setting;

(4) Must satisfy the requirements of “increasing output and reducing pollutant or increasing output or not increasing pollutant”, environmental influence is acceptable.

The environmental feasibility of factory address of this project shall be analyzed based on project nature, characteristics and relevant requirements site selection and in combination of urban development planning, environmental protection planning, distribution of sensitive targets around, meteorological characteristics of factory area, setting of health protection distance, environmental influence and public participation, etc.

9.1.1 Urban development planning compliance of factory address

Junma Company lies in the planning area of Zhumadian city, the eastern section of Dongfeng Road of of Zhumadian city. It faces Beijing-Zhuhai expressway on east and borders on Beijing-Guangzhou railway and 107 national highway on west, combining with Zhuxin in front, the traffic is very convenient. The proposed site of Technological Transformation Project locates about 1km in the southeast of the existing factory. The project faces Yicheng Avenue on the west and faces under-construction Lianjiang road on the north and its terrain is wide and flat. Zhongyuan gasfication methanol and gas-fired power plant are built around. The factory is about 1km from Beijing-Zhuhai Expressway, about 5km from 107 National Highway and only 3km from the Zhumadian station of Beijing-Guangzhou Railway so that the transportation is very convenient.

According to the development plan of Zhumadian, the industry park of Zhumadian is divided into eastern industrial park, northern industrial area and sourthern industry area. The eastern industrial park mainly covers the first and second industries and the tertiary-industry with little pollution; the place between the east 3rd ring road and highway is planned to be as long-term industry land use; enterprises with great pollution discharge must be strictly prevented from entering into the northern part of Lianjiang river. Department of Land Resources,Henan Province and Bureau of Urban Planning of Zhumadian have separately given reply with No.520「2004」of Department of Land Resources,Henan Province and No. 071 「2004」of Bureau of Urban Planning of Zhumadian. Therefore, it is considered in the assessment that the proposed factor address conforms to urban development planning of Zhumdiandian city.

9.1.2 Environmental protection planning and zoning analysis

Zhumadian is not within control area of sulfur dioxide pollution and it belongs to the Huaihe river basin.

The Technological Transformation Project is in Yicheng district, Zhumadian city and is the second industry zone planned by Zhumadian city. There are Zhumadian No.2 paper plant, No. 1 Branch Factory of Henan Tianfang Pharmacy and Zhumadian Tobacco Factory and other enterprises in this area.

Current inviromental condition: standard exceeding phenomenon for PM10 in environment air quality of assessment area is common due to the characteristics of climate; in general, the environment quality still needs to be improved; at present, the water quality of Huangyou River can’t meet the requirements of category IV. Main pollutants are COD and NH-N, which are organic pollutants, and shall be improved through area reduction measures.

9.1.3 Analysis of environmental sensitivity

The proposed site of Technological Transformation Project which is about 1km from existing factory is in the eastern industrial park. The main sensitive targets around are Zhouwancun village which is about 600m away from the western factory boundary and Dongliulizhuang village which is about 800m away from northern factory boundary. The close Niuzhuang village and urban work camp will be removed recently. Others outside the factory boundary are farmland. There are no places of historical interest, heritage conservation units and natural reserve, etc. The environmental sensitivity around the factory is normal.

9.1.4 Climate features

The assessment analysized local ground surface and boundary layer pollution meteorological data detailedly and the result shows that:

Surface wind: according to the observation data of Zhumadian meteorological station in recent three years, the primary common wind direction of area is NW in the whole year, with the frequency of 13.4%. The secondary common wind direction is W, with the frequency of 9.4%. The third common wind direction besides primary and secondary common winds is NE, with frequency of 8.7%. Above winds won’t have influence on Zhumaidan and main affected subject is its leeward rural areas. Winds that can have influence on Zhumadian are ESE wind and SE wind, with the sum of frequency of 10.2%. Zhumadian is mainly affected by fumes of this Chemical factory in summer.

Wind speed: the average wind speed of assessed area is 2.1m/s. Wind has bed diffusion conditions in winter and autumn and good diffusion condition is in spring. Analyzed from overall condition of wind, the area is not good enough for transmission and diffusion of pollutants.

Meteorology features: seen from distribution of atmospheric stability frequency, stabilization type is many, which may indicates that the vertical diffusion capacity of atmosphere is poor. Speaking from seasons, the stabilization type is the most in winter, which accounts for 54.0%; the stabilization type in autumn is the secondary which accounts for 51.7% The sum of frequency of winter and autumn are more than 50%, which indicates that the diffusion in these two seasons are both poor. By comparison, the stabilization type in spring and summer is less and instability is more so that they are good periods for diffusion.

9.1.5 Environmental influence of area

Environment air: the contribution value of SO_2, NO_2, H_2S and PM_{10} on each point-of-care under different meteorological condition doesn’t exceed the standard; the concentration of SO_2 and smoke dust is negative variation after technological transformation finishes, which can be represented with obvious positive benefits of environment.

Water environment: the treated waste water of factory will not be directly discharged into surface water, instead, water shall be discharged into Zhumadian waste water treatment station through waste water pipeline network, which can completely eliminate the pollution on underground water along with the sewage ditch and pollution-holding water of Huangyou river.

Sound environment: as there are no residents at 200m from the proposed factory, therefore, the influence of high noise of equipment this project has little influence on surrounding sensitive targets.

9.1.6 Health protection distance

Based on the calculation results of this assessment concerning with health protection distance, the health protection distance of technological transformation factory is 1000m from ammonia synthesizer. According to site investigation, the sensitive targests within the health protection distance include Zhouwancun village, Niuzhuang village and urban work camp. The removal issues of sensitive targets within the health protection distance have been submitted by Junma Company to urban People's Government with No. 12 file 「2005」 of Henan Junma Chemical Industry Co., Ltd (see attachment 5) and the Govement has repied with the No. 147 file「2005」 of Zhumadian People's Government. The People's Government agrees removal plan of Niuzhuang village and urban work camp within the health protection distance proposed by Junma Company in principle; in the meantime, the government also requires Junma Company to actively coordinate with corresponding departments and arrange properly in accordance with relevant polices during implementation in order to ensure smooth removal and successful implentaiton of project.

With regard to removal issues of residents within health protection distance, Junma Company has formulated specialized removal plan (see attachment 19) according to relevant requirements of urban government and through communication with removal unit. According to this plan, removal of urban work camp will be finished before Jun, 2007 and the removal cost is about RMB 3.4 million. There are 46 houses in Niuzhuang village currently and removal be finished before September, 2007 according to the plan, the removal cost is about RMB 9.2 million. The total cost for above removal is about RMB 12.6 million and shall be self-collected by Junma Company. Now, all the fees have been prepared. According to the removal plan, removal shall be completely finished before completion of project.

According to assessment, the proposed factory is too near Zhouwancun village and can’t meet the requirements of heath protection distance of Technological Transformation Project (1000m from ammonia synthesizer). In order to satisfy the requirements of heath protection distance of Technological Transformation Project and reduce the workload of removal, the technological transformed factory will move eastward about 200m so that Zhouwancun village is more than 1000m from ammonia synthesizer, which can satisfy the requirements heath protection distance.

9.1.7 Transportation

Zhumadian locates at east and south connecting areas of China. Beijing-Guangzhou Railway, 107 National Highway, 106 National Highway and Beijing-Zhuhai Expressway run through the north and south; six provincial highways crisscross Zhumadian city. Waterway goes through Anhui in east, flows into Yangtze River in the south and reaches as long as Shanghai so that transportation is very convenient. The factory is about 1km from Beijing-Zhuhai Expressway, is about 5km from 107 National Highway and only about 3km from Zhumadian station of Beijing-Guangzhou Railway. The transportation of raw material of the factory doesn't go through urban district and population concentration district, therefore, the influences on environment is small.

9.1.8 Public participation

According to public participation and investigation, 99.8% public support the construction of this project.

9.1.9 Summery

To sum up, the technological transformed factory moves southward to the planned industry area on the basis of relaying on old factory and is far from urban concentrated areas. According to the promise of local government, the sensitive points around the factory after Niuzhuang village and urban work camp being moved can satisfy the requirements of safe and health protection distance; the current ammonia storage tank and other equipment that has significant potential risks will be moved from population concentrated areas to technological transformed factory area, through which the hidden dangers of current factory will be eased. Site selection conforms to urban development planning and environment sensitivity requirements. The technological transformed factory is not in upwind of city, therefore, little influence will be generated. The wastewater pollution influence can be greatly reduced, local environmental quality can be improved, good environmental benefits and social benefits can be received after technological transformation finishes. Meanwhile, the local residents also support the construction of this project. Therefore, the factory address of transformed project is selected in Niuzhuang village and urban work camp is feasible.

9.2 Analysis of rationality of factory general layout

9.2.1 Layout principle

According to design data, the proposed factory site will be used reasonably based on the current condition and the functional areas are definite. Process try to be fluent, pipeline to be short, logistic to be smooth under the premise of satisfying the requirements of production process, fire protection, explosion protection, safety and environmental protection, etc in order to save capital investment and land. The specific principles are as follows:

(1) Satisfy production needs and conform to national requirements for fire protection, safety and health etc;

(2) Try to merge the building structure, arrange the production equipment intensively in the open air and utilize the land economically and rationally under the premise of conforming to production process, operation requirements and operation function, etc.

(3) Separate the zone rationally according to the type of production device in order to facilitate production and management;

(4) The auxiliary production facilities should be as near as load center under the condition of satisfying its feature requirements.

(5) The storage and transportation facilities should be put in the place where it is easy for transportation and loading & unloading and is near to the their related facility based on the nature of the materials and the mode of transport, etc;

(6) Organize transportation reasonably, shorten transportation distance for easy contact. Intersect of traffic flow and good flow should be prevented;

(7) Try to create favorable conditions for factory greening and purification according to factory nature and requirements.

(8) Try to deal with the relationship between recent period and future period according to factory construction condition and production development trend.

9.2.2 General layout plan

This project is mainly made up of the installations and buildings such as coal yard, gas generation, conversion, desulfurization, decarburization, compression, synthesis, methanolation-methanation, circulating water station, raw water treatment, air compression station, wastewater collection pool and complex building. The specific layout is as follows:

The process mainline of synthetic ammonia is arranged in the center of the proposed site and the installations of coal yard, gas generation, conversion, desulfurization, decarburization, compression, synthesis, methanolation-methanation are arranged from east to west based on the process flow of synthetic ammonia. To the south of the process mainline lie the installation of complex building, air compression station, circulating water station, wastewater collection pool and raw water treatment; and the long-term development site is reserved on the north of the facrory. The whole factory covers an area of 42hm2. see Attached Drawing Four for plane layout.

In order to improve factory environment, greening design shall abide by the principle of "adaptating to local conditions, ecological greening, environment friendly, beautifying factory appearance, purifying air and making effects to improve labour conditions".

Arbor, shrub and greensward shall be included in the factory greening design and form vertical planting in the factory. Based on the local ecological condition and the characteristic of this project, the tree breeds which are suitable for local area and have the features of acid and alkali-resistance and antidusting shall be selected. The areas before factory and around coal yard are key greening place. The greening of the area before factory shall be coordinated with the building and the ornamental arbor and flowering shrub shall be planted there. The tall arbor and greensward with dust suction function shall be planted around the coal yard and slag yard. Green percentage of the factory open space shall be up to 100%.

10. Volume Control

According to the Tenth Five-year environmental target of Zhumadian city, discharge volume up to 2005 of SO_2, smoke dust, industrial dust and COD, solid industrial waste and other major pollutants shall be reduced by 10% compared to that of 2000; main branches of municipal governed Huai River basin shall reach up to the quality standard determined for surface water environment while Huangyou River shall achieve water standard of Category Ⅳ. The traffic here is very convenient due to its location, as Junma Company's existing plant and technological transformation factory are both located in the southeast industrial zone of Zhumadian city, falling within the urban planning area, on the east section of Dongfeng Road with Beijing-Zhuhai Expressway nearby to its east while Beijing-Guangzhou railway and 107 national highway to its west, and Zhumadian-Xincai County highway crossing right in front of the Company. This technological Transformation Project is proposed to be located at about 1km southeast to the existing plant. Zhumadian does not belong to sulfur dioxide pollution control areas, Huangyou River, the water-holding body, belongs to Huai River basin.

At present, implement volume control which will enable enterprises to organize production and perform pollution prevention and control according to cleaner production principles has become an important measure to ensure the realization of the Tenth Five-year environmental targets and has an important significance in improving regional environmental quality, since the ambient air quality and environmental quality of surface water within the urban area and the proposed factory location can no longer meet the functional zoning requirement.

According to the national planning requirements to pollutant discharge volume in construction projects, this volume control assessment will be mainly focused on emission contained smoke dust, industrial dust and SO_2 as well as COD, NH-N and industrial wastes.

10.1 Analysis of volume control for emission pollutants

This project is the Technological Transformation Project on Route of Synthetic Ammonia Raw Materials of nitrogenous fertilizer industry. The factory's main products are synthetic ammonia, urea and methanol, its emissions are mainly coal gases resulted from heating boilers as well as process tail gases during production procedures, in which main pollution factors such as smoke dust, industrial dust, SO_2, Nox, H_2S, methanol and ammonia are contained. Although not be classified as sulfur dioxide pollution control area, monitoring results over the years showing that the ambient air in urban area of Zhumadian city is in coal-burning pollution based on TSP and PM_{10}. TSP and PM_{10} quotas at any concerned point within the assessment area go beyond standard level while the daily mean of concentration of SO_2 and Nox does not out of limits. According to the National Tenth Five-Year Plan for Environmental Protection, dust (smoke dust and industrial dust) and SO_2 are the quotas in emission pollutant volume control, therefore, it's important to control the discharge volume of smoke dust and SO_2 in this project is particularly important; meanwhile, volume control is suggested to be also applied to H_2S, methanol and ammonia the factory discharged through assessment since they are also among the characteristic pollution factors in this project and that the status monitoring results indicate relative values out of limits at concerned points near the plant area.

10.1.1 Assignment of volume control quotas during the tenth five-year period

According to the National Tenth Five-Year Plan for Environmental Protection, up to 2005, the discharge volume of 6 kinds of main pollutants (smoke dust, industrial dust and SO_2, COD, NH-N and industrial wastes) shall be reduced by 10% in overall compared with that at the end of the Ninth Five-year Plan, while the SO_2 be reduced by 20% at the "two control areas"; pollutants such as heavy metals, cyanide and oil in industrial waste water be under effective control; and volume control quotas of main pollutants be included in the comprehensive index system of the Tenth Five-year Plan for national economic and social development.

According to the National Tenth Five-Year Plan for Environmental Protection, discharge volume of SO2 is 780,000t in 2005 (876,9000t in 2000) in Henan province according to its pollutant discharge control scheme and that of smoke dust is 661,000t, where the discharge volume of SO_2 is cut down by 10.6% and smoke dust by 7.5% compared with that of 2000; according to the assignment scheme of volume control in Henan, the discharge volume of SO_2 during the Tenth Five-year period is determined to be 5,725.24t and smoke dust to be 3,688.91t for Zhumadian. Specific assignment scheme see Table 10.1-1.

Table 10.1-1 Volume control scheme schedule during the tenth five-year period

Project	SO_2	Smoke dust
Henan province	780000	661000
Zhumadian city	5725.24	3688.91

10.1.2 Volume control quotas for main pollutants of existing project and project under consruction

The volume control quotas of SO_2 and smoke dust allocated by the Environmental Protection Bureau to Junma Company is 761.9t and 162.9t respectively according to Yi Huan Zi [2004] Document No.9 issued by Environmental Protection Bureau of Yicheng district, Zhumadian city. Based on the spirit of "increasing production without increasing pollution", no further increment will be given in the emission pollutant volume after the project under construction is being put into production, everything under control as originally assigned quotas. Pollutant discharge volume and total volume control quotas see Table 10.1-2.

Table 10.1-2 Total discharge volume Ccontrol of gas pollutants before technological transformation

Project	SO_2	Smoke dust

Existing project	1201.5	573.4
Project under construction	543.1	107.4
Discharge volume after project under construction is completed	1307.7	586.6
Volume control quotas	761.9	162.9

We can see from Table 10.1-2 that large amount of blowing waste is induced since existing projects adopt backward fixed bed intermittent gasification process which resulted in that neither smoke dust nor SO_2 in the pollutants before technological transformation can meet the quotas requirements for total volume control.

10.1.3 Analysis of total pollutant discharge volume after completion of this project

This project is a technological Transformation Project for synthetic ammonia route proposed to be carried out of original location. After the technological transformation, advanced technology and equipment will be employed with removing existing polluting and backward equipment, such as 16 gas-making furnaces, 2 sets of 20t/h heating boilers, etc. Meanwhile, the strict pollution prevention and control measures will be adopted in this project in managing and reusing the new induced process waste gas, to reduce the volume of pollutants discharged outside and ensures that the waste gas is up to the discharge standard. After these measures are taken, the discharge volume of main pollutants will be obviously reduced compared with that before technological transformation.

Calculations for total emission pollutant volume after technological transformation see Table 10.1-3.

Table 10.1-3 Calculation summary for total emission pollutant volume   unit: t/a

Project	Smoke dust	SO_2	Methanol	Ammonia	H_2S
Before technological transformation	586.6	1307.7	6.0	148.0	22.2
Current project	4.1	5.4	0	0	13.1
Reduced by replacing the old by the new	438.8	560.7	0	0	22.2
After technological transformation	151.9	752.4	6.0	148.0	13.1
Total volume control quotas	162.9	761.9			
Proposed quotas from assessment			6.0	148.0	13.1

We can see for Table 10.1-3 that after technological transformation, dischage volume of both SO_2 and smoke dust as main pollutants in the emissions can meet the requirements of total volume control quotas for existing projects.

10.2 Analysis of TOTAL DISCHARGE CONTROL for waste water

After completion of technological transformation, waste water will be discharged to Huangyou River in Huai River basin through drainage ditches outside the factory. According to engineering analysis, through adopting stringent pollution control measures and replacing the old by the new, the discharge volume of waste water and that of main pollutants in the waste water will be greatly reduced than before after technological transformation, where that of COD is 58.4t/a, and NH-N 13.6t/a. Volume control target for waste water pollutants allocated by Environmental Protection Bureau of Yicheng district, Zhumadian city to Junma Company is COD142.3t/a, while that of NH-N has not been allocated to enterprises yet. Calculations for total volume of waste water pollutants of the plant after technological transformation see Table 10.2-2.

Table 10.2-1 Calculations for total volume of waste water pollutants

Project	COD	NH-N
After technological transformation	41.8	15.7
Total volume quotas	142.3	-
Assessment suggestion	-	15.7

10.3 Analysis of TOTAL DISCHARGE CONTROL for solid waste

After technological transformation, the solid wastes induced in the plant mainly consist of gasifier ash, boiler ash, waste catalyst and cyanide sludge, etc. According to the Comprehensive Utilization Agreement, all gasifier ash and boiler ash induced will be put into fully comprehensive utilization for production of cement, meanwhile temporary residue field will be set in the plant; waste catalyzer generated in the processing devices will be returned to catalyst plant for recovery; cyanide sludge will be stockpiled in the temporary hazardous waste storage site set in the plant and then delivered to Henan Hazardous Waste Disposing Center after its completion for secure landfill. All solid wastes can be disposed in a secure manner without discharging outside, meet local environmental requirements.

10.4 Reachability analysis of volume control

Total discharge volume quotas of pollutants assigned to Junma Company is indicated in No.9 Document [2004] of Environmental Protection Bureau of Yicheng district, Zhumadian city, see annex. Comparison between actual discharge volume of pollutants after completion of Technological Transformation Project and the quotas assigned by Environmental Protection Bureau of Yicheng district, Zhumadian city see table 10.4-1

Table 10.4-1 Total volume control quotas

Project		Unit	After technological transformation	Discharge volume assigned by Environmental Protection Bureau of Yicheng district, Zhumadian city	Volume suggested from assessment
Waste gas	Smoke dust	t/a	151.9	162.9	
	SO_2	t/a	752.4	761.9	
	Industrial dust	t/a	81.0		81.0
	Methanol	t/a	5.6		6.0
	Ammonia	t/a	148.0		148.0
	H_2S	t/a	13.1		13.1
Waste water	COD	t/a	41.8	142.3	
	NH-N	t/a	15.7		15.7

From table 10.4-1, we can see that actual discharge volume of both waste gas and waste water after technological transformation can meet the total volume control quotas requirements made by the Environmental Protection Bureau.

11 Analysis of Environmental & Economic Cost-Benefit

11.1 Social benefits

Social benefits of this project are mainly manifested in the following areas:

(1) Advanced coal gasification and purification technology is applied in this project for energy saving technological transformation to existing backward production facilities, as well as changing the traditional route of raw materials smoke-free lump coal, in line with national industrial policy. Its implementation can significantly reduce the production costs of fertilizer, thereby reducing fertilizer prices to achieve the purpose of supporting agriculture.

(2) This project employ an innovative combination of 6.5Mpa water-coal-slurry pressurized gasification technology, home-made large-scale NHD desulfurization decarbonization technology, home-made non-constant pressure methanol-methanation technology and domestic 15.0Mpa ammonia synthesis technology, any one of these technologies has a mature and reliable design, construction and operation experience. The combination of the above advanced technologies bears advantages with advanced technology, less investment and integrated low-cost, which gives an example for the structure adjustment of China's nitrogenous fertilizer industry.

(3) There are safety problems hidden in the production of existing project, since sensitive targets within the safety and health protection scope of the existing engineering are relatively more and there are still certain difficulties in total relocation so far; after completion of technological transformation, major incident source of ammonia storage tanks of existing engineering will be moved to the technological transformed factory, as existing synthetic devices phasing out and new ones setting in the technological transformed factory and with less sensitive targets around the technological transformed factory, the requirement for safety and health protection distance can be met after relocating the sensitive targets nearby, at the same time, security risks of existing factory is eliminated and social stability is further secured.

(4) The construction of the Technological Transformation Project will enhance the company’s product competitiveness, improve business visibility, increase revenue, promote local economic development, and thereby resulting in good economic and social benefits.

11.2 Economic benefits

Advanced domestic Texaco gasification process is planned to substitute current fixed bed intermittent gasification process. Relying on the existing plant resources and based on construction in manner of localization, after put into practice this project will quickly into normal production and generate benefits with its advanced and reliable technology. IRR (after-tax) of this technological transformation is 17.05％, cost of production of synthetic ammonia after the technological transformation will be reduced to 976.17 Yuan/t from 1,600 Yuan/t, and that of urea be reduced to 778.48 Yuan/t from 1008 Yuan/t. Therefore, the market competitiveness of products is significantly enhanced, so the economic benefits of the project are satisfactory.

Major technical and economic index of the Technological Transformation Project see table 11.2-1

Table 11.2-1 Major economic & technical index and data tables

Project name		Unit	Index	Remarks
Total investment		10,000 Yuan	98126.01	
Project environmental protection investment		10,000 Yuan	2900	
Finance assessment index	Investment profit rate	%	19.78	
	Profit and tax investment ratio	%	25.07	
	IRR of all investment	%	22.74	(pre-tax)
	IRR of all investment	%	17.05	(after-tax)
Average annual sales revenue		10,000 Yuan	60114.77	
Average annual total cost		10,000 Yuan	35518.15	
Average annual sales tax		10,000 Yuan	24596.62	
Investment recovery period (after tax)		year	6.28	(including 2 years of construction period)
Investment profit rate		%	19.78	
Profit and tax investment ratio		%	25.07	

11.3 Environmental Benefits

11.3.1 Estimate of investment in environmental protection

Total investment of this project is 980 million Yuan, where 41.40 million Yuan is for environmental protection, accounting for 4.2% of the total project investment. Detailed investment in environmental protection see Table 11.3-1.

Table 11.3-1 Schedule of environmental protection investment in the rebuilding project

NO.	Measures	Investment (10,000yuan)
一 I	New environmental protection facilities	

NO.	Measures	Investment (10,000yuan)
1	Gas ash water treatment	1000
2	Biochemical sewage treatment	200
4	Raw coal crushing and dedusting	100
5	Coal bunker dedustting	100
7	Torch	350
9	Sewage outfall standardization and pollutant on-line monitoring	60
10	Factory virescence	60
11	Noise prevention & control	150
12	Residue field	80
13	New coal yard dedust	300
14	Accident sewage storage tank (300m3×2)	50
15	Storage site for hazardous solid wastes	80
16	Risk prevention	60
17	Relocation costs	1260
II	Measures of replacing the old by the new	
1	Oily waste water treatment technological transformationand expansion	20
2	Technological transformation of existing coal storage facilities	70
3	Technological transformation of recovery unit for system ammonia and hydrogen of synthetic ammonia	200
Total		4140

11.3.2 Environmental benefits

In this project, advanced technology is adopted with backward existing production technology and equipment being phased out. Policy of cleaner production technology in nitrogenous fertilizer industry is implemented all through the technological transformation process as pollutant discharge is under control. Strict pollution control measures are employed for new induced pollutants, at the same time, a measure of replacing the old with the new is taken to resolve the environmental problems existed in existing project. After completion of the project, all pollutants from the factory can be discharged up the standard and, discharge volume of both major pollutants in the waste gas and in the waste water discharged outside the factory has different levels of reduction, thereby the existing environmental problems exist in the old plant can be resolved. Therefore, the environmental benefits are significant.

12 Environmental Management and Monitoring Plan

12.1 Environmental management plan

12.1.1 Importance of environmental management

The environmental management in industrial enterprises is a systematic management style, by overall planning, balancing and developing the relationship between industry and environment, putting environmental protection into practice in the activities, productions and service process of the enterprises. By using legal, economic, administrative, technical and publicizing means, restrict those production and operation activities that are harmful for the environment to combine environmental protection into all the related work of the management of enterprises. Thus to make their activities, productions and services conform to the environment law and regulations, bring down the costs, reduce environment responsibilities, as well as continually improve enterprises' environmental behavior and social image to increase their market competitive power and finally to unify the production goal with environment goal, furthermore economic efficiency with environment benefit.

The enterprise's effective implementing of the environmental management work is an important way of carrying out the cleaner production measure advanced by appraisal and the entire production process contamination control. It is also the basic safeguard of making engineering construction satisfy the environment goal as well as an effective measure to maximally reduce the adverse effect brings to the environment after the operation of the project. Only to enhance the environment supervisory work can guarantee the enterprise obtain the biggest environmental and economic efficiency by the minimum price and thus make it healthily develop along a highly effective, production-increased and contamination-decreased sustainable development path.

12.1.2 Environmental management structure

According to Regulations on the Administration of Construction Project Environmental Protection, enterprises should establish the environmental protection management structure which is responsible for organizing and inspecting the environmental protection work of the enterprise. Henan Junma Chemical Industry Co., Ltd has now already had Security and Environmental Protection Section, with one section chief and three section members, specializing on managing the environment of the enterprise and securing the safety of it. This project is a displaced Technological Transformation Project, the site of the technological transformation factory has a distance from the original factory. In order to adapt to the need of the production management, appraisal suggests increasing the number of the environment administrative personnel. The existing setting of the personnel of the environmental protection section as well as the newly increasing personnel are listed below.

Table 12.1-1 Structure of environmental protection organization

Unit	Post	Number of staff (person)

<table>
<tr><td colspan="3">Leader</td><td>Manager of the company</td><td>1</td></tr>
<tr><td rowspan="3">Functional department</td><td rowspan="3">Security and environmental protection section</td><td rowspan="2">Existing</td><td>Section chief</td><td>1</td></tr>
<tr><td>Section member</td><td>3</td></tr>
<tr><td>ewly increased</td><td>Section member</td><td>2</td></tr>
</table>

12.1.3 Function of the environmental management organization and the quality of its staff

The above list shows that the machinery of this enterprise is in good gear. Considering that the enterprise develops quickly in recently years and its environmental management task is relatively heavy, in order to manage the environment even better, appraisal suggests the function of the environmental management section and the quality of its staff which are listed below.

Table 12.1 - 2 Function of the management organization

Item	Management function
Management of clean production	• Organizing, coordinating and supervising the implement of the cleaner production content which is proposed in this appraisal • Frequently educating and training the staff about the cleaner production • According to the enterprise development, continuing to carry on the new turn of auditing of the cleaner production Be responsible for management of the daily cleaning of the production activity
Management during construction	Supervising the realization of the environmental protection measures during construction
Completion acceptance management	• According to *Regulations on the Administration of the Completion Acceptance of Environmental Protection Construction Project*(No.14 of State Environmental Protection Administration of China), before the trial production of the construction items, the construction unit, together with the builder and design institute, should inspect whether the environmental protection measures conform to the 'three in unison' request and the inspect result as well as the start time of the trial production of the construction items should be reported to the local environmental protection administrative department. Only when they are approved by the local environmental protection administrative department, the construction items can be put into trial operation. • Construction unit must insure that the environmental protection measures of the construction items and main part project put into trial operation at the same time. Before the formal operation of the construction items, construction unit must submit *The Application of the Administration of the Completion Acceptance of Environmental Protection Construction Project* to the environmental protection administrative department

	which is responsible for auditing. Only when they are approved by the local environmental protection administrative department, the construction items can be put into trial operation.
Operating period management	• Setting down practical and feasible systems and regulations concerning environmental protection management • Integrating the supervisory work of the source of pollution and the emissions of waste water, waste gas and waste residue into the daily administrative work, carrying it out in workshops, working teams and posts, in order to manage in a all-rounded way • Actively developing the multipurpose utilization of waste water, waste gas and waste residue • Implementing a award-and-punishment system based on duties, rights and benefits, which means punishing those who disobey regulations and systems and awarding those who have meritorious actions • Collecting, arranging and popularizing environmental protection technology and experience, solving the environmental protection problems during operation in time Cooperating with the local and upper environmental protection administrative department, carefully implementing environmental protection regulations and rules of administrative departments

Table 12.1 - 3 Quality of the staff in the environmental protection department

No.	Quality requirement
1	Deeply loving the environmental protection enterprise, being familiar with the related national environmental protection laws and regulations, general and specific policies, rules, standard and so on
2	Being familiar with the craftwork of the enterprise, having a general understanding of all the management contents and being able to propose reasonable plan and suggestion concerning of the environmental management protection
3	Having the knowledge about cleaner production, being able to propose reasonable plan of cleaner production so to constantly improve the enterprise's cleaner production level

12.2 Environmental monitoring

Environmental monitoring is a basic task and scientific measure supplying for the management in the enterprise. In order to reduce pollution and prevent the happening of the contamination accident, by the environmental monitoring and contamination source monitoring, analyzing and understanding the enterprise environment quality so that to provide the scientific basis of raising the cleaner production.

12.2.1 Environmental monitoring structure

The enterprise has now had analysis laboratory with four examination personnel, area approximately 100m^2. The launched projects are PH, SS, COD, ammonia nitrogen and sulfide, etc.. The appraisal figures that the existing monitoring structure is quite satisfactory so that the enterprise can do water pollution monitoring work that conforms to the enterprise's pollution discharge characteristics. When the enterprise does not have the ability to monitor waste water and noises it would entrust the local environmental protection department to undertake.

12.2.2 Duty of the monitoring station

The appraisal suggests the duty of the staff of the monitoring station are listed below,

Table 12.1 - 1 Duty of the staff of the monitoring station

Name of the institute	Duty
Duty of the monitoring station	1) Earnestly implementing the related national environmental protection laws, regulations and standard, establishing and perfecting the system of rules and regulations of the station 2) Fulfilling the designed monitoring tasks, inspecting the outlet condition of all the drains and the operating condition of environmental protection measures and ensuring the quality of inspecting. When there are any abnormalities, the monitoring station should find out the reason in time and report to the leadership as soon as possible. 3) Arranging and analyzing the monitoring data, filling in environment statistic table, the monthly monitoring report table, the environment assessment information and other environment reports and setting up environmental protection file 4) Enhancing the maintenance and verification work of the environmental monitoring instrumentation equipment to guarantees the proper operation of monitoring work 5) Joining the investigation work of environmental pollution accidents in the enterprise 6) Joining the assessment work of environment quality in the enterprise 7) Joining the scientific research work of environment in the enterprise
Duty of the staff of the monitoring station	1) The staff of the monitoring station must have the certificate and be responsible for all data related to environment monitoring 2) Based on the monitoring system, regularly monitoring the waste gas, the waste water, the noise and so on of the entire factory and setting up analyzing result file as well as knowing whether the waste discharge in the production conforms to the national and local emission standard and its influence on the environment 3) Monitoring staff are authorized to carry on a scene monitor and inspection to environmental pollution behavior or behavior that may decrease the environment quality and they have the right to report the instance to the manager and upper leadership and giving their treatment opinion 4) Monitoring staff should be familiar with the craftwork of paper making, heat-supplying and electricity-generating, unceasingly improving their service quality and accepting the inspect of higher authority

12.2.3 Environmental monitoring plan

12.2.3.1 Monitoring plan during the construction period

The main factors of the project affecting the surrounding environment during the construction period include the construction noise, construction dust and construction of waste water. In order to reduce the impact on the surrounding environment during the construction period, the practical and corresponding monitoring plan has been evaluated and formulated. The details will be seen in Table 12.2-2.

Table 12.2-2 Monitoring plan of environment influence during the construction period

Categories	Monitoring sites	Monitoring factors	Monitoring rrequency	Control objectives
Noise	Construction boundary	Equivalent sound level	One time each month, each time one day, each time both daytime and night	Meet the requirements of GB12523-90
Ambient air	Construction area and surrounding residential area	TSP	Each season one time, each time three days, no less than 12 hours per day for continuous monitoring	Meet the Grade II requirements of GB3095-1996

12.2.3.2 Monitoring plan during the operating period

After the current projects are put into operation, it is recommended to approve, monitor and inspect Three Simultaneousness according to table 12.2-3 and table 12.2-4. The monitoring content and frequency during daily operation period of Anhua Company's whole plant will be shown in Table 12.2-5 ~ Table 12.2-8. Monitoring methods refer to the relevant national technical standards and norms.

Table 12.2-3 Three simultaneousness environmental acceptance of Technological Transformation Project

Categories	Names of pollution control facilities	Position	Acceptance content
Waste gas	Claus sulfur recovery facilities, exhaust tailpipe	Entrance and exit of Sulfer recovery facility and the exit of exhaust pipe	Flue gas volume, production and emission of H2S, concentration and efficiency of dust collection
	Coal crushing system, coal powder and lime storage bag collector, exhaust pipe	Entrance and exit of dust collector, exhaust exit	Flue gas volume, production and emission of PM10, concentration and efficiency of dust collection
	Unorganized emissions of factory boudary	Technological transformationof factory boundary	Unorganized emission concentration of NH3,H2S,TSP

Wastewater	Gas and sewage treatment facilities	Entrance and exit of facilities	pH,COD,SS,oil type,sulfide, cyanide, volatile phenol, ammonia emission concentration, flow rate
	Oily water treatment facilities	Entrance and exit of facilities	COD, oil type
	Facilities of the terminal wastewater treatment in the whole plant	Entrance and exit of facilities	pH, methanol, COD, SS, oil, sulfide, CN-, volatile phenol, BOD5, ammonia emission concentration, flow rate
	Automatic measurement and on-line monitoring	**Total sewage outlet of the plant**	The standardization of the sewage outfall, outfall logo, drainage automatic measurement and COD, NH3-N automatic on-line monitoring device
	Accidents collecting pond	Existing and technological transformation factory area	Quantity, volume, etc.
Solid Waste	Temporary yard for general solid waste	Northeast corner of the technological transformationfactory area	Rain proof, antiseepage, anti-dust and operation management measure
	Temporary yard for sludge	Within technological transformation factory area	Rain proof, antiseepage, anti-dust and operation management measures
Noise	Control of factory boundary	Out of the technological transformation factory area	Day and night equivalent noise level
Environmental Management	Monitoring plan	Monitoring station	Monitoring project and frequency
	Monitoring organization	Monitoring station	Constitution of organization and staffing
Greening	Greening program	Factory area and factory boundary	Green zones and green belts
Risks	Fire water storage pool	Sewage outlet out of the factory(Liuligou)	Building dams at 50 meters before entering into Huangyou River, hardening of Liuligou
	Risk management		Risk management system and emergency plan

Table 12.4 Removed equipment through replacing the old by the new of Technological Transformation Project

No.	Name of the unit	Parameter and scale	Quantity
I	Gasification unit		
1	Gasifier	φ2610	16
2	Waste heat boiler	Vertical type	14
3	Washer		6
II	Synthesizer		
1	Ammonia converter	φ1.0m	2
2	Saturator-hot water tower	φ3.0m	2
3	Gas disulphider	φ3.0m	2
4	Gas disulphider	φ2.3m	2
5	Ice maker		4
III	Auxiliary unit		
1	Space-division	300 m^3/h	1
2	Tanning extract desulfurization	800t/a	1

Table 12.2-5 Monitoring plan of the waste water pollution source of Junma Company

Name of pollution source	Sampling location	Monitoring item	Monitoring rate(time/month)
Urea plant resolving water	Oulet of two devices	pH, urea, COD, ammonia, discharge and water temperature	4times/month
Coal gasification sewage	Discharge outlet	pH, COD, SS, oil type、sulfide、cyanide、Ar-OH、ammonia、tonnage	Once per duty
Sewage biochemical treatment plant of the whole factory	Inlet/outlet	pH, COD, SS, petroleum type, sulfide, cyanide, Ar-OH、ammonia and discharge	Once per duty

Include oily waste water treatmet device	Inlet/outlet	Oil type、COD	4times/month
Main drain of the factory	Main drain outlet of the factory	pH, methanol, COD, SS, oil type, sulfide, cyanide, Ar-OH, ammonia and discharge	On-line monitoring continuous of COD and NH3-N once a day，

Table 12.2-6 Monitoring plant source of atmospheric pollution of Junma Company

Name of pollution source		Monitoring location	Monitoring factor	Monitoring rate
Process gas	Organized Emission	Claus retrieve tail gas exhaust outlet	2S,methanol	Once/month，3days /time, monitor once every four hours everyday，using the maximum，
		Inlet and outlet of coal breaking system bag collector	PM_{10}	Once/month，3days /time ,not less than four times everyday，one hour/ time continuous sampling
	Unorganized emission	Operating in accordance with the monitoring methods of unorganized emission in *Integrated Emission Standard of Air Pollutants GB16297-1996*, and the amount of the installation method of unorganized emission and the sampling location in the appendix C “integrated emission standard of air pollutants”	NH3, H2S, methanol TSP	Once/quarter
Heating boiler		Boiler uptake	Exhaust gas volumn, smoke dust, SO2 and NOx	On-line continuous monitoring
		Inlet and outlet of the dust remover（on-line monitoring installation）		

Table 12.2-7 Monitoring plan of underground water

Monitoring location	Monitoring factor	Monitoring rate

Liulizhuang village、Huozhuang village sewage shore phreatic water	Ph, total hardness,total dissolved solids,AH-OH, S2－,CN－,ammonia, trate nitrogen, nitrite （calculate in N） and well depth	Twice/year

Table 12.2-8 Monitoring plan of sound environment

Category	Monitoring location	Monitoring factor	Monitoring rate
Factory boundary	Current factory	Equivalent sound level	Once/year、two days/time、once each day and night respectively
	Technological transformation factory		
Sensitive target	Living quarter of the company	Equivalent sound level	
	Living quarter of Gongluduan		

12.3 Enviromental management and monitoring focus

In order to ensure a smooth operation of the environmental monitoring work, the assessment suggests that the following work should be reinforced by the factory based on the environmental monitoring.

1) In accordance with the current environmental management requirements, the existing boiler uptake must be installed with permanent sampling monitoring hole, and the continuous monitor of the concentration of the emission of the dust and sulfur dioxide in the air should be installed.

Monitor and mange collection treatment of all the sewage that need addressing in the present project including the technological revolution project as well as the daily operation of the sewage treatment station well to ensure the treated sewage of the whole factory reaching the standard steadily.

2) Standarize the construction of drain and arrange environmental protection mark at the waste water oulet, waste gas outlet and noise source in accordance with Environmental Protection Mark-Outlet (Source) (GB15562.1-1995) Standard in order to supervise and manage the pollution source and conduct routine monitoring work.

3) Do the dust prevention and denoise work of the present project and technological revolution project well , protect the environment form being polluted by the coal dust and fly ash.

13 Public participation

13.1 Goals of public participation

Some impact will be brought to the nearby environment and the inhabitants after the feedstock line for ammonia synthesis project being carried out. So it is important to let the public be clear the benefit and loss of the project through public participation.

In terms of the actual character of the project, carried out in the principle of scientific, objective, just and public, the main goals of this public participation line in:

Be clear about the attitudes of the villagers around the sensitive spot near the project factory location.

Get the opinions and suggestions of the public toward the project, and feedback to the project process to make the project more complete, justify, and reduce the impact of the project to the environment to the largest extent.

Make full use of the impact of the public monitoring; ensure the implementing of the project environment protection measures.

Strengthen the purposiveness of the assessment work, the pertinence and operability of the environment protection measures.

Enhance the validity of the assessment work to make it more overall and justify.

13.2 Objects and mode of public participation

13.2.1 participated objects

Public

Mostly the beneficial inhabitants of the project impact area including:

The inhabitants of the project impact area which has made impact on the agricultural production, industrial production and the production and living habits of the inhabitants around the technical revolution factory location and main factory location.

The public who are benefited due to the operation of the project.

Social group

Government management departments include the Environmental Protection Bureau of Zhumadian city, Environmental Protection Bureau of Yichen district, committee of Zhumadian People’s Congress, Political Consultative Committee, etc.

Expert assessment group; experts in the related field.

13.2.2 Participation mode

Whether the form and the content design of the public participation are reasonable and overall can have a direct impact on the validity and authentic of the result of the poll as well as on the operability of the environment protection measures. The universal modes of public participation include expert consultation, questionnaire survey, panel method, etc. The following forms are adopted in this environmental assessment public participation:

Participation of the managing department

Get to know the attitudes of the district various governmental agencies and their functional department, project industry execution and competent department toward the project construction. Consider their opinions and the requirements of the project environmental impact, through letters, interview, attending conference, etc.

Participation of the experts

Widely get to know the experts' identification, selection, assessment of the environmental impact element of this project and their opinions and requirements about the environment protection through expert review, consultation, discussion forum, etc.

Public questionnaire participation

According to the regulation of the environmental impact assessment, the construction unit takes the responsibility of organizing the public participation survey. The assessment unit designs and works out the contents of the questionnaires of the public opinions and print them. The construction unit takes the responsibility of organizing the surveying of the public opinions and handing out and collecting the questionnaires. The assessment is responsible for the categorization, statistics and analysis of the surveyed opinions, and then feedback them to the construction unit and related department.

General situation of public participation

The assessment unit has arranged EIA staff to inspect the project impacted area and heard the opinions of the nearby public when making the outline. During the investigation of the current situation, with the corporation of the company, the assessment unit has a deeper investigate of the environment element that maybe impacted by the project, and designs the related survey content. The construction unit carries out the questionnaire survey work.

There are 200 copies of public opinions questionnaires being handed out and 200 copies being filled and recollected. The recollecting rate is 100%. The people questioned are at different ages, with different education degree, in different fields and from districts that have wide representativeness. The general situation of the public participation is shown in table 13.2-1

Symposium participation

After the preliminary clearing of the conclusion of the EIA, the construction unit held another symposium, and introduces the conclusion of the EIA report, the construction situation to the planning, land and development and reform commission again, and heard from them.

Table 13.2 - 1 General situation of public participation

Item		Situation of the participants	Rate(%)
Copies of the handed out questionnaires		200	/
Copies of the recollected questionnaires		200	100
Age structure	< 20	2	1
	20～29	78	39
	30～39	80	40
	> 40	40	20
Education degree	Below Junior school	67	33.5
	High school	62	31
	Special school	32	16
	Junior college	39	19.5

13.3 Statistics of the survey result

The result of the statistics of the public opinions is shown in table 13.3-1

The representative of the local management department believes that this project complies with the relevant industrial policies of the state and the industry development plan, complies with the requirements of clear production. The implementing of the project can enhance the economic benefits, increase the local economy benefit and promote the local economic growth, which complies with the “project promoting” policy. He requires that the companies strictly carry out the policy of “three at the same time” to ensure all kinds of the pollutions being discharged up to the standard after the operating of the project.

Table 13.3-1 Statistical findings of public opinion

Name	Gender	Age	Occupation	Education	Economic resource
See the following attachment for project profile to synthetic ammonia route technological transformation engineering of Henan Junma Chemical Industry Co., Ltd					

The local environmental problems in your opinion are: Air pollution(53 people, 26.5%) Water pollution(（48 people, 24%） Noise pollution(38 people, 19%) Others（61 people，30.5%）
Your satisfaction of environmental protection of Junma Company existing project: Satisfied(98 people，49%) Unsatisfied（8 people，4%）Remain to be improved（94 people，47%）
The main environmental problems of Junma Company in your opinion are: Air pollution(40 people, 20%) Water pollution(（41 people, 20.5%） Noise pollution(56 people, 28%) Others（63 people，31%）
Whether you know this project or not: Completely know （22 people，11%） Partly know（125 people，62.5%） Not know（53 people，26.5%）
The impact that this project construction has on you in your opinion: (1) Work: Beneficial(80 people, 40%)Inreversible negative impact(8 people, 4%） Bearable negative impact（13 people, 6.5%）No impact(99 people, 49.5%) (2) Life :Beneficial(65 people, 32.5%)Inreversible negative impact(7 people, 3.5%） Bearable negative impact（29 people, 14.5%）No impact(99 people, 49.5%) （3）Health：Beneficial（39 people, 19.5% ）Inreversible negative impact（8 people, 4%） Bearable negative impact（10 people, 5%）No impact(143 people, 71.5%)
Your demand of compensation for resettlement: Resettlement in a different area(37 people, 18.5%） Currency indemnity(54 people,

27% ） No opinion（109 people, 54.5%）
The impact you think that this project has on local environment: Beneficial（35 people, 17.5% ）Inreversible negative impact（9 people, 4.5%） Bearable negative impact（69 people, 34.5%）No impact(87 people, 43.5%)
The impact you think that this project has on local social economy: Great stimulation（107 people, 53.5%）Certain stimulation （90 people, 45%）No stimulation（3 people, 1.5%）
Your opinion towards the proposed factory site: Support（113 people, 56.5%） Oppose（3 people, 1.5%）No opinion（84 people, 42% ）
Your opinion towards this project construction： Support （114 people, 57%） Oppose（1 person, 1.5%） No opinion（85 people, 42.5% ）

Table 13.3-2 Project content

Attachment Synthetic Ammonia Route Technological transformation Engineering of Henan Junma Chemical Industry Co., Ltd

Project profile

①Project type: technological transformation

②The proposed factory site: East of Runing Road, south of Lianjiang road, about 1km from existing factory

③ Construction plan and scale: The production scale and product plan keep current status. Advanced water coal slurry gasification process will be adopted to replace the existing fixed-bed intermittent gasification process with high pollution and high energy consumption. Meantime, synthetic ammonia installation will be transformed, but methanol rectification installation and urea installation will not be transformed in this project.

⑤Raw material consumption: feed coal 435 thousand t/year, Yima coal; bunker coal 148 thousand t/year, Pingdingshan coal.

Newly-added industrial water is 5988 thousand t/year and the water of deep well in current factory will be used as water-supply source.

⑥Pollution factors and environmental protection measures:

Atmosphere:

☻Pollutants: sulfur dioxide, nitrogen oxide, soot, bug dust and characteristic pollutants including ammonia, methanol and sulfureted hydrogen.

☻Pollution links: tail gas of coal preparation, acidic gas of desulfurization, flashed vapour of gasification, ammonia synthesis off-gas and boiler smoke gas.

☻Environmental protection measures: desulphurization by mixing and burning limestone, standardized discharge after treated by sulfur recovery, bag dust collecting, torch burning and recycling ammonia of ammonia synthesis off-gas and using the rest of combustible gas as fuel.

Water

☻Pollution factors: ammonia-N, COD, prussiate, fluoride, sulphide, petroleum and volatile phenol.

☻Pollution links: coal gasification wastewater, gasification boiler blow-off, condensate of process change, wastewater of acidic gas and rectification wastewater, etc.

☻Environmental protection measures: the method of combining distribution and centralization shall be taken to treat the wastewater of the whole factory. Production and domestic sewage will be sent to city sewage treatment station through pipe networks after treated by newly-built biochemical treatment installation.

Solid waste：

☻Pollution links: gas generation clinker, boiler clinker, dead catalyst, molecular sieve, alumina gel, pearlife and gas-generation sludge.

☻Environmental protection measures: safe treatment, landfill and recycle based on the relevant requirements of national environmental protection.

Risks:

☻Risk factors: The chemicals, carbon monoxide, hydrogen and methanol, involved in production all have fatalness of blast and they belong to poisonous and harmful substances. They can do harm to people within a certain distance (about 400 to 700m) from the accident source.

☻Precautionary measures: The sensitive points, such as villages and schools, are not forbidden to be built within calculated health protection distance and the existing sensitive objects shall be removed. Moreover, the enterprise shall entrust relevant department to put forward precautionary measures and emergency plans to respond to potential risks.

⑦Environmental benefits: The discharge of waste gas and water of whole factory can be reduced in a certain degree and the environment quality around the factory will be improved after the completion of Technological Transformation Project.

⑧Necessity of project construction: this project can realize the localization of feed coal supply, effectively reduce production costs, stabilize production and effectively reduce the production and discharge of pollutants, which has remarkable economic and environmental benefits and can lay a solid foundation for a long-term development of the enterprise.

Henan Junma Chemical Industry Co., Ltd

June 6, 2005

13.4 Expert Opinion

This project belongs to technological transformation engineering. The original low level cleaning production process will be replaced by high level cleaning production process after the project implementation. It is a project of energy-saving, economic and environment-friendly, and it confirms to the requirement of Cleaner Production Promotion *Law of the People's Republic of China*, the policy of “build a conservation-oriented society” and relevant industrial policy. The production and discharge of this project will obviously lower than existing project and there will be feasible treatment measures. This project can help to improve regional environment and realize the standardized discharge of pollutants.

The construction unit shall earnestly strengthen cleaning production management, further control the point source of ammonia and bug dust and their fugitive discharge; summarize the optimal control parameters of each ammonia-containing wastewater treatment by trial and error to ensure maximum recycling of wastewater. It shall also strengthen the operation and management of sewage treatment station in order to ensure that the standardized discharge of wastewater is long-term and stable.

13.5 Public opinion

Based on above statistical findings and combining the opinions of the public and participants of the conversazione during investigating period, publis opinions are concluded as follows:

(1) Social economy effects that this project has on the region: 98.5% respondents think that this project has great promoting effect and a certain promoting effect on local social economy development;

(2) Profit and loss of environmental impact of this project: When asked for the possible impact that this project has on local environment, 17.5% people think it is beneficial, 78% people think it has no impact or has bearable negative impact, and only 4.5% people think it has inreversible negative impact;

(3) the impact that this project has on the people in the region: the people who think it is beneficial and has no impact on the work, life and health of themselves respectively account for 89.5%, 82% and 91% of the respondents. However, the people who think it has irreversible negative impact on work, life and health are not over 5% (respectively 4%, 3.5% and 4%)

(4) Opinions of factory site: the people who support or have no opinion on the factoy site account for 98.5% of the respondents, which reflect the public can accept the proposed factory site.

(5) The representative participating the conversazione, who think this project can help promote city environment quality, improve the living environment of residents, reduce environmental risks of existing factory and reduce production costs, are favor of the implementation of this project as soon as possible.

(6) Overall Attitude: 99.5% respondents hold the attitude of “support” and “no opinion”, which shows the public have had a high degree of recognition of the construction after they found out this project is helpful to promote social and economic development and improve regional environment.

13.6 Statistical findings feedback analysis and suggestions

Through public participation and combining pollution features of this removal project and environmental characteristic of the surroundings, the following feedback analysis and suggestions are put forward by the assessment:

(1) Effective implementation of pollution prevention measures shall be earnestly ensured. When this project is under construction, the design and construction of pollution prevention facilities of waste gas, wastewater and noise, etc. shall be carried out.

(2)Because the affected objects are mainly Niuzhuang village and Zhouwan near the factory, the factory shall intensify propaganda to increase the residents’ awareness and recognition of this project. And meantime, land compensation and house dismantlement & migration compensation of the relevant villagers shall be arranged properly to conscientiously relieve their extra worries.

(3) On the whole, the public have favorable and supportive attitudes towards this project and hope it will be started and completed as soon as possible. The public suggest that the scientific management should be implemented, that comprehensive treatment plan of combining production process with end-of-pipe treatment for environmental pollution improvement should be put into practice and that effective management of the operation should be strengthened to minimize the impact that this project has on environment in order to make the project accomplish good economic, social and environmental benefits and

14 Assessment Conclusions and Suggestions

This project belongs to synthetic ammonia route technological transformation engineering. The proposed factory which is about 1km from existing factory is in eastern industrial park planned by Zhumadian city and conforms to urban development planning. The project will rely on present public facilities and supporting facilities and adopt Texaco water coal slurry gasification process to replace present fixed-bed intermittent gasification with production capacity of the whole factory and product scheme unchangeable. This project has been included in the list of alternative pilot projects of structural adjustment of raw materials and power in nitrogenous fertilizer industry in the year 2004 and 2005. And it conforms to the state's industrial policies and is a state-encouraged project. However, the existing project of Junma Company has certain problems in environmental protection, and strict measures and the measure “replacing the old by the new” to solve the existing pollution problems have been put forward by the assessment. The whole factory can meet the requirements of standardized discharge, cleaning production and overall control after project implementation and meantime the local environment quality can be improved. Therefore, it is recognized through assessment that this project must earnestly carry out each measure for preventing and controlling pollution and accept the suggestions put forward by the assessment, do well in the relocation of the residents’ within health protection distance, strengthen environmental management, prepare emergency plans for risk prevention, implement the removal of the existing replaced equipment and analyze the construction feasibility of this project from environmental protection.

The assessment conclusions and suggestions for each special subject are as follows:

14.1 Assessment Conclusions

(1) This project construction conforms to the state's industrial policies and the project implement can largely reduce the production cost of chemical fertilizer, thus reducing the price of it to achieve the purpose of supporting agriculture.

This project adopts advanced and clean gasification and purification technology to transform the existing production facilities with high energy consumption and high pollution to achieve energy-saving and cost-reducing, and use local soft coal to replace Shanxi anthracite, which changes the traditional route of raw materials and implement route adjustment , which can largely reduce production cost. The production cost of synthetic ammonia can reduce from RMB1600/t to RMB 976.17/t and the production cost of carbamide from RMB 1008 /t to RMB 778.48 /t, thus reducing the price of chemical fertilizer, lightening the burden on the peasants and strengthen the competitiveness of the enterprise at the same time.

This project is consistent with the requirements of “Tenth Five-year” plan of chemical industry concerning “vigorously promote the industrial structure adjustment, accelerate the adjustment of raw materials route and technology route, reduce the production cost of basic fertilizer; large and medium-sized nitrogenous fertilizer plants, which use anthracite of higher price, shall adopt local cheaply-priced coal and raw materials route technological transformation of advanced gasification technology; large and medium-sized nitrogenous fertilizer plants shall implement technological transformation to increase production and conserve energy."

This project will implement the measure of "replacing the old by the new" for all pollution sources treatment. With decreasing production cost largely, the reduction of major pollutants of the whole factory can be realized after technological transformation. The project can meet the requirements of Chemical Industry Environmental Regulations. The principle of "replacing the old by the new" must be implemented to settle the new and old "three wastes" together if any project relies on the current enterprise to carry out enlargement, reconstruction and digging, "Technological Transformation Project must adopt the best raw materials route and advanced techniques of efficient resource use and less discharge of "three wastes"; and "vigorously carry out comprehensive utilization and fully implement cleaning production."

Therefore, this project conforms to the state's industrial policies and is a state-encouraged project.

The total investment of this project is RMB 980 million, of which environmental protection investment is RMB41.4 million, accounting for 4.2% of the total. The internal rate of return of this project after tax is 17.05% and it has better profitability. This project also has better economic benefits, environmental benefits and social benefits.

(2) This project belongs to relocated construction and the proposed factory site, located in the planned industrial park, is consistent with urban development planning. It is only 1km away from current factory. With its convenient transportation, it can make the best of public utilities and technical superiority of the current factory and it is convenient to transmit raw gas. Also the construction condition of the project is better. Meantime, the government issued document and promised that Junma Company would be responsible for the relocation expenses and plan of the residents within health protection distance of this project. On this basis, it is recognized through assessment that the proposed factory site is feasible.

(3) The wastewater discharge of current factory can't satisfy the need of safety discharge and overall control, waste gas discharge can't satisfy the need of overall control and the noise of current factory boundary is out of limits. The Technological Transformation Project adopts advanced and clean manufacturing technique to replace old technique with heavy pollution. Meantime, strict measures for pollution prevention and the measure "replacing the old by the new" have been put forward by the assessment to control the existing pollutants. The standardized discharge of whole factory can be realized after technological transformation. And compared with the situation before technological transformation, the discharge of main pollutants of the whole factory can be reduced in various degrees.

The production facilities such as air separation, gasification, conversion, desulfuration/decarburization, methanolizing-methanation, synthesis, synthetic gas compressor will be newly established in this Technological Transformation Project. The three wastes treatment, ancillary and public works matched with this project will be also built, and meantime the relevant equipment of existing project will be removed. See table14.1-1 for main equipment eliminated after technological transformation.

Table 14.1-1 Main eliminated equipment after technological transformation

Serial number	Equipment name	Parameter and size	Number
一 I	Gas-making equipment		
1	Gas-making furnace	φ2610	16
2	Waste heat boiler	Vertical type	14
3	Washing tower	φ5000	6
二 II	Synthesizer		
1	Ammonia synthesis tower	φ1.0m	2
2	Saturated hot water tower	φ3.0m	2
3	Shift gas desulfurization tower	φ3.0m	2
4	Shift gas desulfurization tower	φ2.3m	2
5	Ice maker		4
III	Auxiliary device		
1	Air separation	300 m^3/h	1
2	Tannin extract desulfurization unit	800t/a	1

The waste gas pollution sources generated by the whole factory mainly includes coal-fired boiler flue gas, tail gas of coal-making, gasification flashed vapour, acidic gas from purification plant and ammonia synthesis off-gas etc. after completion of Technological Transformation Project. The discharge of waste gas pollution sources can reach the standard by taking the measures of furnace desulfurization, electrostatic dust collection plus water film dedusting, dust bag, torch burning sulfur recovery, three-reactor Claus sulfur recovery and ammonia recovery.

The waste water pollution sources generated by the whole factory mainly includes gas making wastewater, domestic sewage, oily sewage, acid and alkali wastewater and recirculated cooling water after completion of Technological Transformation Project. The waste water treatment mode is a combination of distribution and centralization. The discharge of production and living wastewater can reach emission standard after centralized treatment by newly-built biochemical equipment and the recirculated cooling water can be discharged directly.

The coal gasification waste residue and boiler clinker generated by the whole factory are 156 thousand t/a, which are planned to be used to produce cement. And the temporary ash yard will be arranged in the factory. Waste catalyst will be recycled by manufacturers. Cyanogen-contained sludge shall be piled up temporarily in the hazardous waste storage farm built and managed according to the requirements of Standard for Pollution Control on Hazardous Waste Storage (GB18597-2001) and will be treated by hazardous waste treatment center after it is completed.

The noise sources of Technological Transformation Project mainly includes coal pulverizer, industrial pump and compressor, the noise level of which is between 80 and 110dB (A). Equipment with low noise shall be chosen in project design and the noise reduction measures shall be taken to deal with strong noise sources in order to have a weak impact on the surroundings. Meantime, some equipment with high noise in current factory will be abandoned after completion of Technological Transformation Project. The noise level of current factory will reach the standard.

See table 14.1－2 for pollutant discharge of the whole factory after completion of Technological Transformation Project,.

Table 14.1-2 Pollutant discharge of whole factory

Category	Item	Unit	Factory before technological transformation	Factory after technological transformation	Variation
Waste Gas	Smoke dust	t/a	191.4	151.6	-39.8
	Bug dust	t/a	81.0	81.0	0
	SO_2	t/a	1307.7	752.4	－555.3
	NO_x	t/a	581.3	581.3	0
	Methanol	t/a	5.6	5.6	0
	Ammonia	t/a	148.0	148.0	0
	H_2S	t/a	22.2	13.1	－9.1
Waste Water	COD	t/a	159.2	41.8	－117.4
	Ammonia-N	t/a	106.6	15.7	－90.9
	Prussiate	t/a	0.32	0.16	－0.16
	Sulphide	t/a	0.01	0.008	－0.002
	Petroleum	t/a	1.05	0.78	－0.27

(4) The amount of SO_2 and NO_2 of environmental air quality in the assessment area can meet the requirements of Category II. The amount of TSP and PM_{10} is commonly out of limits and H_2S and NH_3 exceeding the standard also occurs in some areas near the factory; Huangyou River exceeds the standard of Category Ⅳ; Sound environment of the proposed factory site is favorable; phreatic water along coastal region of the drainage ditch can't meet the requirements of CategoryⅢ.

Main pollution factors in assessment area are TSP and PM10. The measured value range of daily mean TSP concentration in each monitoring point is from 0.128 to 1.10mg/m3. Exceeding the standard occurs in each monitoring point and the maximum value is 2.7 times of the standard; the measured value range of daily mean TSP concentration in each monitoring point is from 0.044 to 0.501mg/m3. Exceeding the standard occurs in each monitoring point except Liulou Village and the maximum value is 2.3 times of the standard; 1 hour daily mean SO2 and NO2 concentration in each monitoring point does not exceed the standard; the measured value range of 1 hour daily mean H2S concentration in each monitoring point of assessment area is from 0.0005 to 0.024mg/Nm3. Exceeding the standard does not occur in each monitoring point except living quarters of Gongluduan and the maximum value is 1.4 times of the standard; the measured value range of 1 hour daily mean NH3 concentration in each monitoring point of assessment area is from 0.015 to 1.00mg/Nm3. Exceeding the standard occurs in each monitoring point and the maximum value, which occurs in the monitoring point of living quarters of Gongluduan, is 4 times of the standard.

Surface water of Huangyou River is in heavy pollution and has exceeded water quality of category Ⅳ. It belongs to organic pollution and main pollution factors are COD, ammonia-N, volatile phenol and prussiate. Except that volatile phenol in Suya Lake Reservoir exceeds the standard, the other pollution factors can meet the requirement of water quality of categoryⅢ.

Phreatic water along coastal region of drainage ditch can't meet the requirements of water quality of category Ⅲ and main pollution factors exceeding the standard are trate nitrogen and total coliform, the maximum times of which are separately 1.1 and 765.

The noise in the sensitive points around the factory site does not exceed the standard in the daytime and at night.

(5) This project is about technological transformation, which will transform the raw materials route of synthetic ammonia with production scale and product scheme unchangeable. This project implements "replacing the old by the new" to make old pollution load reduced largely and the discharge of new pollution source controlled strictly. After project implementation, the regional environment air, surface water and groundwater are all improved in certain degree. Solid waste can be comprehensively used or safely disposed of. Sound environment near technological transformation factory will not have obvious change. Project implementation can bring positive benefits to the environment.

Environmental air impact assessment shows that the measured value of SO_2, NO2, NH3, methanol and H2S in each monitoring point in different weather conditions does not exceed the standard. It is concluded that regional environmental air quality will be improved in certain degree and positive environmental benefits are more notable after completion of this project by analyzing the change of average daily concentration and average yearly concentration before and after the project.

This project will take effective waste water treatment measures and eliminate or treat old pollution sources by "replacing the old by the new". Pollution load will be largely reduced and the quality of discharged waste water will be improved remarkably. Meantime, the waste water which can be discharged after reaching the standard will be no longer discharged into surface water body, but will be delivered into sewage treatment station through pipes, which will get rid of the pollution to surface water body and underground water.

Based on solid wastes disposal condition of existing project and comprehensive utilization agreement of reconstruction and expansion, it is concluded through assessment that fly ash and cinder of solid waste produced by the whole factory shall be comprehensively used and piled up in the temporary slag dump inside factory in the event of accidents and that hazardous waste generated by the factory mainly includes cyanogen-contained sludge and waste catalyst, of which cyanogen-contained sludge shall be safely disposed of and waste catalyst shall be recycled by the manufactures. The design, construction and operation of temporary slag dump and hazardous waste storage site shall meet the standard of *Standard for Pollution Control on the Storage and Disposal Site for General Industrial Solid Wastes (GB18599-2001)* and *Standard for Pollution Control on Hazardous Waste Storage (GB18597-2001)* and be implemented strictly based on the measures of waterproof, anti-leakage and anti-loss put forward by the assessment to make all solid waste dispoded of safely. The measures are feasible.

(6)The course of producing synthetic ammonia, urea and methanol involves flammable, explosive, virulent and harmful materials and there are certain potential risks. Precautionary measures and emergency preplans have been proposed in this assessment.

Existing project health protection distance is 1500m away from ammonia and urea installation after calculating. And it shows through spot field investigation that there are many sensitive objects in health protection distance, which shall lead to potential safety hazards. After Technological Transformation Project implementation, ammonia tank and synthetic ammonia installation in current factory will be removed and potential safety hazards shall be mitigated. But urea installation will be reserved and there shall still be potential safety hazards. The health protection distance is 1200m and existing project still can't meet its requirement. Meantime, the local government shall make a resettlement plan in the health protection distance based on the requirements of urban development planning and fine chemical zone planning and relocate gradually all sensitive objects in health protection distance without building new sensitive objects at the same time.

Risk impact assessment shows that Technological Transformation Project will do extrem harm to population centre within the range of 550m from accident source in case of leakage accident . Meantime, the ammonia storeroom must be removed 200m eastward in order to meet the requirement of health protection distance. Ammonia tank is 1,000m from Technological Transformation Project health protection distance. Two sensitive objects, Niuzhuang Village and City Labor Camp，is within health protection distance and the city government has issued documents to promise to remove them. Meantime, City Planning Bureau issued documents and promised that no new sensitive objects will be built within health protection distance and removal plan and expenses shall be implemented by Junma Company issuing documents.

The length of synthesis gas pipework is 1.6m and the buried depth of it is1.2m. Its pipe diameter isΦ159×6 and it is made of 20＃carbon steel. The pipework goes along Yicheng Avenue for about 600m and then goes 400m westward into current factory. It passes over Yicheng Avenue and Lianjiang Road. There is no village for 200m along the way.

Generally speaking, fires and explosion happen only inside the factory after the accident caused by methanol material under construction and has less impact on the places outside the factory boundary. In the accident of toxic substances leakage, there is no partial accumulation even if a little amount leakage happens in synthesis gas pipework because the specific gravity of synthesis gas is less than air. So it has little impact on environment. Assuming that moderate intoxication concentration occurs within 200m after methanol leakage but that fatal concentration region is not caused and that the permitted concentration in workshop is reached at the point 400m from project construction site, it also has little impact on population centre outside the factory. Health protection distance of methanol material project under construction is set to be 200m from methanol installation.

(7) After the implementation of design plan, assessments and suggestions, cleaning production level of the whole factory is higher than that of existing project and the factory has the foundation for cleaning production.

This project belongs to synthetic ammonia route technological transformation engineering. Compared with existing project, this project has advanced manufacturing technique and higher automation degree. After Technological Transformation Project implementation, the production and discharge of the three wastes can be largely reduced, and in particular, the pollution of gas generation and blowing air can be eliminated. Gas generation sewage will be recycled after three stage flash process and only a little waste will be discharged outside. The wastewater of the whole factory can reach standardized discharge after being treated with the terminal wastewater treatment measure. The pollutants of the whole factory can reach standardized discharge and effective control. The main pollutants such as waste water and gases, etc. can be largely reduced and solid waste can get comprehensive utilization or harmless treatment. So this project has the feature of protecting environment. Compared with those before technological transformation, comprehensive energy consumption will be largely reduced, pollutant discharge quota will be lower than enterprises of its kind and cleaning production level of this project is obviously higher than that of existing project.

(8) After the completion of this project, the total discharge amount of main pollutants is reduced and can meet the requirement of overall control quota given by local environmental protection department.

See table 14.1-3 for total volume control of whole factory after completion of this project.

Table 14-.1-3 Overall control quota after completion of this project

Category	Item	Unit	Pollutants discharge amount after technological transformation	***Quota transmitted by city environmental protecting bureau***	***Suggested quota***
Waste gas	Soot	t/a	151.9	***162.9***	
	SO_2	t/a	752.4	***761.9***	
	Methanol	t/a	5.6		***6.0***
	Ammonia	t/a	148.0		***148.0***
	H_2S	t/a	13.1		***13.1***
Sewage	COD	t/a	41.8	***142.3***	
	Ammonia-N	t/a	15.7		***15.7***

(9) The investigation with public participation shows that the project construction is supported by most of the public receiving investigation. And meantime it is hoped that the company can strengthen environmental management and overall-process management shall be implemented to achieve pollution control and risk prevention in order to minimize the pollution impact that the project has on the surroundings, especially accident risk impact. The residents within health protection distance hope that the government and the enterprise can resolve the settlement after relocation to relieve the extra worries for them.

14.2 Suggestions

(1) It is investigated that Junma Company is the only enterprise that discharges characteristic pollution factors, NH_3 and H_2S, within assessment area. The controllable discharge source of ammonia and the discharge within factory boundary of existing project can meet the standard discharge according to project analysis and monitoring result of fugitive discharge within factory boundary. However, the monitoring result of current situation shows that 1 hour mean NH_3 and H_2S concentration in environmental air exceeds the standard in the concerned point in short distance of the assessment area. The maximum value all occurs in Living quarter of Gongluduan, which indicates that the discharge of NH_3 and H_2S has had a bad impact on surrounding environmental air. Therefore, the assessment suggests that the enterprise shall take further measures to reduce controllable discharge and fugitive discharge source of ammonia and minimize their impacts on environmental air.

(2) Although current factory and proposed factory site is located in the industrial park, the enterprise shall attach importance to the impact of accident risks because there are many sensitive objects around the factory site. The enterprise shall also strengthen risk prevention awareness of all employees, earnestly implement the

measures of risk prevention and emergency preplan and minimize or preclude risk accidents. Meantime, the enterprise shall often give speeches on security information to the residents around the factory in order to raise their risk-preventing conscientiousness and minimize casualties in the event of accidents.

(3) The enterprise shall strengthen environmental management and increase the environmental protection consciousness of all employees to make cleaning production become the conscious activity of all employees in order to ensure the implementation of project design, pollution prevention and control measures proposed by environmental impact assessment.

(4) It is difficult to complete relocation in a short time because there are many sensitive objects within existing project health protection distance. The enterprise and local environmental protection department shall pay close attention to ammonia pollution of sensitive objects within health protection distance and perfect daily monitoring system. If any problems are found, please report to related departments in time and take corresponding measures.

(5) The enterprise shall entrust a qualified unit to conduct safety assessment of technological transformation factory and planning environmental impact assessment of chemical industrial park as soon as possible.

Registration form of construction project of cleaning production management

Name	Location	Longitude	Latitude	Construction specification and scale	Type（new, reorganization, expansion）	Industry type	Environmental protection management category(report, report form, archival registration form	Total investment(Ten thousand)	Environmental protection investment(Ten thousand)	Environmental sensitive features (water protection zone, natural reserve etc.)	Supplementary material and use level（Indicate two main materials）	Main products and output	Main by-products and output	Pollutant-holding water body	Where there are effective contingent cy measure or emergency preplan	Energy consumption per ton product	Material consumption per ton product	Water consumption per ton product

Technological Transformation Project on Route of Synthetic Ammonia Raw Materials of Henan Junma Chemical Industry Co., Ltd	Zhumadian, Henan Province	E113°3′	N32°59′	Replace current fixed-bed coal gasifier by Texaco coal gasifier, transform current synthetic ammonia system without scale unchangeable(300 thousand t/a)	Reconstruction	Chemical raw material and chemical product manufacturing c26	Report	RMB 981.26	RMB 41.40	Three rivers	Feed coal	4.35 thousand t/a	Synthetic ammonia 30thousandt/a		Municipal sewage plant	There are	48.17GJ	1050 Standard coal	

Chemical oxygen demand（t/year）					Ammonia-N（t/year）					Sulfur dioxide（t/year）					Soot（t/year）					Nitrogen oxide（t/year）					Solid waste discharge
Generated amount	Reduced discharge of itself	Reduced discharge by replacing the old by the new	Reduced discharge by region replacement	Discharge amount	Generated amount	Reduced discharge of itself	Reduced discharg e by replacing the old by the new	Reduced disc harge by region replacement	Discharge amount	Generated amount	Reduced discharge of itself	Reduced discharge by replacing the old by the new	Reduced discharge by region replacement	Discharge amount	Generated amount	Reduced discharge of itself	Reduced discharge by replacing the old by the new	Reduced discharge by region replacement	Discharge amount	Generated amount	Reduced discharge of itself	Reduced disc harge by replacing the old by the new	Reduced discharge by region replacement	Discharge amount	
89.3	62.5	118		26.8	15.5	9.3	97.1		6.2	5.4		560.7		5.4	410	405.9	43.9		4.1						0

Registration Form of Construction Project Environmental Protection Approval

Form-filling unit（Seal）: Henan Environmental Protection Research Institute **Completed by (Signature)** **Project operator (Signature)**

<table>
<tr><td rowspan="6">Construction project</td><td>Name</td><td colspan="3">Technological Transformation Project on Route of Synthetic Ammonia Raw Materials of Henan Junma Chemical Industry Co., Ltd</td><td colspan="2">Location</td><td colspan="3">Zhumadian, Henan Province</td></tr>
<tr><td>Construction specification and scale</td><td colspan="3">Replace current fixed-bed coal gasifier by Texaco coal gasifier ,transform current synthetic ammonia system without scale unchangeable (30000 a/a)</td><td colspan="2">Type</td><td colspan="3">□New □Reorganization and expansion ■Technological transformation</td></tr>
<tr><td>Type</td><td colspan="3">Chemical raw material and chemical product manufacturing c26</td><td colspan="2">Environmental protection management category</td><td colspan="3">■Compile report □Compile report form □Fill in registration form</td></tr>
<tr><td>Total Environment(ten thousand)</td><td colspan="3">98126</td><td colspan="2">Environmental protection investment(ten thousand)</td><td>4140</td><td>Proportion(%)</td><td>4.2</td></tr>
<tr><td>Project approval department</td><td colspan="3">Henan Development and Reform Commission</td><td colspan="2">Approval number</td><td>（2004）1988 号
(2004) No.1988</td><td>Project approval time</td><td></td></tr>
<tr><td>Report approval department</td><td colspan="3">Henan Environmental Protection Bureau</td><td colspan="2">Approval number</td><td></td><td>Approval time</td><td></td></tr>
<tr><td rowspan="3">Construction unit</td><td>Unit name</td><td>Henan Junma Chemical Industry Co., Ltd</td><td>Contact number</td><td>13783963999</td><td rowspan="3">Assessment unit</td><td>Name</td><td>Henan Province Institute of Environmental protection</td><td>Contact number</td><td>0371-66324667</td></tr>
<tr><td>Address</td><td>No.94 Dongfeng Rd., Zhumadian, Henan</td><td>Postal code</td><td>463000</td><td>Address</td><td>No.1 Shunhe Rd., Zhengzhou</td><td>Postal code</td><td>450004</td></tr>
<tr><td>egal representative</td><td>Tang Guangbin</td><td>Contact person</td><td>Zhang Fuqiang</td><td>Certificate number</td><td>GHPZJZ No.2502</td><td>Assessment funds</td><td></td></tr>
<tr><td>Environment situation</td><td>Environment quality grade</td><td colspan="8">Environmental air: TSP and PM_{10} over gradeⅡ   Surface water: over Category Ⅳ   Underground water: below CategoryⅢ   Environment noise: CategoryⅢ   Seawater: Soil: Others</td></tr>
</table>

	Environment sensitive features	□Drinking water reserve □ Natural reserve □Scenic spot □Forest park □Basic farmland protection zone □Ecological reserve □Soil erosion prevention and control region □Ecological sensitive vulnerable area □Population denseness district □Cultural relics protection unit ■Three rivers, two lakes and two control’s area □ Reservoir area of Three Gorges															
Pollutants scandalized discharge and overall control（industrial project needs fill in detail）	Pollutants	Existing project				This project						Overall project				区域平衡替代削减量 Local equilibrium substitutes pollutant reduction
		Real discharge concentration	Permitted discharge concentration	Total discharge	Approval total discharge	Predicted discharge concentration	Permitted discharge concentration	Generated discharge	Reduction of itself	Predicted total discharge	Approval total discharge	Deduction by replacing the old by the new	Predicted total discharge	Approval total discharge	Discharge increment and decrement	
	（Wastewater）			**76.8**		——	——	**190.4**	**0**	**190.4**		**71.3**	**195.9**		**+119.1**	
	Chemical oxygen demand*	**212**	**150**	**159.2**	**142.3**	**80**	**100**	**89.3**	**62.5**	**26.8**		**118.0**	**68.0**	**142.3**	**- 91.2**	
	Ammonia nitrogen*	**146**	**93**	**106.6**		**30**	**40**	**15.5**	**9.3**	**6.2**		**97.1**	**15.7**		**- 90.9**	
	Petroleum	**1.5**	**10**	**1.05**		**1.0**	**10**	**0.2**	**0.14**	**0.06**		**0.33**	**0.78**		**- 0.27**	
	Waste gas			**558000**		——	——	**19000**	**0**	**19000**		**70000**	**507000**		**- 51000**	

	Sulfur dioxide*		450～860	700～900	1307.7	761.9	28	550	5.4	0	5.4		560.7	752.4	761.9	- 555.3	
	Soot*			150～200	586.6	162.9	50～80	120	410	405.9	4.1		438.8	151.9	162.9	- 434.7	
	Industrial dust*		30～180	150～200	81									81.0		0	
	Nitrogen oxide*		100～300		581.3									581.3		0	
	Industrial solid wastes*				0				8.7	8.7	0			0		0	
	Other specific pollutants related to project	H_2S			22.2				2620	2606.9	13.1		22.2	13.1		- 9.1	
		Methanol			6.0									6.0		0	
		Ammonia			148.0									148.0		0	

Note:1. * represents pollutants to which the country implements total amount control during the "10th five-years" period.

2. Discharge increment and decrement: (+) represents increment and (-)represent decrement.

3. Measuring unit: wastewater discharge——ten thousand t/year; waste gas discharge——10 thousand standard m^3/year; industrial solid wastes——ten

thousand t/year; discharge concentration of water pollutants——mg/litre; discharge concentration of atmospheric pollutants——mg/ m^3; water pollutants discharge amount——t/year; atmospheric pollutants discharge amount——t/year