ENVIRONMEANTAL IMPACT

ASSESSMENT

Project: **Bayer Coatings Systems Shanghai Co., Ltd. LDA Project**

Company (seal): **Bayer Coatings Systems Shanghai Co., Ltd.**

Date: **27th Sep. 2002**

Issued by National EPB.

General situation of the project

Name	Bayer Coatings Systems Shanghai Co., Ltd. LDA Project				
Construction Unit	Bayer Coatings Systems Shanghai Co.Ltd.				
Representative	MARCEL PETINAUX	Person in charge	Dr. Eric Bischof		
Address	21/F,Rui'an plaza, Hua Hai Zhong Lu 333,Shanghai, China				
Telephone	63868282	Facsimiles	53831992	Zip Code	200021
Construction site Address	Lot F3, Shanghai Chemical Industry Park, Caojing, Jingshan District, Shanghai, China.				
department for Approval			Approved Number		
Construction nature	New Construction ☐ Mend & Expansion √ Technical Innovation ☐		Trade sort & code	2652	
Area Covered (m^2)	1350		Area of green (m^2)		
Total Investment (USD)	24,000,000	Including: Environmental Investment (USD)	992,400	Environmental Investment Proportion of the total (%)	4.13 %
Cost of the EIA (RMB)		The Expected Date of Operation	2005.4		

Engineering content & capacity:

Bayer Coatings Systems Shanghai Co., Ltd. (BCSS) plan to expand the three production lines (project LDA) on the site of PIC project of Shanghai Chemistry Industry Park(SCIP). (The PIC project will finish construction at the end of 2002, and plan to operate at the start of 2003).

(1) process mend & enlarge

Product Desmodur L (Line L) 9000 t/a

Product Urethane Dispersion (Line D) 4000 t/a

Product Unsaturated Acrylate (Line A) 2500 t/a

(2) Utility engineering mend & enlarge

Power supply, 1 set 2500KVA,10/0.4 KV transformer

(3)Auxiliary facility mend & enlarge

Tank farm: TDI tank: 300 m^3 Acetone tank: 50m^3 TMP tank: 50m^3

Waste acetone tank: 50m^3 Desmodur tanks:3X100m^3

Polyester 170HN tank：50m^3 Polyester 225B tank：50m^3

DE water tank：100 m^3 Acrylic Acid tank：50m^3

Acrylicacid ester tank：50m^3 Desmodur L67 tank： 50 m^3

Desmodur L75 tank： 50 m^3 DEG tank：50 m^3

Diol tank：50 m^3

Environmental facility: Safety dip-in tank Carbon absorber system

Cleaning Oven

The old pollution situation and the main environmental problem of the project:：

Index the detail information in “EIS Monograph”.

Natural & Social Environment Situation Of Construction Site

Brief situation of natural environment（Topography、physiognomy、Geological Survey、Climate、Meteorology、Hydrology、vegetation、biologic diversity ,etc.）:

The terrain of project area is low and smooth, rivers and canals interweaves, and the ground altitude slightly rises from northwest to southeast. The average altitude is above 4m。Coastal shoal of enclosure belongs to the landform of tidal level ground and the natural elevation falls 3.8m to 2.8m.

The ground is covered by the fourth epoch rock stratum in this area. The lithology of Holocene contains silty clay, silty subclay, subsand and so on. The lower stratum is coastal shallow sea deposit, which has been formed from the largest sea intrusion since the fourth epoch. The west and north area of the stratum is lakeswamp deposition. The area is classified as class Ⅵ intensity district by the National Seismic Bureau.

Project area faces Hangzhou Bay on the south. The total length of river courses is 7~10km per km^2. The main river courses around the project area follows: Yunshi Creek, Dong Haigang Creek.

Project area belongs to the northern subtropical marine monsoon climate. The characteristics of the climate include: The four seasons are abviously different. The rainy season coincides with the hot season. The climate is temperature and humid. The catastrophic weather such as typhoon, tornado, waterlogging and flood season occurs occasionally. Annual average temperature: 15.6℃,extreme highest temperature:37.9 ℃ , extreme lowest temperature:-10.1 ℃ , annual average precipitation: 1100.7mm, annual average evaporation:1271.2mm, annual average relative humidity:82%, annual average sunshine time:1913h, annual maximum frozen earth depth:9cm annual average atmospheric pressure:1015.8hpa, annual average fog days:35.9d, annual average free-frost period:228.3d, annual average wind speed：3.4m/s.

Brief Situation of Social Environment (Social economic structure 、education、culture、cultural relic, etc.)：

Shanghai Chemical Industry park, where the project should be built, is located Caojin-zhenlin-Huqiao area. It stretches over Jinshan and Fengxian district.

The total area of Caojing Town covers 46.39km^2 with coasting 8 km long., with 30917 people, including 27472 agricultural population. In 1997, Caojing Town accomplished social gross product 772 million Yuan(RMB), including 152 million Yuan of agriculture gross product, and 516 million Yuan of gross industry product.

The total area of Zhelin Town covers 25.75 km^2 with coasting 7.8 km long., with 14400 people, including 12829 agricultural population. In 1997, Caojing Town accomplished industrial gross product 758 million Yuan(RMB), 118 million Yuan of gross agricultural product, and 19.45 million Yuan of commercial gross product.

The total area of Huqiao Town covers 42.89 km^2 , with 24677 people, including 23851 agricultural population. In 1997, Caojing Town accomplished industrial gross product 1051 million Yuan(RMB), 115 million Yuan of agricultural gross product, and 10.39 million Yuan of commercial gross product.

Situation of Environmental Quality

Environmental Quality & main environmental problem of the project site(Air quality、ground water quality、underground water quality、Acoustic quality、Ecological Environment, etc.)

Ambient Air Quality:

In general, the environmental air quality in the area of the project site is good, the concentration of SO_2, NO_X, CO and TSP basically meet the requirements of "Class Ⅱ Area" of the "standards on Environmental Air Quality"(GB 3095-1996).

Surface Water Quality:

offshore sea area water quality around project area totally meet the requirements of "Class Ⅲ" of the "Standards on SeaWater quality"(GB3097-1997), but the detected concentrations of phosphorus, nitrogen and petroleum is comparatively high.

The main inland river water quality in project area(Donghai Greek and Yunshi Greek) basically meet the requirements of : "Class Ⅳ" under the "Standards on Surface Water Quality"(GB3838-2002), but the contamination of NH_3-N in inland river is obviously.

Acoustic Environmental Quality:

At present, the background acoustic environmental quality is comparatively good. Acoustic level around the project site is higher than "Class Ⅱ" and lower than "Class Ⅲ" standard(GB 3096-93) in the daytime for the reason of construction noise and human activity. But the environmental noise lower than 50dB(A).

Ecological Environmental Survey:

Salinized Soil Vegetation only covers about 10% of the project area. Crops comprises grain, wheat, barley and highland barley, rape, cotton, melon and fruit and vegetable.

Only a few kind of wild animal survive, including leopard cat and yellow weasel, for no natural vegetation existing in the project area and the interference of human activities.

In addition, there are about 60 kinds of fresh fish in the area, and 81 kinds of sea fish in the offshore sea area. 57 kinds of birds in spring. 33 kinds in summer, 57 kinds in autumn, 20 kinds in winter.

Main environmental protection Objects (listing name & protect grade):

1. Huqiao Town and Zhelin Town of Fenxian District and Caojing Town of Jinshan District.
2. Hangzhou bay.

Assessment Standards

Standard of environ-mental quality	"Ambient air quality standard"(GB3095-1996) ,Grade Ⅱ; "Environmental Quality Standard for Surface Water" (GB3838-2002),standard for class Ⅳ; "Hygiene Standard of Industrial Enterprise Plant Planning"(GBZ1-2002); "Quality Standard of Sea Water" (GB30997-1997), standard for class Ⅲ "Standard of Environmental Noise of Urban Area" (GB3096-93), standard for class 3.
Discharge Standard of Pollutants	"Integrated Emission Standard of Air Pollutants" (GB16297-1996), New Atmospheric Pollution Emission Limits, Grade Ⅱ; "Pollution control standard for hazardous wastes incineration"(GB18484-2001). "Wastewater Pipe Connection Standard of Wastewater Treatment Center of SCIP (Preliminary)". "Standard of Noise at Boundary of Industrial Enterprises" (GB12348-90), standard for class Ⅲ.
Standard of Total Amount Control	1. Total Amount Control factor of air pollutants: SO_2, dust; 2. Total Amount Control factor of water pollutants: COD_{Cr}, Oil, NH_3-N.

Engineering Analysis of the project

Process Description(diagram)：

Index the detail information in “EIS Monograph”.

Main Pollutants Emission Process：

Index the detail information in “EIS Monograph”.

The Main Pollutants Emission & Discharge of the Project

Content / Types	Emission Source (No.)	Name	Concentration Before treatment & Quantity (units)	Discharge Concentration & Quantity (units)
Air Pollutants	1.Dip-in Tank 2.Cleaning oven		TDI 0.064kg/h Other organic 6.016kg/h Isocyanate 0.008 kg/h Organic: ≤ 20 mg/m^3 CO : ≤ 0.1 mg/m^3 Dust : ≤ 30 mg/m^3 NOx : ≤ 200mg/m^3	288.4-322.4m^3/h 1500-2000 m^3/h The same as before treatment
Water Pollutants	1. process and dip-in tank 2.living sewerage		COD_{Cr}<7.49kg/h (59.92t/a) BOD_5 2.41kg/h (19.28t/a) SS<0.576kg/h (4.61t/a) NH_3-N<0.0014 kg/h (0.0112t/a) Oil<0.095kg/h (0.76t/a) acetone<0.385kg/h (3.08t/a) Urea<0.39 × 10^{-6}mg/l (3.12 × 10^{-6}t/a) DEG<2 × 10^{-3}mg/l(16 × 10^{-3}t/a) TMP<1×10^{-3}kg/h (8×10^{-3}t/a)	16455 m^3/a The same as before treatment
Waste Residuals	1. waste solid 2. waste liquid	Filter bag Living sewage Waste acetone Waste solvent	21.2 t/a 2.2 t/a 600 t/a 200 t/a	The same as before treatment
Noise	The noise from the equipment will below 80 dB. And will meet the "Standard of Noise at Boundary of Industrial Enterprises"(GB12348-90),standard for class Ⅲ.			
Others				
Main Ecologic Impact：				

Environmental Impact Analysis

Brief Analysis of Environmental Impact during Construction period：

The project construction will inevitable give rise to some environmental impact. Countermeasures against pollution must be taken to prevent any avoidable harm to the environment.

(1) Special sprinkling vehicles should be provided to reduce the dusts generated during excavation, building material handling, application and transport.

(2) Low-noise construction machines shall be used as much as possible. The machines with loud noise shall be far from the residential area and shall not be used at the rest time such as at night.

(3) The waste materials and building rubbish etc. During construction shall be sent to the designated place for storage and shall not be stored at random or discarded to the water body.

(4) Necessary treatment facilities such as ash-water settling pond shall be provide for the wastewater and domestic sewage during construction, and temporary wastewater popes shall be provided so as to have organized discharge.

Analysis of Environmental Impact during Operating period：

Index the detail information in “EIS Monograph”.

Countermeasures and Expected Effect of the Project

Contents / Types	Emission source (number)	pollutants	Countermeasures	Expected Effect
Air Pollutants	dip-in tank		Be send to incinerator of BIS, when the incinerator shut down, the off-gas will send to active carbon absorber.	Conform the standards
Water Pollutants	1. process waste water 2. dip-in tank 3. living		if COD_{Cr}<700mg/l, will be sent to SCIP's waste water treat center, if not will send to the plant, which have the business license for handling hazardous wastes.	Conform the standards
Waste Residuals	1. process waste residual 2. living	Filter bag & waste liquid Living rubbish	1. send to the plant, which have the business license for handling hazardous wastes. 2. to local environmental sanitation department.	Conform the standards
Noise	The noise from the equipment will below 80 dB. And will meet the "Standard of Noise at Boundary of Industrial Enterprises"(GB12348-90),standard for class Ⅲ.			
Others				
Ecologic Countermeasures and expected effect：				

Conclusion and Recommendation

The off-gas of the project will be collected in safety dip-in tank, and the off-gas from the dip-in tank will be sent to the incinerator of BIS, The total amount of the off-gas discharge from the dip-in tank will be 288.4-322.4m^3/a, containing Isocyanate, N_2, Other organic, NMP,TDI, etc. When the incinerator was shut down in the case of maintenance or of other reason, the off-gas will be sent to the active carbon absorber system. The incinerator is designed for the whole BIS, and efficiency of it is higher than 95%, In the flue gas after incineration, concentrate of SO_2, CO, dust and xylene are 275,75,75 and <70 mg/Nm^3 respectively, which is in compliance with the discharge standard, and the flue gas is discharged to the atmosphere through a 35-meter high stack.

The total amount of off-gas discharge from oven will be 1500~2000 m^3/h. The main pollutants is dust, CO, etc., Off-gas from cleaning oven will discharge through incinerator stack of BIS and conform the standard required.

Total waste water quantity is 16455m^3/a, containing COD_{Cr} <59.92t/a, BOD_5 <19.28t/a, SS <4.61 t/a, NH_3-N <0.0112 t/a, oil<0.76t/a, acetone<3.08t/a, little urea, DEG, TMP, the quality of waste water of LDA project should meet the requirement of the connect concentrate of WWTC, if not it will be send to the companies, which have the business license for handling hazardous wastes. The maximum quantity of waste solid is 23.4 t/a, and the maximum quantity of waste liquid is 808 t/a., and 8 of 808 will be recycled. The low-noise equipment will be used in the project.

After put into operation, the following water pollutants value are suggested for the total amount control: CODcr<77.55t/a, Oil< 1.56 t/a, NH_3-N<0.1712 t/a. The process off-gas generate from this project will be send to the incinerator of BIS, the off-gas from oven will discharge from the stack of the incinerate of BIS. So the air pollutants value of Bayer Industry park suggested:SO_2 87.8 t/a, Dust 19.242t/a.

On the basis of the results of environmental impact assessment, it be concluded that this project which is located in F3 block in SCIP is environmentally feasible.

The project should be designed according to related safety standard。

1. Introduction of the Project

1.1Title, Nature and Legal Address of the Project

Project title: LDA Project of Bayer Coatings Systems Shanghai Co. Ltd. (hereinafter referred to as “BCSS”)

Project Nature: Expansion

Legal Address: Lot F3, Shanghai Chemical Industry Park(hereinafter referred to as “SCIP”), Caojing, Jingshan District, Shanghai, China.

The geographical position shows in Fig.1.1-1.

1.2 Product Capacity, Arrangement and Annual Operation Time

1.2.1 Product Capacity

The capacity is selected on the basis of overall arrangements of production and sale of Bayer for LDA, according to the market distribution in the world.

The designed capacities of the three production lines follows below:

- Product Desmodur L (Line L): 9000 t/a
- Product Urethane Dispersion (Line D): 4000 t/a
- Product Unsaturated Acrylate (Line A): 2500t/a

1.2.2 Product arrangement

Based on recent market analysis, polyurethane market in China is expanding. First some products will be sold in China, the rest production should be sold in Korea and ASEAN countries by Bayer’s network. As market demand in China increase, more products will be sold in China, less will be exported.

1.2.3 Annual Operation Time

8000 hours

1.3 Project Composition

The principal part, auxiliary facilities and utility facility of the LDA project are listed in Table 1.3-1.

Table 1.3-1 Composition of the project facility

No.	Facility composition	Capacity
1	Line L Line D Line A	9000 t/a 4000 t/a 2500 t/a
2	Utility engineering	
2.1	Power supply	1 set 2500KVA,10/0.4 KV transformer
2.2	One safety dip-in tank	for line A and line D
2.3	One active carbon absorber system	for line A and line D
3	Auxiliary facility	
	Tank farm	TDI tank: 300 m^3
		Acetone tank: 50m^3
		TMP tank: 50m^3
		Waste acetone tank: 50m^3
		Desmodur tanks:3X100m^3
		Polyester 170HN tank：50m^3
		Polyester 225B tank：50m^3
		DE water tank：100 m^3
		Acrylic Acid tank：50m^3
		Acrylicacid ester tank：50m^3
		Desmodur L67 tank： 50 m^3
		Desmodur L75 tank： 50 m^3
		DEG tank：50 m^3
		Diol tank：50 m^3
3.2	Environmental facility	Safety dip-in tank
		Carbon absorber system
		Cleaning Oven

1.4 General layout

A new production building with 25m length and 20m width will be connected at west part of the existing production building. New tank farms will be connected with existing tank farm at east part.

1.5 Plant Staff

The LDA project will be operated in 3 shifts with about 3 persons per shift and totally 4 shifts of manpower is 12 persons.

1.6 Project Investment

Total investment of the project is 24,000,000 USD, Total investment of environment is 992,400USD, equivalent to 4.13 % of the total investment.

1.7 Raw & Auxiliary Material, Utility Consume & Source

1.7.1 Raw & Auxiliary Material Consumption & Source

The raw and auxiliary material consumption & source shows in table 1.7-1.

The raw and auxiliary material consumption & source table 1.7-1

No.	Item	Consumption（t/a）	Resource
1	TDI	5300	Global supply
2	TMP	900	Global supply
3	DEG	500	Global supply
4	Solvent A	2320	Global supply
5	Acrylic Acid/ester	700	Global supply
6	Stabilizer/Cat./Add./other	200	Global supply
7	Polyol	2350	Global supply
8	Isocyanate	960	Global supply
9	DE-water	2100	Global supply
10	Co-solvent	900	Global supply

1.7.2 The utility Consumption & Source

The utility Consumption & Source shows in table 1.7-2.

Utility Consumption & Source Table 1.7-2

No.	Items	Unit	Quantity	Supplier	Remarks
1	Potable water	m^3/h	3.04	BIS	
3	cooling water	m^3/h	200	BIS	Recycled Max. 250
4	Chilled water (6 °C~ 12°C)	m^3/h	300	BIS	Recycled Max. 450
5	DE water	m^3/h	1	BIS	Max. 4
6	Steam 1.6MPa	t/h	2	BIS	Max. 4
7	Compressed air	Nm^3/h	200	BIS	Max. 300
8	Nitrogen	Nm^3/h	100		Max. 200
9	Power	kWh	2000	BIS	Max. 3000

1.7.3 Material balance

The material balance of the LDA project shows in Fig 1.7-1, Fig 1.7-2, Fig 1.7-3.

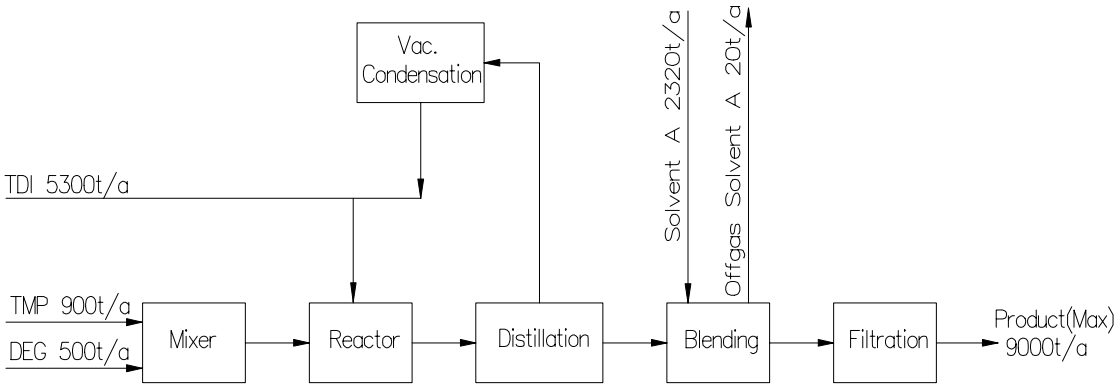

Fig 1.7-1 Material Balance of Line L

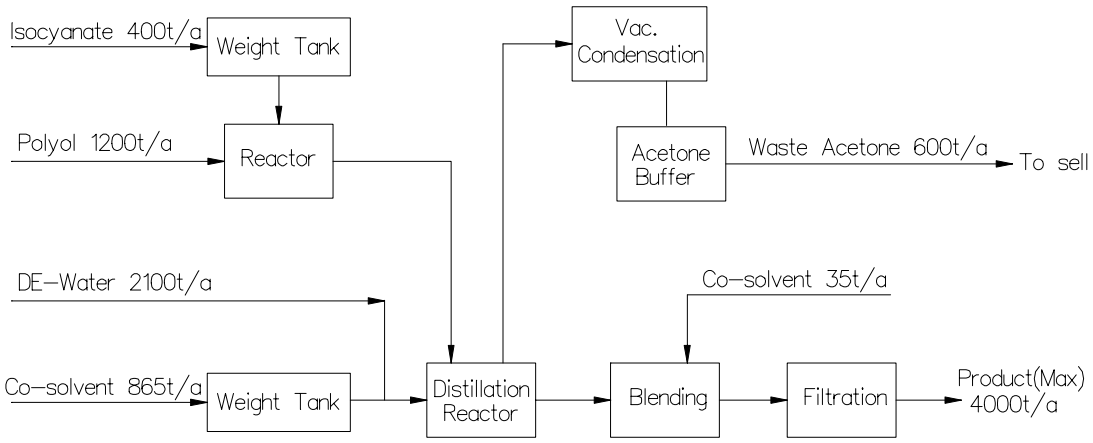

Fig 1.7-2 Material Balance of Line D

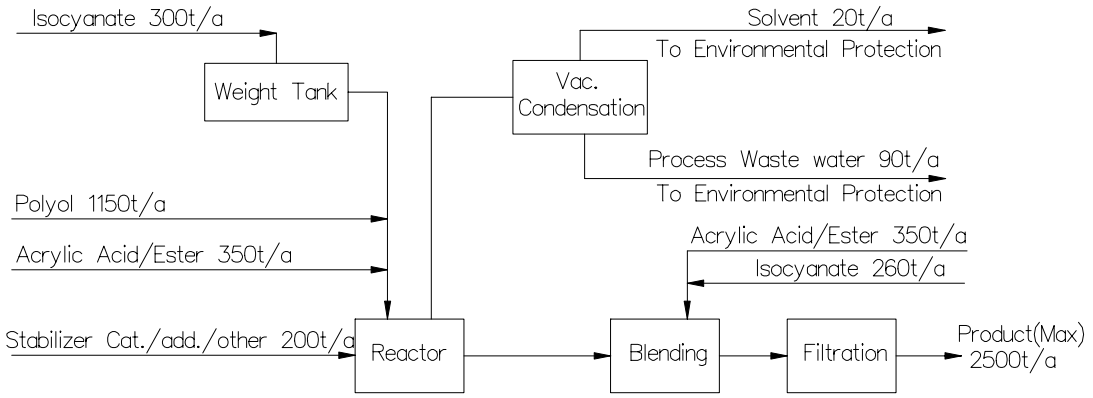

Fig 1.7-3 Material Balance of Line A

1.7.4 Balance of Water Supply & Discharge

Water supply and wastewater flow of the expansion project shows in table 1.7-3 and table 1.7-4.

Water supply flow of the project table 1.7-3

Item	Potable water		DE water		Cooling water		Chilled water	
	m^3/h	m^3/d	m^3/h	m^3/a	m^3/h	m^3/a	m^3/h	m^3/a
cleaning purpose	1.85	44.4						
Dip-in tank	0.11	2.64						
living	0.036	0.855						
Total	1.996	47.89	1	24	200	4800	300	72000

Wastewater flow of the project table 1.7-4

Item	Industrial waste water		Domestic waste water		Early rain water	
	m^3/h	m^3/d	m^3/h	m^3/a	m^3/time	m^3/a
Process generate	0.01125	0.27				
Cleaning purpose	1.85	44.4				
Dip-in tank	0.12	2.88				
Living			0.036	0.855		
Contaminated rainwater					10	300
Total	1.98	47.55	0.036	0.855	10	300

Re: only the early 5 minutes of rainfall in the contaminated area will be collected.

1.8 Utility and Auxiliary Facility Scheme

1.8.1 Existing utility services of BIS (Bayer Integrated Site)

Bayer has a Bayer Integrated Site, the 1st phase of infrastructure will supply the utilities and serving facility for polycarbonate and polyisocyanate device. And it will be constructed complete before this project so it can meet the requirement of this project.

The scale for Infrastructure project is as table 1.8-1:

The scale for Infrastructure project Table 1.8-1

No.	Device	Material	Capacity	Specification
1.	Pump station/ industry Water/fire water	Potable water	5m^3/h	0.2MPa
		Industry water	365m^3/h	0.6MPa
		Fire water	200L/s	0.6MPa/0.4MPa
2.	Cooling towers/ water	Cooling water	6450 m^3/h	0.45MPa
3.	DEM1-water	DM-water	57 m^3/h	
4.	Boiler house	Steam	17-35t/h 15-22t/h	0.6MPa 1.6MPa
5.	Main substation	Electricity	24.7MW	35kV/10kV/0.7; 0.4kV
6.	Instrument air and compressed air building	Compressed air and Instrument air	1800 m^3/h	0.6MPa
7.	Chiller units	Chiller water	8.5MW	6-12℃
8.	nitrogen plant	Nitrogen	1050-3000 m^3/h	0.6MPa
9.	incinerator	Waste gas	1240-1740 Nm^3/h	

1.8.2 Existing utility services of SCIP

1.8.2.1 Sewage System

Separate Sewage system is used in the project. In the plant area, domestic wastewater system, industrial wastewater system, rainwater drainage system are to be arranged, Domestic wastewater directly drains to the domestic wastewater pipeline of SCIP. Wastewater from cleaning together with other industrial wastewater drains to the industrial wastewater pipeline of SCIP. The contaminated rainwater(only the early 5 minutes of rainfall in the contaminated area will be collected) will be drained to the industrial wastewater pipeline via waste water tank. Clean rain water drains to the rainwater pipeline of SCIP directly. To prevent the chemical pollution from fire-fighting, the fire-fighting water is collect too, it should be treated before discharge into industrial waste water system.

1.8.2.2 Wastewater Treatment

According to the plan, a central wastewater treatment plant is to be built in A3 Block to treat industrial wastewater and domestic wastewater from the SCIP, as well as the process wastewater and domestic sewage from surrounding areas. The first phase capacity of wastewater treatment plan is 7,000t/d. As confirmed by SCIP, the wastewater treatment center of SCIP will be put into operation before Jan. 2003, and will meet the demand of the project.

2. Analysis of the Former Process

2.1 Process Description & Pollution source analysis

2.1.1 Process Description

The description of existing process of project PIC of BCSS are as follows：

（1） Former line A

The fresh HDI, recovered HDI, demineral water are brought to the reactor of the former line A. Under the effect of catalyst/solvent for mixer, polymerization take place, polyisocyanate is formed and CO_2 off-gas is discharged to the crude buffer tank. Off-gas is washed in a scrubber with recycle monomer(HDI). Then CO_2 off-gas is send to safety dip-in tank and the rich HDI solution from the scrubber is return to the reactor. The reacted solution from the buffer tank which contains polyisocyanate, unreacted monomer and some heavier and lighter components, enters the distillation section. By 4 step distillation, the unreacted monomer, mainly HDI, is feed back to the reactor, lighter components(as off-gas) is sent to safety dip-in tank and then an activated carbon absorber or to an own incinerator for incineration. Part of the components(eg.catalysts) are dissolved in the water. The water is sent to biological purification. The catalysts contained ate readily biodegradable. Target product polyisocyanate is sent to blending section. According to the quality requirement of production, solvent and additives are added the polyisocyanate solution in blending section, then they are send to tank-farm or directly into drums, the to be stored and sold.

（2） Former line B

Comparing with former line B, there is no big difference on process flow for former line B. The differences are as follows:

- No water is added to the reactor and therefore no off-gas discharge from the reactor.
- There is no scrubber for CO_2 off-gas washing.
- Only 3 steps needed in the distillation section.

（3） Former line C

The former line C ,whose capacity is smaller than former line A and former line B uses only TDI as raw material, solvents and additives as catalyst, to produce polyisocyanates. The teacted “final product” from the reactor is pumped directly into final product containers or into drums as final products.

2.1.2 Analysis of pollutants Discharge from the PIC Project

2.1.2.1 Off-gas

Under normal operation conditions, all off-gas streams from the individual process steps， together with the off-gas from the tank farm, are directly sent to the safety dip-in tank, and the off-gas from the dip-in tank will be sent to the incinerate of Bayer Integrated Site. Table 2.1-1 gives off-gas pollutants discharge from the process.

Off-gas from PIC project table 2.1-1

Item	Source of waste gas	Qty. （m^3/h）	Pollutants Composition (kg/h)	Discharge character	Discharge direction
Former Line A	Scrubber	90~110	CO_2 average 52kg/h by continuously 8000h/a CO_2 max. 185 N_2 20 HDI 1~3 max. Other organic 1～2.5 max. (mainly PV-Acid and TEP)	Disc. 2200h/a	Sent to former safety dip-in tank
	Crude buffer	2~17	N_2 20(max) HDI 0.3 Other organic 0.15 (mainly PV-Acid and TEP)	Disc. 800 h/a	
	4 step distillation	1	CO_2 1.4 N_2 0.5	Con. 8000 h/a	
	blending	2~18	N_2 20Max. Other organic 3	Disc. 2200h/a	
Former line B	Reactors, distillate and crude buffer	2~25	N_2 30Max. HDI 0.1 Other organic 0.15	Disc. 2200h/a	
	3 step distillation	1	N_2 1.2	Con. 8000 h/a	

Item	Source of waste gas	Qty. (m^3/h)	Pollutants Composition (kg/h)	Discharge character	Discharge direction
	blending	2~17	butylacetate 0.3 solventnaphtha 0.15 xylene 0.006 N_2 20(max)	Disc. 2200h/a	
Former line C	reactor	2~17	TDI 0.004(max) ethylacetate 5(max) N_2 20(max)	Disc. 300h/a	
Tank farm	Solvent tank	2~25	Xylene 0.1~0.5 solventnaphtha 0.05~0.2 butylacetate 1～5 methoxipropylacetate 0.05~0.3 N_2 30(max)	Disc. 300h/a	
	TDI、HDI tank	2~13	TDI 0.003 HDI 0.004 N_2 15(max)	Disc. 700h/a	
	Final product tank	3~30	Xylene 0.001~0.005 solventnaphtha 0.02~0.08 butylacetate 0.1～0.35 methoxipropylacetate 0.01~0.03 N_2 36(max)	Disc. 300h/a	
Load & unload	Truck or drum loading	17	Xylene 0.001~0.005 solventnaphtha 0.02~0.08 butylacetate 0.1～0.35 methoxipropylacetate 0.01~0.03 N_2 20(max)	Con. Drum loading 8000h/a	
Former dip-in tank	Dip-in tank	109～274	HDI 1.4～3.4 TDI 0.004(MAX) Xylene 0.1~0.52max solventnaphtha 0.2~0.51max butylacetate 1.1～5.4 max Other organic 1.3~2.8 CO_2 186.4 N_2 232.7(max) ethylacetate 1.5~5 max methoxipropylacetate 0.06~0.33max		To incinerator of BIS.

2.1.2.2 Waste water

Wastewater discharge from the project table2.1-2

sources	Qty. (m^3/h)	污染物组成			Discharge character	Discharge direction
		pollutants	(mg/l) Aver.	(Kg/h) Aver. Max.		
Dip-in tank	0.5	butylacetate ethylacetate PV-Acid and catalyst Urea COD_{Cr} BOD_5	20 51 5 10 150 55	0.01 0.03 0.003 0.005 0.08 0.03	Con.	Collected in liquid waste tank for storage, and only if COD_{Cr}<700mg/l then pumped to waste water tank, if not will sent to incinerator of BIS.
cleaning	2	COD_{Cr} BOD_5 SS oil little HDI、TDI	<700 200 <300 <50	<40 0.40 <0.60 <0.10	Disc.	Via industrial wastewater pipeline sent to waste water treatment center of SCIP.
lab	0.5	COD_{Cr} BOD_5 Little HDI、TDI	<700 200	<0.35 0.10	Cont.	
outdoor area contact with chemical handling	0.08 (2 m^3/d)	COD_{Cr} BOD_5 SS oil little HDI、TDI	<700 200 <300 <50	<0.06 0.02 <0.02 <0.004	Disc.	
plant	0.5	COD_{Cr} BOD_5 SS NH_3—N	<700 200 <300 <35	<0.35 0.10 <0.15 <0.02	Cont.	Via domestic wastewater pipeline sent to waste water treatment center of SCIP.

2.1.2.3 Waste liquid

Waste liquid discharge from the PIC project table2.1-3

Source	Qty.	Composition	Discharge character	Treatment
Former Line A 4-step distillation	10	Organic and mostly waster	Disc.	Collected in liquid waste tank for storage, and only if COD_{Cr}<700mg/l then pumped to WWTC, if not will be sent to incinerator of BIS.
Former Line B 3-step distillation	10		Disc.	
Tank farm	80	Organic and monomer	Disc.	

2.1.2.4 Waste Solid

Waste solid from the plant table2.1-4

source	name	Qty.	Composition	Discharge character	treatment
cleaning	Solid	10	organic	Disc.	Collected, then sent to external incinerator
Chemical handling	Packing material	10/20		Disc.	
Active carbon absorber	Waste active carbon	0.2	organic	Disc.	
Plant area	Domestic rubbish	4		Disc.	Disposed by local ESD

2.1.2.5 Noise

Noise of the project mainly from the pumps and mixer, etc., This type of noise is continuous.

3. Engineering Analysis of the LDA Project

3.1 Reaction Principle

Polyurethane product is one of high performance coatings and adhesives. There are many kinds of polyurethane according to the monomer it used. The performance also changed with the monomer it used.

3.2 Process Description & Pollution Source Analysis

3.2.1 Process Description

Raw materials such as Isocyanates, Polyol, acetone and TMP are stored in tanks (tank farm). The product Desmodur L is stored in tanks too. These materials are unloaded through the existing loading/unloading station of the first phase project. Other materials, such as DEG, Amines, Acrylic acid, Solvents, Stabilizer, Additives and special Auxiliary material are stored in containers, drums or as solid raw material product in big bags. They are stored on the existing stockyard of the first phase project.

(1) Line L

In general, Line L is a continuous process and the following procedure has to be done for all three types of Desmodur L: L75,L67BA or L67MX:

The necessary amount of raw material will be pumped into the Heated Mixing Buffer. The unit is designed for an amount of 5300 t/a TDI, 900 t/a TMP and 500 t/a DEG.

After all the raw materials have the correct mixing condition, the mixture will be pumped into a reactor cascade of 3 units (each 1.6 m^3). The chemical conversion of TDI with TMP and DEG (continuous reaction) happens in this cascade.

After having the right temperature and the right specification, the contents will flow into the Heated Buffer (6~10m^3). This buffer is a receiver for the distillation. When this Buffer has the right amount the

product will be shifted into the two-stage distillation to separate the monomer TDI. In the first step the product will be concentrated from 60 to 8~10% TDI, in the second step the product will be concentrated to less than 0.5% TDI with a film evaporator.

The two-stage distillation needs 7000t/a steam with 16 bar.

The originated resin will be dissolved in solvent and added additives to get a product with the right sales specification.

The blending part needs 2300 t/a solvents and additives.

The product with the right sales specification will flow into two Heated Mixing Buffers (each 20m^3) for the final control.

The final product will be pumped into the final product tank (tank farm).

(2) Line D

In general, Line D is a batch-wise operation and three stages procedure has to be done then, there are Pre-reaction, Distillation Reaction and Blending.

The necessary amounts of raw materials such as isocyanates and polyol out of tanks will be pumped with weight checking either about the raw material dosage buffer or directly in the main reactor. After all the liquid contents in the pre-reactor is mixed and heated to the right temperature in a fixed period, the reaction takes place. When the reaction conversion rate is reached, it will be stopped and ready for Distillation Reaction.

The prepolymer must be gone on to fill additional amounts of other co-solvent and water, meanwhile acetone is filled and plays the roles of solvent. The reaction mixture is heated first, then in the course of the distillation –reaction until the acetone is completely evaporated out of the reaction-product and finally collected in waste acetone tank. If the specification data of the reaction–product are reached, the product is cooled down and transferred to blending section.

After all distillation is finished, the product is cooled down and afterwards to buffer where the solvents, additives are added, if necessary. The final product is sent after passing a filter system directly to the filling station for drums or from the main-reactor directly into drums, containers or tanks.

(3) Line A

Line A is a batch-wise operation also. Different kinds of raw materials are necessary according to the individual recipe of final product.

The necessary amounts of raw materials will be filled with weight checking either about the raw material dosage buffer or directly in the main reactor.

The liquid content in the main reactor is to be mixed and heated to the right temperature and the reaction takes place under reflux until the initialized conversion rate has reached. Afterward it is cooled down to a certain temperature and must be gone on to fill additional amounts of other (catalysts, additives and auxiliary materials). The reaction mixture is heated, then the water from reaction is evaporated out of the reaction –product and finally collected in process waster water buffer in the course of the distillation-reaction. If the specification data of the reaction-product are reached, the product is cooled down to a certain temperature and afterwards to buffer where the rest raw materials are added if necessary.

The final product is sent after passing a filter system directly to the filling station for drums or from the main-reactor directly into drums, containers or tanks.

3.2.2 Analysis of Pollutants Sources in Process Equipment

3.2.2.1 Off gas

(1) Off-gas from process and tank farm

Under normal operation conditions, all off-gas streams from the individual process steps and the tank farm are directly sent to the safety dip-tank. The off-gas stream coming from the dip-in tank is sent to an incinerator for incineration. The incinerator is designed for the whole Bayer integrate Site, and the capacity of the incinerator has been demonstrated in EIA of PIC project. The total quantity of off-gas sent to incinerator will be 280.4-314.4m^3/h, main pollutants are N_2, little TDI, TMP, etc.

(2) Off-gas discharge from Cleaning Oven

An efficient and environment friendly cleaning system-cleaning oven for the treatment of polymer contained equipment has been planed to be applied. The off-gas from the cleaning oven will discharge from incinerator stack of BIS

table 3.2-1 gives off-gas emission during normal operation.

3.2.2.2 Waste water

There will be only about 90t/a process wastewater generated from Line A. Wastewater generated in the project mainly consists of washing water from safety dip-in tanks, cleaning purposes, domestic sewage. Total quantity of waste water discharge from the project will be about 16485m^3/a, main pollutants are TDI, TMP, and a little catalyst etc. table 3.2-2 shows wastewater discharge from the project.

3.2.2.3 Waste solid

Waste solid of the project consists mainly of waste residue from reactor, packing material, product filtration waste, waste active carbon and domestic rubbish of daily living, the total quantity would be 23.4t/a. table 3.2-3 shows waste Solid disposal from the LDA project

3.2.2.4 Waste liquid

table 3.2-4 shows waste liquid disposal from the LAD project

3.2.2.5 Noise

Noise of the project mainly comes from pump. 3 sets of vacuum pump will be used in the three production line, each set have 4 pumps and 3 of them will be used and 1 will be ready. Each sets will have 80 dB(A). The pumps lay on the third floor, 10 meter away from the wall of the plant. And the plant is location at the center of the Bayer industry park, so it will meet the “Standard of Noise at Boundary of Industrial Enterprises”(GB12348-90),standard for class Ⅲ.

The noise is continues. The detail information shows in table 3.2-5

List of waste gas emission from the project Table 3.2-1

Item	No.	Source of Waste Gas	Name of Waste Gas	Qty. (m^3/h)	Pollutants Composition (kg/h)	Discharge Character	Discharge Direction
Line-L	1	Mixing buffer (for raw material)	Off gas	4.4	TMP： 0.001 DEG： 0.002 TDI： 0.008	Disc.	Sent to existing safety dip-in Tank
	2	Reactor cascade	Off gas	3	TDI: 0.006	Con.	
	3	Distillation Vac. Condensation	Off gas	10	TDI: 0.05 Other Organic： 0.015 (Mainly DEG and TMP)	Con.	
	4	Blending	Off gas	3	Solvent ： 2.5 (mainly ethyllacetate or butylacetate)	Disc.	
Line-D	5	Pre-reactor	Off gas	10	Isocyanate: 0.004 polyol: 0.005	Disc.	Sent to new safety dip-in Tank
	6	Distillation Reactor	Off gas	25	Acetone 0.3 other organic: 0.001	Disc.	
	7	Isocyanate Weight Tank	Off gas	5	Isocyanate: 0.004	Disc.	

List of waste gas emission from the project Table 3.2-1

Item	No.	Source of Waste Gas	Name of Waste Gas	Qty. (m^3/h)	Pollutants Composition (kg/h)	Discharge Character	Discharge Direction
	8	Blending	Off gas	50	N_2, water	Disc.	
	9	Acetone Weight Tank	Off gas	10	Amine: 10×10^{-6}	Cont.	
Line-A	10	Raw Material Weight Tank	Off gas	10	other organic: $(0.5 - 1.2) \times 10^{-6}$	Disc.	Sent to new safety dip-in Tank
	11	Blending	Off gas	40	Isocyanate: 0.4×10^{-6} other organic: 1.25×10^{-6}		
	12	Reactor	Off gas	40	Organic: 6.0	3333t/h	
	13	Buffer	Off gas	65	N_2, water	Disc.	
	14	Isocyanate Weight Tank	Off gas	10	Isocyanate: 0.7×10^{-6}		
Tank Farm	15	main solvents tanks	Off gas	1-15	TMP: $0.1\ 4 \times 10^{-6}$ Acetone 0.0854 Amine 1×10^{-6}	Disc.	Sent to new safety dip-in Tank

List of waste gas emission from the project Table 3.2-1

Item	No.	Source of Waste Gas	Name of Waste Gas	Qty. (m^3/h)	Pollutants Composition (kg/h)	Discharge Character	Discharge Direction
	16	TDI-Tank IPDI-Tank	Off gas	1-10	TDI 0.4 ×10^{-6} IPDI 0.4 ×10^{-6}		
	17	Final product tanks	Off gas	1-12	$N_{2:}$		
Add to existing dip-in tank	18	Off gas from Line L	Off gas	20.4	TDI 0.064 Other organic 0.015	Disc.	Sent to incinerator of BIS
New Safety Dip-in tank	19	Off gas from Line D , Line A and tank farm````	Off gas	268-302	Isocyanate 0.008 Otherorganic: 6.001 TDI 0.4×10^{-6} Organic: 6.0	Disc.	Sent to incinerator of BIS
Cleaning Oven	20	Off gas from incinerate residue of reactor	Off-gas	1500～2000	Organic: ≤ 20 mg/m^3 CO : ≤ 0.1 mg/m^3 Dust : ≤ 30 mg/m^3 NOx : ≤ 200mg/m^3	Disc. 800 h/a	Discharge from the 35 meters high incinerate stack of BIS .

Notes: the off gas from LDA project will be sent to activated carbon absorber when the incinerator of BIS is shut down.

List of waste water emission from the project Table 3.2-2

Item	Source	Kind	Qty. (t/a)	Composition			Discharge Character	Methods of discharge and direction
				Pollutant	mg/l	kg/h		
Line L	Cleaning reactor	Cleaning water	2000	COD_{Cr} BOD_5 SS Oil	< 700 200 < 300 < 50	<0.175 0.050 <0.075 <0.0125	Disc.	Collected in waste water tanks for storage, and only if COD_{Cr}< 700mg/l , then pumped to waste water treatment center of SCIP, otherwise be sent to the companies, which have the business license for handling hazardous wastes.
Line D	Cleaning reactor	Cleaning water	6000	COD_{Cr} BOD_5 SS Oil	< 700 200 < 300 < 50	<0.525 0.15 <0.225 <0.0375	Disc.	
Line A	Cleaning reactor	Cleaning water	2000	COD_{Cr} BOD_5 SS Oil	< 700 200 < 300 < 50	<0.175 0.050 <0.075 <0.0125	Disc.	
	process	Waste water	90	Acylic Acid COD_{Cr} BOD	6500 7995 5395	0.073 0.09 0.06	Disc.	Be sent to the companies, which have the business license for handling hazardous wastes.

List of waste water emission from the project Table 3.2-2

Item	Source	Kind	Qty. (t/a)	Composition			Discharge Character	Methods of discharge and direction
				Pollutant	mg/l	kg/h		
Tank farm	Tank cleaning	Waste water	4800	COD_{Cr} BOD_5 SS Oil	< 700 200 < 300 < 50	<0.42 0.12 <0.18 <0.03	Disc.	Collected in waste water tanks for storage, and only if COD_{Cr}< 700mg/l, then pumped to waste water treatment center of SCIP, otherwise be sent to the companies, which have the business license for handling hazardous wastes.
Add to Exiting dip-in tank	From line L And former three line	Waste water	240	TMP DEG Solvent COD_{Cr} BOD_5		0.001 0.002 2.5 5.1 1.38	Con.	Collected in liquid waste tanks for storage, and only if COD_{Cr}< 700mg/l , then pumped to waste water treatment center of SCIP, otherwise be sent to the companies, which have the business license for handling hazardous wastes.
New Safety Dip-in tank	From line D and line A	Waste water	740	Urea Amine acetone Polyol COD_{Cr} BOD_5		0.39×10^{-6} 10×10^{-6} 0.385 5×10^{-3} 0.966 0.499	Con.	

List of waste water emission from the project Table 3.2-2

Item	Source	Kind	Qty. (t/a)	Composition			Discharge Character	Methods of discharge and direction
				Pollutant	mg/l	kg/h		
Only outdoor area contact with chemical handling	Early rainwater	Waste water	300	COD_{Cr} BOD_5 SS NH_3-N	< 700 200 < 300 < 50	<0.026 0.0075 <0.01125 <0.001875	Disc.	Collected in waste water tanks for storage, and only if COD_{Cr}< 700mg/l, then pumped to waste water treatment center of SCIP, otherwise be sent to the companies, which have the business license for handling hazardous wastes.
plant		Living sewage	285	COD_{Cr} BOD_5 SS NH_3-N	< 400 250 < 300 < 40	<0.014 0.089 <0.01 <0.001425	Disc.	Via SCIP domestic wastewater pipeline sent to wastewater treatment center.

The total waste water discharge Qty. is 16455m^3/a, 2.06m^3/h.

COD_{Cr} <7.49kg/h(59.92t/a) BOD_5 <2.41 kg/h(19.28t/a) SS <0.576 kg/h(4.61t/a) NH_3-N <0.0014kg/h(0.0112t/a)

Oil<0.095 kg/h(0.76t/a) acetone<0.385 kg/h(3.08t/a) Urea<0.39×10^{-6} kg/h(3.12×10^{-6}t/a)

TMP< 1×10^{-3}kg/h(8×10^{-3}t/a) DEG<2×10^{-3} kg/h(16×10^{-3}t/a)

Waste solid disposal from the project Table 3.2-3

Item	Source	Quantity t/a	Discharge character	Treatment
Line L	Residue from cleaning reactor	4	Disc.	Cleaning Oven
	Filter bags, Packing material	2		Collected, then be sent to the companies, which have the business license for handling hazardous wastes.
Line D	Residue from cleaning reactor	5		Cleaning Oven
	Filter bags,Packing material	6		Collected, then sent to the companies, which have the business license for handling hazardous wastes.
Line A	Residue from cleaning reactor	2		Cleaning Oven
	Filter bags,Packing material	2		Collected, then sent to the companies, which have the business license for handling hazardous wastes.
New active carbon absorber	Waste active carbon	0.2		
Plant	Living rubbish	2.2	Disc.	Sent to local ESD
	total	**23.4**		

Waste liquid disposal from the project Table 3.2-4

Item	Source	Composition	Quantity t/a	Discharge character	Treatment
Line L	Sampling	Product	2	Disc.	Recycling
Line D	Sampling	Product	4		Recycling
	Cleaning solvent	Waste solvent	200		Collected, then sent to the companies, which have the business license for handling hazardous wastes.
	process	Acetone	600		
Line A	Sampling	Product	2		Recycling
	total		**808**		

Noise disposal from the project Table 3.2-5

Source	Num.		Working character		Before treatment dB(A)	Treatment	After treatment dB(A)
	Using	Ready	Cont.	Disc.			
Vacuum pump	9	3	√	--	80	-	80

3.3 Compliance with the Pollutants Emission Standard

3.3.1 Off-gas Pollutants Emission

3.3.1.1 Emission Standard of Air Pollutants

"Pollution Control Standard for Hazardous Wastes Incineration "(GB18484-2001) shall be applied for air pollutants emission from incinerator of the project. Item not be listed in this standard such as Xylene shall follow class 2 criterion of "Integrated Emission Standard of Air Pollutants "(GB16297-1996). Since there is no control standards at present in China for Butylacetate, Ethylacetate, HDI and TDI emission, The Germany Standard will be adopted for this EIA.

3.3.1.2 Analysis of Off Gas Emission in Compliance with Standard

(1) Off-gas from process

Under the normal condition, the off-gas coming from the dip-in tank of LDA project will be sent to incinerator, incinerator is designed for the whole BIS, and the capacity have been demonstrated in the PIC project.

(2) Off-gas from cleaning oven

Off-gas from cleaning oven will discharge through incinerator stack of BIS. The total amount of off-gas will be_1500~2000 m^3 /h, contribute to 13.8~18.5% of the total discharge amount BIS stack, the discharge temperature is 300℃. The main pollutants is dust, CO, etc., the concentrate is too low to effect the composition of the off-gas from BIS, the discharge rate of the pollutants from incinerator stack shows in table 3.3-1.

Analysis of off-gas emission rate in Compliance with standards table 3.3-1

Item	SO_2	NO_X	CO	Dust	Xylene	Butylacetate	Ethylacetate	HDI	TDI
Emission Rate (mg/m^3)	275	375	75	75	<70	<150	<150	<100	<20
Standard of emission rate (mg/m^3)	400	500	100	100	70	150	150	100	20

According to analysis results in table 3.3-1, the emission concentration of pollutants in the off-gas from incinerator is lower than the standard value. Therefore the pollutant of off-gas emission from this project is within the emission standard.

3.3.2 Wastewater Pollutants Discharge

3.3.2.1 Wastewater Discharge Standard

As the process and domestic wastewater and polluted rainwater of the early time from this project will final treated in SCIP Wastewater Treatment Center and then discharged in sea, therefore pollutants concentrations contained in industrial and domestic wastewater from this project will follow the wastewater pipe connection standard of Wastewater Treatment Center of SCIP.

3.3.2.2Analysis of Wastewater Discharge in Compliance With Standard

Wastewater generated in the project mainly from cleaning purposes, lab drains, domestic sewage etc. And only 120t/a process wastewater generate from line A. General water drainage system will be provided in the project for process wastewater, domestic sewage and rainwater respectively. Polluted early rainwater will be collected in wastewater tank, from where it will be evenly drained into process wastewater piping system. The later rainwater goes into rainwater pipe. Before entering into the connection pipe of chemical wastes treatment center, the pollutants concentration in the waste water generated in this project are COD_{Cr}<700mg/l, BOD_5<300mg/l, SS<300mg/l, NH_3-N<35m/l, oil<50mg/l , within the temporary standard of SCIP treatment center pipe connection.

3.4 Analysis on Risk and Events

3.4.1 Characteristic of the hazardous materials

The hazardous materials used or produced in this project production are: TDI, solvents, some additives and catalysts. hazard characteristics of these materials are as follows.

Tolylene diisocyanate (TDI): Colorless liquid with irritant odor. The vapor irritate the eyes, noise and mucous lining, very toxic.

n-butyl acetate: flammable, repeated exposure may cause skin dryness or cracking. Vapours may cause drowsiness and dizziness.

Acetone: highly flammable. Irritating to eyes. Repeated exposure may cause skin dryness or cracking, vapours may cause drowsiness and dizziness.

Xylene isomers mixture: flammable. Harmful by inhalation and in contact with skin. Irritating to skin.

Acrylic acid: flammable. Harmful in contact with skin and if swallowed. Causes severe burns. Very toxic to aquatic organisms.

Ethyl acetate: highly flammable. Irritating to eyes. Repeated exposure may cause skin dryness or cracking, vapours may cause drowsiness and dizziness. Harmful to aquatic organisms.

Hydrazine hydrate: may cause cancer. Also toxic by inhalation, in contact with skin and if swallowed. Cause burns. May cause sensitization by skin contact. Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

IPDI: Light yellowish liquid. Toxic by inhalation. Irritating to eyes, respiratory system and skin. May cause sensitization by inhalation and skin contact. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Product L: because the production contains flammable and toxic solvents, it is flammable, toxic and irritation.

Product D: no dangerous.

Product A: Irritating to eyes. Harmful in contact with skin and eye.

Additives and catalysts: many additives and catalysts are used. Some of them are poisonous and flammable.The main hazardous of materials refers to table 3.4-1.

Harmful characteristic of main materials Table 3.4-1

No.	Material	Harmful characteristics	Flash Point ^oC	MAC mg/m^3	LD_{50} mg/kg
1	n-butyl acetate	Flammable, irritation, toxic	26	300	14000
2	xylene	Flammable, irritation, toxic	25	100	2000
3	acetone	Flammable, irritation	-20	400	5800
4	ethyl acetate	Flammable, irritation, toxic	-1	300	5-60
5	acrylic acid	Flammable, irritation, toxic	48.5	20	1500
6	Hydrazine hydrate	Flammable, irritation, high toxic	75	0.13	94
7	TDI	Flammable, irritation, very toxic	127	0.2	913
8	IPDI	Light toxic	155	0.1	5490
9	Product L	Because the production contains flammable and toxic solvents, it is flammable, toxic and irritation			
10	Product A	Irritating to eyes. Harmful in contact with skin and eye.			

3.4.2 Analysis on probability of Risk Events

The probability of risk events is extremely low. However, the impacts are great. By some literature about risk events, we estimated the probability of risk events which is shown in Table 3.4-2.

Probability Estimation of Major Risk Evens table 3.4-2

No.	Events	Probability* (times/a)	Remarks
1	Damages and leakage events of pipe, pump and valves	0.1	Possible
2	Breaking and leakage event of tanks and drums	<0.1	Rare
3	Serious leakage event of tanks and drums	~0.03	Rare
4	Serious fire disaster event of storage tanks & reactors	0.001～0.0001	Extremely rare
5	Natural disasters like earthquake, sea-quake, etc.	1×10^{-6}(or little higher)	Extremely rare
Probability of risk events source “Study and application of chemical sudden risk events assessment”			

3.4.3 Preventative measures for professional safety and hygiene

The policy, putting safety & prevention first and “Three Simultaneously” (namely, that the production unit and the corresponding labor protection facilities shall be designed simultaneously, constructed simultaneously and used simultaneously), is carried out in this project design. The requirements of safety and hygiene are also meet in each specialty design, so safe and reliable, technically advanced, economic and reasonable design can be done. Each facility designed in the project will be in accordance with relevant safety and hygiene standard and code of the nation and profession. Workers’ safety and health are the most important factors in the operation of the Bayer.

4. Feasibility Analysis on Waste Water Collection

4.1 Plan of Waste Water Treatment Center in SCIP

(1) Selection of Plant location

In order to keep the water quality of the Hangzhou Bay, which close to SCIP, the construction of a waste water treatment center(WWTC), locate in land block B4, is planned by SCIP to backup its projects in stare Ⅰ of phase Ⅰ.

(2) Scale of the Plant and the Expected Date to Operation

The7 design capacity of early stage I of phase I of the WWTC in SCIP is 7000t/d. It will be put into operation in Jan 2003 according to the plan. It will meet all the requirements of LDA projects and other projects.

(3) Treatment Scheme

To ensure the treated water not apparently contaminate the seawater of Hangzhou Bay, which is close to SCIP, the following scheme is adapted to constructing and operating of WWTC:

All plant should pre-treat their wastewater to eliminate matters which is harmful to the biological treatment and then send the pre-treated wastewater to SCIP's WWTC for further biochemical treatment.

WWTC will adapted two-stage active sludge disposal treatment. The wastewater will meet the requirement of "Integrated Discharge Standard of Shanghai Waste Water"(GB31/199-1997). Grade Ⅱ

4.2 Requirements of Waste Water Collection

(1) Control Standard of Waste Water Collection

To guarantee the proper operation of WWTC, Shanghai Chemical Industry Park Development Co., Ltd. has issued a provisional control standard—"Standard of Waste Water Discharge in SCIP(provisional)". The control values of some pollutants concentration follow below:

COD_{Cr}<700mg/l

BOD_5>0.3 COD_{Cr}

SS<300mg/l

Oil<50mg/l

NH_3-N<35mg/l

(2) Control Target of Waste Water Collection

The total amount control of pollutants and the necessary license regulation of pollutants discharge will be implemented within SCIP. The objects of the total amount control of pollutants for industrial waste water follows below:

- Hard-to-degraded organic pollutants
- Bio-accumulating pollutants
- Penetrating anions

4.3 Feasibility Study on Waste Water Collection

Based on the results of Chapter 3 “Engineering Analysis of the LDA Project” of this report, after the LDA project is completed and put into operation, the amount of waste water discharged into SCIP’s waste water treatment center is about 49.1t/d(max), which accounts for only 0.7% of the planned capacity (7000t/d) of the waste water treatment center in SCIP in early stage Ⅰ of phase Ⅰ. There are Enthylenglycole, acrylics, some catalysts,etc. In the discharged waste water, all of them are degraded easily. The concentrations of the main parameters in waste water discharged by the project are as follows:

COD_{Cr}<700mg/l

BOD_5 200 mg/l

SS<300mg/l

Oil<50mg/l

There are basically no hard-to-be–degraded organic matters, accumulating pollutants and penetrating anions in the waste water discharged. It can be seen that the quality and amount of the waste water discharged from this project to the waste water collection pipe network of SCIP can basically meet the requirements stipulated in the “Standard for

Waste Water Discharge in SCIP(provisional)", so it is feasible to put the waste water into SCIP's waste water treatment center. It can be viewed that after the project put into production, the waste water and living sewage of this project will not be discharged to the surface water environmental, it will bring no pollution to the environment.

5.Pollutants Discharge and Total Amount Control

5.1 The Factors of Total Amount Control

Based on the current situation of the total amount control, the pollutants which will be discharged from the project as well as surroundings environmental situation, the total amount control factors of air pollutants in this EIA is decided as follow:SO_2,dust , and the total amount control factors of water pollutants as fallows: COD_{Cr}, Oil and NH_3-N.

5.2 The Air pollutants of Project and the Proposal of Total Amount Control

The off-gas discharge from the process of the project will send to the incinerator of BIS, and the incinerator is designed for the whole Bayer Industry Park, so it will not effect the total amount control of Bayer Industry Park:: SO_2 87.8 t/a，dust 19.2 t/a, and the off-gas of the cleaning oven will discharge through the stack of incinerator of BIS, add 0.042 t/a dust to the value of the total amount control . So the values of the total amount control of the air pollutants of Bayer industry park suggest as follow table 5.2-1.

The proposed values for total amount control of air pollutants table 5.2-1

Factors	Former discharge amount (t/a)	New discharge amount of project(t/a)	The Proposed values for total amount control (t/a)
SO_2	≤87.8	—	87.8
dust	≤19.2	0.042	19.242

5.3 the Water Pollutants Discharge of Project and the Proposal for Total Amount Control

The quality and quantity of the waste water have been described in Chapter 3

"Engineering Analysis of the LDA Project". Most of It will be accepted and treated by waste water treatment center of SCIP, the proposed total amount control of waste water pollutants of this project are listed in table 5.3-1.

The proposed total amount control values of water pollutants discharge through waste water collecting pipe network of SCIP table 5.3-1

Factors	Former discharge amount(t/a)	New discharge amount(t/a)	The proposed value of total amount control(t/a)
COD_{Cr}	≤17.63	≤59.92	77.55
Oil	≤0.8	≤0.76	1.56
NH_3-N	≤0.16	≤0.0112	0.1712

6. Demonstration of Countermeasures Against Pollution

6.1 Description and Assessment of Pollution Prevention

6.1.1 Pollution Prevention Measures of the Project

Countermeasures against pollution of the project table 6.1-1

No.	pollution	measures	Concentration of discharge
1	Off-gas	All waste gas from process will be sent to safety dip-in tank, the off-gas from dip-in tanks will be sent to incinerator of BIS, if the incinerator shut down, the off-gas will be send to active carbon absorber system.	Conform to the standards
2	Waste water & liquid	All waste industrial water & liquid will be first collected respectively in the storage tanks, and if COD_{Cr}<700mg/l, it will be sent to SCIP's waste water treat center, otherwise it will be sent to the companies, which have the business license for handling hazardous wastes. The domestic waste water will be send to WWTC directly.	Conform to the standards
3	Waste solid	The residue stick to the reactor will be incinerated by cleaning oven of the project . Other hazardous wastes will be sent to the companies, which have the business license for handling hazardous wastes. Living rubbish will be sent to local environmental sanitation department	Conform to the standards
4	Noise	Low noise equipment will be used	Conform to standards

6.1.2 Description and Assessment of Waste Gas Treatment Measures

(1) Off-gas from process

In the project effective treatment will be made in each waste gas emission source. All the process waste gases will be treated by incinerator or absorbed by active carbon instead of being emitted to the environment directly.

All the organic waste gases from the 3 production lines of the project and respiration gases from the tank farm are sent to the safety dip-in tanks via general pipe. Waste gas emits emitted from the safety dip-in tanks is sent to the incinerator for incineration or active carbon adsorption system.

a) Under normal conditions organic waste gas and volatile gas such as solvent emitted during production are directly incinerated at high temperature and made harmless. This method has advantages of high purification efficiency (especially for waste gas with high pollutant concentration) and no need for pretreatment. The incineration efficiency of the incinerator used in the project is higher than 95%, incineration temperature is 1100℃, residence period is 2s. The contents of SO_2, CO, dust and xylene inside the flue gas out of incineration are 275,75,75 and <70 mg/Nm^3 respectively, this stream is in compliance with the discharge standard, and is discharged to the atmosphere through a 25-meter high stack.

b) In case of incinerator failure or shutdown due to maintenance, waste gas from the safety dip-in tanks will be treated with active carbon adsorption to ensure that the limits mentioned above is not exceeded:

(2) Off-gas from cleaning Oven

Off-gas from cleaning oven will discharge through incinerator stack of BIS. According to table 3.3-1 of “engineering analysis”, the emission concentration of pollutants in the off-gas from incinerator is lower than the

standard value. Therefore the pollutant of off-gas emission from this project is within the emission standard.

6.1.3 Description and Assessment of Waste Water and Waste Liquid Treatment Measure

The wastewater to be discharged is mainly comprised of dip-in tank wastewater, plant area(equipment and floor) washing water, laboratory wastewater, early rain water in the outdoor places and living sewage. In addition, during change-over of product grades, the distillation separator of process etc., and the product storage tanks in tank farm should be cleaned, and therefore waste cleaning liquid in small amount will be produced.

In the tank farm of the PIC project, a waste water storage tank and a waste liquor storage tank at 100 m^3 each is provided for collection and storage of above-mentioned waste water/liquor. And the expansion project will also use these two tanks, and another 50 m^3 tank will be added to storage the waste acetone.

(1) Waste water from safety dip-in tank , wastewater from cleaning reactor when product grade change-over and cleaning tanks, polluted rainwater （early 5 minutes）, will be collected in the waste liquor storage tank primarily before sampling analysis is performed. If COD_{Cr}<700mg/l the waste water will be pumped to waste water treatment center of SCIP via industrial wastewater pipeline, Otherwise, it will be sent to the companies, which have the business license for handling hazardous wastes.

(2) Waste water of process, 120t/a from Line A and other waste liquid will be pumped into the waste liquid storage tank, before be sent to the companies, which have the business license for handling hazardous wastes.

(3) Living sewage from the project is to be sent to the waste water treatment center of SCIP via the living wastewater pipeline of SCIP directly.

The capacity of the waste water treatment center of SCIP , Phase Ⅰ is

7000t/d, which is scheduled to be put into operation in Jan 2003 , and it can meet the requirement of the project. The center is to be constructed in phases according to the progress of the projects in SCIP. Based on the experience of the wastewater biochemical treatment of the pretrochemical plants in China, 2- stage active sludge biochemical treatment method will be applied in the wastewater treatment center, and the water after treatment will be in compliance with class 2, Shanghai Wastewater Comprehensive Discharge Standard (DB21/199-1997).

6.1.4 Description of Solid Waster Treatment Measures

Solid wastes of the project are mainly comprised of cleaning residue from reactor, product filter impurities, discarded packing material, waste active carbon and living rubbish. Annually quantity is about 23.4t, in which filter impurities, discarded packing material and waste active carbon are sent to the companies, which have the business license for handling hazardous wastes. Living rubbish will be sent to local environmental sanitation department.

In the case of unstable operation, certain amount of polymer, the total quantity is included in Table 3.2-3/ Waste solid disposal from the project , will be generated and stick to the equipment such as vessel, pump and piping system etc., It's not easy to remove these polymers by normal way in which a lot of solvent will be involved and a plenty of waste water will be generated meanwhile..

In LDA project, an efficient and environment friendly cleaning system-Cleaning Oven for the treatment of polymer contained equipment has been planed to be applied. This cleaning oven consists of a cleaning chamber and a combustion chamber.

The parts to be cleaned are placed inside the fluidized bed cleaning chamber. The oven is heated to the preset temperature by sand which takes

the role of heat carrier. The polymer sticks to the parts is melted and further burned while the parts themselves are protected against overheating.

The off gas which develops during the cleaning process goes directly into the second combustion chamber, where it is completely burnt at temperature above 800°C. Off-gas from cleaning oven will discharge through incinerator stack of BIS.

6.1.5 Description and Assessment of Noise Treatment Measures

Proper selection of equipment and reasonable arrangement of noise sources shall be taken into consideration in noise control. The main preventive measures are:

(1) Low-noise equipment should be selected as much as possible

(2) To make reasonable arrangement, avoiding noise superposition and interference.

6.2 Countermeasure Against Unorganized Discharge

Unorganized emission refers to irregular emission of atmospheric pollutants not through vent stack or emission sources from vent stack under 15m. It is mainly irregular emission resulting from leakage. Furthermore, evaporation during material handling and maintenance also leads to unorganized emission. Quantity of unorganized emission is related to process technology level, quality of equipment and pipelines, operating conditions and operation management level, etc.

Due to the advanced technology and equipment used in the project and related leakage is prevented by feasible countermeasures, the unorganized discharge of this project is under effective control. The countermeasures integrated in the engineering are as follows:

(1) All the storage tanks in the project are provided with nitrogen seal and

connected with exhausting headers, by which the gas emitted is sent to safety dip-in tanks before incineration. In case of incinerator failure or shutdown due to maintenance, waste gas treatment system will be switched to active carbon adsorption unit, and thus unorganized discharge from the storage tanks is avoided effectively.

(2) In this project, electromagnetic driven pumps, double mechanical seal pumps and diaphragm pumps or other kind of leakage-proofing pumps are selected for transfer of harmful fluids. As a result fluid leakage due to aging of seals is eliminated, and unorganized discharge of harmful fluids is effectively avoided. Because of the practical countermeasures mentioned above, no remarkable fluid leakage and escaping will occur. In our opinion only the leakage from the piping(flanges, valves, etc.) can cause unorganized emission.

Other preventive measures will be made as follows:

(1) Promptly collecting and treating the washing water generated from equipment routine maintenance, strictly control washing water consumption.

(2) Recover the fluids after maintenance of such equipment as compressors and pumps during plant operation.

(3) Set up necessary management regulations, strengthen the operator post patrol inspection and promptly eliminate any found leakage.

6.3 Counter- Measures During Construction Period

The project construction will inevitable give rise to some environmental impact. Countermeasures against pollution must be taken to prevent any avoidable harm to the environment.

(1) Special sprinkling vehicles should be provided to reduce the dusts generated during excavation, building material handling, application and transportation.

(2) Low-noise construction machines shall be used as much as possible. The machines with loud noise shall be kept far from the residential area and shall not be used at the rest time such as at night.

(3) The waste materials and building rubbish etc. During construction shall be sent to the designated place for storage and shall not be stored at random or discarded to the water body.

Necessary treatment facilities such as ash-water settling pond shall be provide for the wastewater and domestic sewage during construction, and temporary wastewater popes shall be provided so as to have organized discharge.

7. Conclusion and recommendation

(1) The off-gas of the project will be collected in safety dip-in tank, and the off-gas from the dip-in tank will be sent to the incinerator of BIS, The total amount of the off-gas discharge from the dip-in tank will be 280.4-314.4m^3/h, mainly containing N_2, little IPDI/HDI, amine:1.6mg/h, Acetone,TDI, TMPetc,. And when the incinerator was shut down in the case of maintenance or of other reason, the off-gas will be sent to the active carbon absorber system.

Off-gas from cleaning oven will also discharge through incinerator stack of BIS.

The discharge concentrate of the project will within the discharge limits of "Pollution control standard for hazardous wastes incineration"(GB18484-2001) and "Integrated Emission Standard of Air Pollutants" (GB16297-1996), New Atmospheric Pollution Emission Limits, Grade Ⅱ.

(2) Total waste water quantity is 16455m^3/a, containing COD_{Cr} <59.92t/a, BOD_5 <19.28t/a, SS <4.61 t/a, NH_3-N <0.0112 t/a, oil<0.76t/a, acetone<3.08t/a, little urea, DEG, TMP, etc.

General water drainage system of the project will be provided in the project for process wastewater, domestic sewage and rainwater respectively. Polluted early rainwater will be collected in wastewater tank, from where it will be evenly drained into process wastewater piping system. The later rainwater goes into rainwater pipe. Before entering into the connection pipe of chemical wastes treatment center, the pollutants concentration should be within the temporary standard of SCIP treatment center pipe connection, that is COD_{Cr}<700mg/l, BOD_5<300mg/l, SS<300mg/l, NH_3-N<35m/l, oil<50mg/l. The amount of waste water discharge into SCIP's waste water treatment center is about 48.2t/d(max), which accounts for only 0.7% of the planned capacity (7000t/d) of the waste water treatment center in SCIP in early stage

Ⅰ of phase Ⅰ. So the waste water discharge plan is feasible. And concerning waste water, COD_{Cr} above 700mg/l, it will be send to the company which have the business license for handling hazardous wastes.

(3) The total quantity of solid discharge from the project is about 23.4 t/a, the living garbage (2.2 t/a) will be sent to local environmental sanitary department, the cleaning residue of the reactor (11 t/a) will be incinerator by the cleaning oven, the waste active carbon (0.2 t/a) and the waste package material (10 t/a) will be sent to the plant who has qualified on treating waste residue.

(4) The waste liquid would be 808 t/a, and 8 t/a of 808 t/a will be recycling, the others will be sent to the plant who has qualified on treating waste residue.

(5) In this project, low-noise equipment such as electromagnetic driven pumps will used. The noise from the equipment will below 80 dB. And will meet the "Standard of Noise at Boundary of Industrial Enterprises"(GB12348-90),standard for class Ⅲ.

(6) The off-gas generate from this project will be send to the incinerator of BIS, which designed for the whole BIS, and the total amount control of air pollutants has been demonstrated in the EIA of PIC project. This project will not effect the total amount control of air pollution of BIS (SO_2 87.8 t/a, dust 19.2 t/a). Off-gas from cleaning oven will also discharge through incinerator stack of BIS., it will increase dust 0.042 t/a。So the following air pollutants value are suggested for the total amount control.

SO_2 87.8 t/a

Dust 19.242 t/a

(7) After put into operation, the waste water will be sent to waste water treatment center of SCIP, and will increase COD_{cr} 59.92 t/a，oil 0.76 t/a，NH_3-N 0.0112 t/a。Plus the former pollutants, it will be COD_{cr} 77.55 t/a，oil 1.56 t/a，NH_3-N 0.1712t/a , then the following water pollutants value are suggested for the total amount control.

COD_{cr}: 77.55t/a

Oil: 1.56 t/a

NH_3-N: 0.1712 t/a

(8) On the basis of the results of environmental impact assessment, it be concluded that this project which is to located in F3 block in SCIP is environmentally feasible.