

**The impact of direct investment of BASF in Nanjing, China on the  
sustainable development of the region**



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## List of abbreviations

AA/AE	Acrylic Acid / Acrylic Esters
BCC	Basic Chemicals Complex
BYC	BASF-YPC Company Ltd.
COD	Chemical Oxygen Demand
DMF	Dimethylformamide
EG	Ethylene Glycol
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EPC	Engineering, Procurement, Construction
FA	Formic Acid
FDI	Foreign Direct Investment
FFE	Foreign Funded Enterprise (=FIE without HMT)
FIE	Foreign Invested Enterprises
GDP	Gross Domestic Product
GTZ	Gesellschaft für Technische Zusammenarbeit
HMT	Hong Kong, Macao, Taiwan
IMT	Integrated Management Team
IPS	Integrated Petrochemical Site
IRIK	Index of Regional Industrial Concentration
JPC	Jinling Petrochemical
JV	Joint Venture
LDPE	Low Density Polyethylene
LEDZ	Luhe Economic Development Zone
LSTK	Lumpsum turnkey
MA	Methylamine
MOFCOM	Ministry of Commerce
NCIP	Nanjing Chemical Industry Park
OECD	Organisation for Economic Co-operation and Development
Oxo	Oxo-Alcohols
PA	Propionic Acid
PPE	Personal Protection Equipment
R&D	Research and Development
RMB	Renminbi (Yuan)
VAT	Value Added Tax
YBS	Yangzi-BASF Syrenics Company Co., Ltd.
YPC	Yangzi Petrochemical Corp.

## Executive Summary and Recommendations

The concept of “Sustainable Development” is part of the major strategy of most of the important global corporations. Under this concept not only environmental guidelines are to be implemented but it is also important to follow the economic and socio-economic effects of a business to the neighbouring region. As such foreign direct investment can play an important additional role in the provision of employment, the economic development and environmental protection through technical innovations in a region. BASF and Sinopec Yangzi Petrochemical Co., Ltd. (YPC) invited the “Deutsche Gesellschaft für Technische Zusammenarbeit GmbH” (GTZ) to provide an impact study on the BASF-YPC Company Limited (BYC) integrated petrochemical site (IPS) in Nanjing. This study has been addressed environmental, socio-economic and economic impacts associated with BYC.

Until 2005 a world-scale integrated petrochemical production site was built in Nanjing, Jiangsu province, and started operation. BASF holds a 50-percent stake in the joint venture project with an overall investment amounting to US\$ 2.9 billion. The goal of the independent study by GTZ is to analyse the sustainability of the joint investment regarding ecological and economic impact and coherence with social goals and benefits for the location and the region. Furthermore an indicator set for future research will be composed and some recommendations will be given.

The location of the IPS is at the “Nanjing Chemical Industry Park” (南京化学工业园区, NCIP) which provides convenient access and many neighbouring large petrochemical enterprises. The land for the site was leased from the government for 50 years, and the money was partly used by the government to compensate the relocated farmers who were living on the site. All together 2,000 farmers had to be relocated of which up to 1,400 already had been relocated at the beginning of the project. The ground breaking ceremony for the beginning of the construction at the NCIP was held at the end of September 2001. The commissioning phase started end of 2004 during which the very first product (methyl acrylate) was successfully produced on December 23<sup>rd</sup> 2004. On January 7<sup>th</sup> 2005 BYC made its very first delivery of 20 tons of methyl acrylate to its first customer, Sinopec Shanghai Petrochemical Company Limited. Finally the commercial operation in all process units started in June 2005. The official opening ceremony of the IPS with national and international guests is to be held in September 2005.

The study differentiates between impacts during the construction phase of the project and expected impacts during production. In terms of economic impacts three major

impacts could be observed during construction: BYC offered a huge number of jobs for construction workers. At peak times there were 14,000 workers on the site at the same time. BYC also had a strong influence on the speed of some public infrastructure projects such as roads as well as pipelines. Furthermore BYC even financed one road within the NCIP which is now also used by the public. During production phase due to the sheer size of the project a strong influence on the sales market and its prices is expected. Furthermore BYC helps increasing the attraction of the NCIP for new businesses to settle down in the park or neighbouring areas. Later the chemical park, Luhe district as well as Nanjing city and the province will profit from increasing tax incomes from BYC. As all foreign investments in China, BYC enjoyed certain tax and duty exemptions during the construction phase and will also enjoy them for some years during production.

BYC has also major implications on the socio-economic level. Especially in the implementation of safety regulations BYC played a major positive role already during construction but also now during production and transportation of the products. Every construction worker had to pass strict safety training with a final test. The use of personal protection equipment on the construction site was strictly monitored. A major spill-over effect in terms of implementation of safety regulations during production can be seen e.g. in the chemical transportation sector. Transportation firms are selected according a strict safety checks, drivers receive training and trucks are controlled at the entrance gate to the site. Here BYC gives several examples for best practices in China. Further major socio-economic impacts during the construction of the IPS are an – at least in a short term view – growing wealth in Luhe district and Nanjing city through the expenses spent there by the workers as well as the relocation and compensation of farmers who partly moved to the city. During the production phase BYC guarantees safe jobs for the more than 1,000 employees, who mostly used to work at the joint venture partner. Furthermore public sponsorship by BYC especially in the field of education in Luhe and Nanjing city is highly effective.

As a chemical company BYC has also potentially major impacts on the environmental situation in Luhe district and the region. Some positive implications for the production phase are the implementation of BASF environmental standards also for third party business partners. Similar to the safety standards here BYC can play a leading role in China. Furthermore the power plant built by BYC uses gas which contributes much less to the overall emission level compared to a coal based power plant. Although BYC creates additional waste which has to be burned or stored in the neighbouring areas, the amount of waste is rather low compared to the production volumes at older Chinese companies. Already during the construction phase BYC had some environmental impacts on the neighbouring region which are however

mostly of a temporary nature. People living around the site had been affected by dirt and noise directly related to the construction of the IPS. During the commissioning phase the noise temporarily created by the flare led to rather large protests by the neighbouring farmers. BYC emphasized that this noise will end after the proper adjustment of the steam cracker during the commissioning phase. Although no detailed investigations were undertaken it can be stated that the eco-system in the area of the site changed alone due to the construction of an IPS of this size. However, since BYC is located within a chemical park the area is already dedicated for industrial purposes. All in all around 45 percent of the industrial park will be covered by industry, the rest by a "green belt".

In general it can be stated that BYC in Nanjing takes the topic of "sustainable development" very seriously. Municipal institutions in Nanjing stated that the standards of BYC exceed compliance with World Bank Standards, PRC regulations and international standards. Especially in the field of safety standards BYC plays an exemplary role in China. In terms of measuring the environmental impacts, BYC already set up a detailed monitoring system in a broad range of fields and implemented methodologies such as the Responsible Care<sup>®</sup> system which are also used on a group wide basis. The strict adherence of the environmental standards secures BYC a less critical perception by the residents of Luhe district as well as Nanjing city. The beginning of the production phase is an optimal time to identify an indicator set for all three kinds of sustainable development indicators (economic, socio-economic as well as environmental) for long-term measurements, which can be used as a basis for recommendations for the development of a final sustainability strategy not only for BYC. An implementation of this vision would mean a further important step for the pioneering work of BASF in China.

### **Recommendations:**

- Stress what can be achieved by teaching and strictly implementing BASF safety standards on the site and for transportation
- Promote BASF safety and environmental standards also to other Chinese companies by holding seminars, allow company visits, etc.
- Support local community to improve transportation and distribution safety.
- Continue public sponsorship since it is a popular way in Asia to become a respected player in the local society
- Take the fears by the public and government agencies about environmental degradation (in particular the Yangtze river) serious – continue community talks
- Enlarge company network in the Nanjing Chemical Industrial Park to improve transportation and environmental issues and coordinate community dialog.



- Continue impact assessment during production phase and carry out the results in a following study. A possible tool is the indicator set proposed in the present study.

# 1 Introduction

## ***1.1 Objectives and Approach of the study***

The concept of “Sustainable Development” is part of the major strategy of most of the important global corporations. Under this concept not only environmental guidelines are to be implemented but it is also important to follow the economic and socio-economic effects of a business to the neighbouring region. As such foreign direct investment can play an important additional role in the provision of employment, economic development and technical innovations in a region.

In December 2000, after seven years of negotiation, the 50:50 joint venture BYC Co Limited (BYC) was established to undertake the challenging task of building and operating an “Integrated Petrochemical Site” (IPS) with worlds-scale chemical plants. The contract was signed in the presence of Chinese Premier Zhu Rongji and German Chancellor Gerhard Schröder demonstrating the significance of the project. In December 2004, after just over four years of construction, the site was mechanically completed and the first plant, methyl acrylate, was successfully started up. Full operation started in mid 2005 and the official opening ceremony will take place at the end of September 2005.

BASF and Sinopec (the mother company of YPC) invited the “Deutsche Gesellschaft für Technische Zusammenarbeit GmbH” (GTZ) to provide an impact study on the BYC IPS in Nanjing. The goal of the independent study is to analyse the sustainability of the joint investment regarding ecological and economic impact and coherence with social goals and benefits for the location and the region. Furthermore consequences will be drawn and some recommendations will be given.

To measure sustainability, appropriate criteria and indicators have to be identified. A clear and traceable contribution of the joint venture to sustainable development of the region is important for the people living there as it is for the long-term profitability of the company itself. With this study, BASF and Sinopec will on the one side disclose the impact of the foreign direct investment and on the other side conduct investigations for additional meaningful development projects for the location and the region.

Against this background, the indicators to be identified and the approaches to be chosen shall

- identify a direct and concrete success which is attached to the investment,
- point out synergies between social, economic and ecological development, and

- take into account the core competence of the company to implement innovations, developing new markets and initiating new ideas for new concepts to improve the private-public dialogue.

Two external consultants were invited to interview the management of BYC in Nanjing. Furthermore interviews with relevant municipal institutions were undertaken as well as interviews with residents living in the area of the production site. Most of the interviews were held within three weeks between May and June 2005. All members of the BYC management were greatly helpful during all interviews. The same counts for the municipal institutions which partly were very well prepared for the interviews and were also able to deliver significant data and statements.

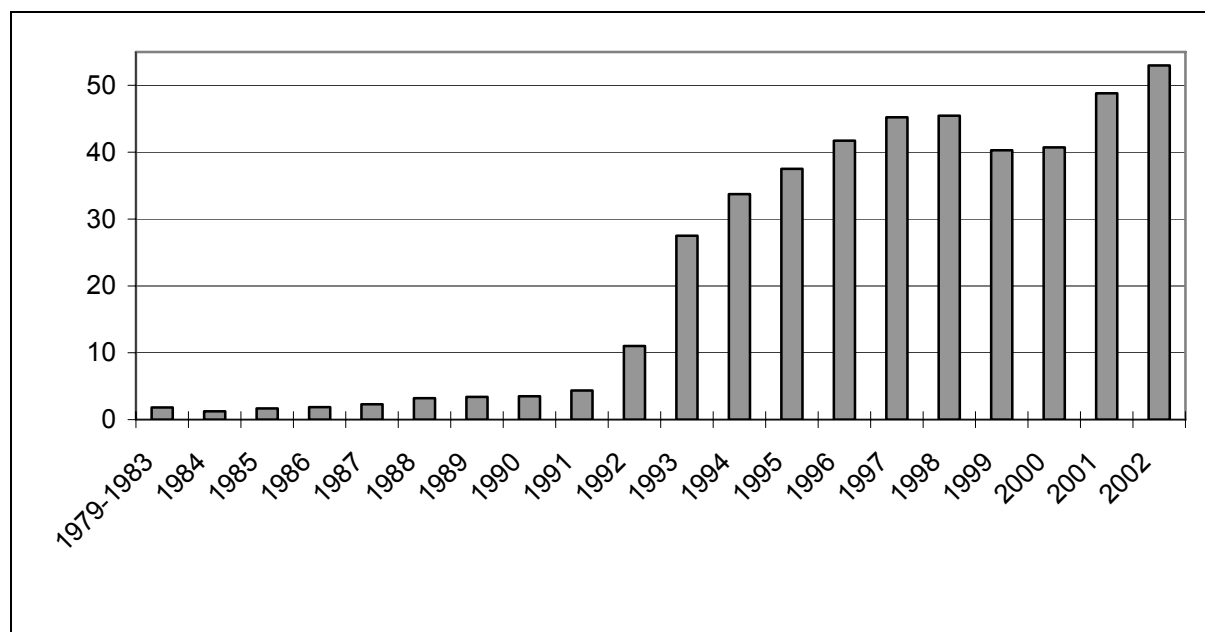
At the time of the interviews from May to June 2005 the BYC plant just underwent the commissioning phase. This means there are no representative impacts or even data available from the production phase. This study concentrates on general implications of the overall project. As far as possible and useful the descriptions of the impacts are divided into actual impacts during the construction phase and possible impacts during the production phase. Most impacts during the construction phase were non-recurring impacts with rather little long term implications. Although especially the environmental impacts during the commissioning phase might be higher, they are also considered as temporary impacts. The study includes suggestions for indicators which will also be collected during the production phase and can therefore be compared over time. From these indicators strategic measurements can be derived to optimize the overall “Sustainable Development” Strategy of the BYC site in Nanjing.

## ***1.2 The development of Foreign Direct Investment in China***

*The Volume of China’s FDI Inflows Over Time:* The initial legal and institutional basis for an inflow of FDI to China was established only in the late 1970s and early 1980s. But despite of various measures to attract foreign investors FDI inflows picked up only slowly in the 1980s. It was not before China’s strong commitment to a market economy in the early 1990s that the country was able to attract truly substantial amounts of FDI. The first “FDI-boom” began in 1992 and came to a halt in the turmoil of the Asian crisis. A short period of consolidation was quickly followed by the take-off of the second “FDI-boom” which finds its basis in China’s accession to the WTO in late 2001 (see Figure 1). In 2002 eventually China surpassed the USA and advanced to the top of the globe’s destinations for FDI.

*The Regional Distribution of FDI in China:* In terms of their regional distribution China's FDI inflows have been heavily concentrated in the coastal provinces (the "eastern" region), while the central and western regions have attracted only marginal shares of the national FDI inflows (Table 1).

Figure 1: FDI Inflows to China, 1979-2002; billion US\$



Source: *Guojia tongjiju (various); MOFCOM.*

This highly unbalanced picture is reproduced when looking at the provincial level. Here Guangdong seems to constitute a class of its own. During the 1980s Guangdong absorbed nearly one half of all FDI China attracted during this period. In the 1990s, when the volume of China-bound FDI rose exponentially, the province still hosted more than one quarter of the national FDI stock. Taking the period as a whole Guangdong has absorbed nearly one third of all FDI stock China attracted since the beginning of the reform era. The next most important host provinces for FDI have been Fujian and Jiangsu with a share of about 10% of the national FDI stock each.

Table 1: Geographical Distribution of FDI Stock in China

	1983-1998	1980s	1990s
Eastern Region*	87.8	90.0	87.6
Central Region	8.9	5.3	9.2
Western Region	3.3	4.7	3.2

\* *BYC is located in the eastern region of China*

Source: *OECD, MOFCOM*

These relative degrees of importance and the dynamics of the last decade are also reflected in the table, where the provinces' share in total FIE industrial output value and its change is documented. As can be seen, the eastern region has recently lost some of its importance as a production location for FIE, but has still a share of nearly 90%. Nearly all the losses of the eastern region have been absorbed by the central region, leaving the western region with a still negligible share in FIE industrial production.

Map 1: China’s West, Middle, East and the location of BYC



About one third of China’s total industrial output by all FIE is created in the province of Guangdong and another third in the Shanghai – Jiangsu – Zhejiang growth triangle. The industrial output value of foreign funded enterprises excluding those with capital from Hong Kong, Macao and Chinese Taipei (FFE), however is first of all generated in the Shanghai – Jiangsu – Zhejiang growth triangle, which accounts for nearly 40% of the total. In Guangdong FFE generate only 20% of their national total, leaving enterprises with capital from Hong Kong, Macao, Chinese Taipei (HMT), with a far greater leverage on industrial development in the province.

*The Geographic Origin of China’s FDI Inflows:* The bulk of China’s massive FDI inflows have not originated in the world economy’s industrial growth centres. Most foreign investors belong to the Overseas Chinese community. Hong Kong and South-East Asia have been the most important investors in China. The triad economies of

the EU, Japan and the USA each have accounted for only about 10% of all China-bound FDI. Even if potential misrepresentations arising through investments executed by affiliates of triade companies registered in Hong Kong, Singapore, Virgin Islands etc., and as a result not showing up as triade FDI, are taken into consideration, the quantitative triade FDI engagement in China has been comparatively moderate.

### ***1.3 Introduction to the concept of “Sustainable Development”***

The first time boundless economic growth was questioned, was in 1972 with the publication of the Club of Rome. Also in economic theory this was the beginning of the creation of intertemporal economic models which take economic development over several generations into account. At the beginning only economic and ecological topics were discussed under this early concept of “sustainable development”.

Since the publication of the “Brundtland Commission Report” in 1987 the term “Sustainable Development” stands as a mission statement for the global community. Economic activity should not only take the needs of today’s generation into account but also the needs of future generations. At the World Conference in Rio de Janeiro in 1992 178 nations committed themselves to the guidelines of a sustainable development. The guidelines refer to the three dimensions of economy, ecology and socio-economy. These three fields are nowadays widely accepted as the three dimensions of a sustainable development strategy.

This means that any sustainable strategy should preserve or increase the ecologic, economic and social capital. Ecologic capital covers in an ecological system the existing amount of renewable resources, land and ecological factors such as climate, different kinds of equilibriums in an eco system as well as solarisation. The economic capital forms the economic production capital like capital equipment, human capital and knowledge capital. Finally the definition of social capital is less distinct. From an economical perspective social capital includes infrastructure and public establishments. Lately also basic needs for living in general are counted under the term of social capital. All these dimensions have to be included into an overall business strategy which includes the principles of a sustainable development.

## 2 Background of the BYC and YBS projects

### 2.1 Introduction to the BYC IPS and status of the project

Together with its partner Sinopec BASF established the joint venture company, BYC Company Limited, on December 8<sup>th</sup> 2000. The goal of the project was to build and operate a world-scale integrated petrochemical production site in Nanjing, Jiangsu province. The site is being designed to the latest technological standards and will be one of the most advanced petrochemical complexes worldwide. BASF holds a 50-percent stake in the joint venture project with an overall investment amounting to US\$ 2.9 billion on an area of 2,2 km<sup>2</sup>. Since the investment volume is over US\$ 30 million the company is registered in Beijing and not at the local “Nanjing Industrial & Commerce Administration”. Only Shell (Nanhai) and BP made or are planning to make comparable FDI in China.

The location at the “Nanjing Chemical Industry Park” (南京化学工业园区, NCIP) provides convenient access and many neighbouring large petrochemical enterprises. The land for the site was leased from the government for 50 years, and the money was partly used by the government to compensate the relocated farmers who were living on the site. All together 2,000 people, mainly farmers had to be relocated of which up to 1,400 already had been relocated at the beginning of the project. The ground breaking ceremony for the beginning of the construction at the NCIP was held at the end of September 2001. The commissioning phase started end of 2004 during which the very first product (methyl acrylate) was successfully produced on December 23<sup>rd</sup> 2004. On January 7<sup>th</sup> 2005 BYC made its very first delivery of 20 tons of methyl acrylate to its first customer, Sinopec Shanghai Petrochemical Company Limited. Finally the commercial operation in all process units started in June 2005. The official opening ceremony of the Integrated Petrochemical Site (IPS) with national and international guests is to be held in September 2005.

Photo 1: Nanjing BYC site



Source: BASF

The core of the “Verbund” site is a steamcracker (600,000 metric tons of ethylene per year). With a 600,000 t/year ethylene plant as the centerpiece, BYC comprises 9

world-scale petrochemical plants. All the plants on the site are equipped with state-of-the-art technology and are working to the BASF's "Verbund" concept. According to the design the plants will produce 1.7 million tons of chemicals and polymers per year. Most of the products are to be sold in China and therefore expected to supply the growing Chinese market for these products. With this project BYC is now the biggest AA/AE producer in China. The following table summarizes the main process units and their capacities in the project:

Table 2: The main process units in the "Integrated Petrochemical Site" (IPS) project

Ethylene	600,000 t/y
Aromatics	300,000 t/y
Low Density Polyethylene	400,000 t/y
Ethylene Glycol	300,000 t/y
Acrylic Acid	160,000 t/y
Acrylic Esters	215,000 t/y
Oxo	250,000 t/y
Formic Acid	50,000 t/y
Propionic Acid	30,000 t/y
Methylamine	30,000 t/y
DMF	40,000 t/y

Source: <http://www.basf-ypc.com.cn/>

The project includes the construction and operation of a US\$ 150 million power plant with three gas and one steam turbines and an overall capacity of 180 megawatt. The power plant based on gas was built in order to produce only a minimal amount of waste. Most power plants in China are still coal based and contribute as such much more to the environmental pollution. Commercial Production of the power plant started on November 16<sup>th</sup> 2004. The major reason for building the power plant is the need for a reliable power supply which can not be guaranteed by the public grid. As a matter of fact the power plant is synchronized with the public grid and BYC already provided power to the public in order to support the raising need for electricity during a certain period of time. In addition to the power the plant also produces steam for the whole IPS.

The location of the IPS offers several advantages. First of all the west-east gas pipeline from Xinjiang to Shanghai could be easily connected with the site by a seven kilometre long branch. On the other hand the proximity of the Yangzi river offers rather quick access to international waterways. BYC operates three jetties at the estuary of Huangchang river which are officially approved for international operation



– the only BASF ones worldwide. On December 23<sup>rd</sup> 2004 the first incoming parcel tanker berthed and unloaded at the jetty. The site is also connected via railway to the international railway system. Through this connection BYC even has access to Ludwigshafen using the Tran Siberian railway as well as the railway through Mongolia.

The overall construction of the BYC site was managed by the “Integrated Management Team” (IMT) including more than 300 foreigners from 22 countries. At peak times more than 14,000 construction workers were employed on the site. For the construction BYC enjoyed tax exemptions for VAT and duties for imported material as well as VAT refund for equipment purchased from local suppliers. Furthermore BYC enjoys tax holidays for income tax for until two years after the first year of accumulated profit. During the third year the income tax exemption amounts for 50%. Furthermore because BYC is located within the NCIP it does not have to contribute to several local funds within the first years of operation.

The construction of the process units and power plant had been awarded to the following international contractors on a lump sum EPC (Engineering, Procurement, Construction) or a lump sum turnkey (LSTK) basis, except for IOU which was directly executed by the Integrated Management Team.

Table 3: Process units and power plant and its contractors

<b>Plant</b>	<b>Contractor</b>
Basic Chemicals Complex (BCC)	Shaw / Stone & Webster - UK
Ethylene Glycol (EG)	JGC/SEI - Japan/China
Low Density Polyethylene (LDPE)	CTCI - Taiwan,China
Acrylic Acid / Acrylic Esters (AA/AE)	TOYO - Japan
Oxo-Alcohols (Oxo)	TOYO - Japan
C1 Chemicals:	TR / CTCI - Spain / Taiwan,China
- Formic Acid (FA)	
- Methylamine (MA)	
- Propionic Acid (PA)	
- Dimethylformamide (DMF)	
Syngas Plant	Technip Coflexip - Netherlands
Power Plant	Daelim - Korea

Source: <http://www.BYC.com.cn/>

In order to monitor the impacts of the project to the environment as well as health and safety the corporate wide Responsible Care<sup>®</sup> data base is also fed with data from the Nanjing site. All data which are collected according to the Responsible Care<sup>®</sup> system can be internally used as one part of the overall “Sustainable Development Strategy”. The view from the outside especially on the economic and socio-economic impacts however often provides a rather opaque picture of the respective impacts of BYC. Nevertheless it is possible to identify important internally as well as externally measurable indicators which can be used for the development of further strategic actions.

## ***2.2 Introduction to the YBS project***

“Yangzi-BASF Styrenics Company Co., Ltd.” (YBS) was established in October 1994 and came to commercial production in March 1998. It is a Sino-German joint venture with investments by SINOPEC Yangzi Petrochemical Corp. (YPC)(40%), BASF AG (BASF)(50%) and BASF (China) Co. Ltd (10%) located in the “Nanjing Chemical Industrial Park”. It was the first joint venture of BASF in Nanjing. The total investment volume was RMB 2.2billion. The plant is producing high quality styrenics products for the electrical, electronics and packaging industry on the Chinese market. The main competitors of YBS are Dow, Chevron, Secco, Chimei, Atofina, Loyal, Xinda and Taida. YBS is an own company, but more and more synergies between YBS and BYC will be used. Both will have a common HR department, financing/ accounting and a common administration. From a location point of view YBS is totally integrated into BYC and it is hard to recognize, that there is a different joint venture.

The number of employees was 215 in 2004 and is planned to be 204 in 2005. 16 out of the 215 employees are female. There is no German working for YBS. The total revenue of the company in 2004 was RMB 2,064 million in 2004 and the planning for 2005 is RMB 2,337 million. Taxes are paid to the state tax bureau as well as the local tax bureau and the customs. From 2003 to 2004 the amount of taxes paid increased by 23%. According to the joint-venture contract, energy including electricity as well as steam, water, waste water treatment, fuel oil, fuel gas, etc. are supplied by YPC. Around 40% of the raw materials and 18% of spare parts and services are imported from outside China.

YBS implemented Responsible Care<sup>®</sup> as well as ISO9001/ISO14001 as the basic management systems in accordance with the overall goal of adopting the concept of sustainable development in the respect of quality management, safety, health and environmental protection. The economic impacts to the surrounding economy are not

particularly covered by this approach. According to YBS the company promotes a policy of increasing the awareness and knowledge of employees regarding environmental protection and responsible care through continuous training. The overall goal is to decrease the environmental influence of the products during the whole process of production, storing, distribution, selling, applying, retrieving and discarding. The company also demands frank and constructive responds to the public regarding their concern and inquiries about YBS products. All in all the company commits to comply with the respective statutory obligation and official regulations.

According to YBS major objectives in terms of EHS include a “Zero accident and no occupational disease policy”, the establishment and maintenance of an environmental management system according to the requirements of the ISO14001 standard, the efficient and effective use of raw materials and natural resources, the reduction of wastes and emissions, the avoidance of heavy pollution accidents, quick response to the public’s inquiry and concerns as well as the distribution of knowledge about safety, environmental protection and health to the public, suppliers and customers. Table 4 on page 20 shows some of the achievements of YBS concerning its EHS policy.

In terms of environmental initiatives by YBS the company periodically monitors the air emissions to ensure that the emissions are in line with legal requirements. YBS makes full use of by-products, for instance flux oil, oligomer and vent gas as fuel. It also partly uses condensate instead of fresh water. Periodically YBS supports the maintenance and improvement of the recycle water system. The waste water treatment methodology completely separates contaminated water and uncontaminated waste water. For hazardous waste disposal YBS makes use of qualified contractors. For incineration the Jiangbei disposal center is used and YPC is used for landfill. In 2004 the total amount of waste was 1662.1 t, of which 1216.2 t were hazardous waste.

For operational safety YBS also introduced the OHSAS18001 standard. YBS is also implementing the distribution safety code according to the implementation plan of BASF. YBS takes different measures including trainings to ensure safety condition of all workers. It also provides necessary PPE and forces its employees to follow safety regulations. The company established its own emergency response system and shares the fire brigade service with YPC.

Concerning its employees YBS provides various kinds of trainings. Most of these trainings are job-related trainings. Managing staff of the plant including some shift foreman received licence training overseas. Training is provided by either experts

from outside or internal senior staff. YBS also sends some colleagues to attend external seminars and trainings supplied by BASF. YBS also follows all legal requirements in terms of gender related topics. The labour union represents all employees at YBS and organizes for example sport games and outdoor activities.

Table 4: 2004 YBS “Environmental Protection, Health and Safety” (EHS) Performance

Target Index	Actual number	Achieved or not
Zero Serious Accident	0	✓
Zero Minor Accident	1	x
Zero Lost Time Injury	2	x
Zero New Occupational Disease Cases	0	✓
Polystyrene waste product rate ≤ 1.3‰	0.96‰	✓
Expanded Polystyrene waste product rate ≤ 5‰	1.477%	x
Consumption of Fresh Water ≤ 2.8 t/t	2.378	✓
Waste water discharge ≤ 0.70 t/t	0.579	✓
≥ 98% Qualification rate of waste water discharge	99.45%	✓
≥ 98% Qualification rate of uncontaminated water	99.18%	✓
≥ 95% Overall Qualification Rate of Environmental Supervision	99.36%	✓
≥ 95% Overall Qualification of Supervision of Hazardous Factors	99.87%	✓
Important Environmental Factor and dangerous source is well controlled	Completed	✓

Source: YBS, “Young Brilliant Site” Issue 6, 2005

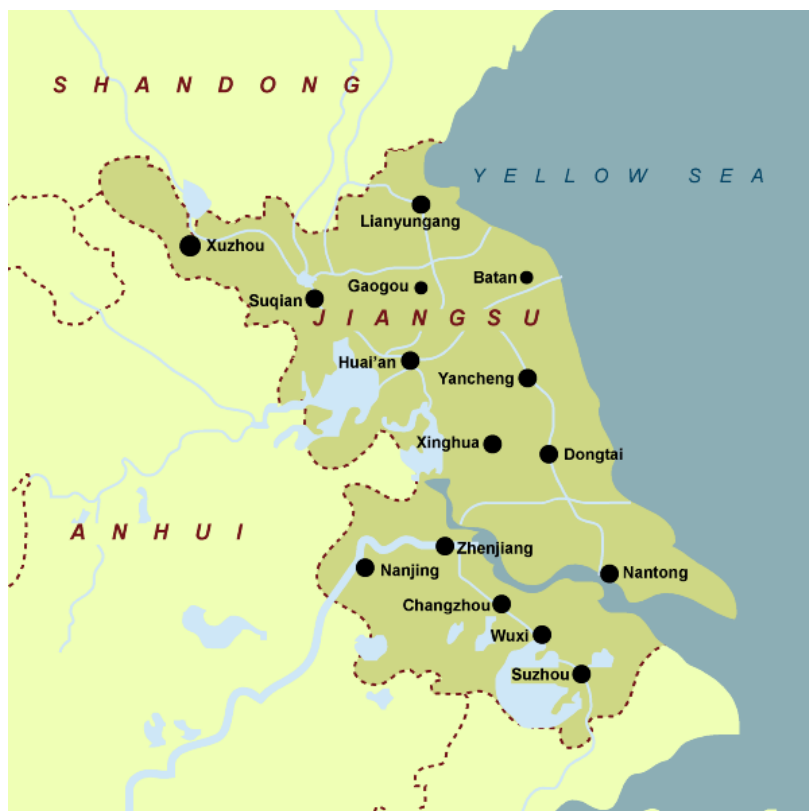
Since the emphasis of this study lies on the newly built BYC project only a very short introduction to the older joint venture can be given. The results show that several methods for the support of a sustainable development, including the company wide Responsible Care<sup>®</sup> system, are already implemented. Since YBS is already present on the Chinese market for more than 10 years its long term development in terms of sustainability could be investigated in future research.

### **3 Economic background**

#### **3.1 Economy of Jiangsu Province (江苏省)**

Jiangsu province with a total area of 102,600 km<sup>2</sup> and a population of 72.06 million is the most densely populated province in China. Since Jiangsu is located at the eastern part of the Yangzi delta it not only has a 1,000 km long coastline but it is also highly accessible by water transport through the various rivers across the area. The province accounts for around 10% of the national GDP. In terms of GDP per capita Jiangsu is only ranked seventh in 2003, partly due to the imbalance between the poorer northern and the richer southern regions. The southern regions alone accounted for 62.8% of Jiangsu's GDP in 2003. As a municipality direct under the central government Shanghai doesn't count to Jiangsu, but still the southern area covers the five cities of Suzhou, Wuxi, Changzhou, Nanjing and Zhenjiang.

Map 2: Jiangsu province



Source: [www.maps-of-china.com](http://www.maps-of-china.com)

Leading industries in Jiangsu include the electronic industry and telecommunications, chemical, textile, machinery and equipment as well as the metallurgy industry. The share of these seven pillar industries was 57.2% of the total gross industrial output of Jiangsu in 2003. The “Index of Regional Industrial Concentration” shows that in a countrywide comparison Jiangsu is especially strong in chemical fiber, textile and ordinary machinery industry. An index value of one hints that Jiangsu contributes exactly the same share to the national gross production value in a certain industry as Jiangsu contributes to the overall national industry production. A value over (under) one means that the respective industry has a relatively high (low) concentration in Jiangsu province and therefore plays an above-average (under-average) role for the economic development of Jiangsu. Table 5 shows the outstanding index values for the province.

Table 5: Index of Regional Industrial Concentration, 2002

<b>Industry</b>	<b>IRIK</b>
Chemical Fiber	2,3688
Textile Industry	1,9309
Ordinary Machinery	1,7861
Garment and Other Fiber Products Industry	1,5483
Raw Chemical Materials and Chemical Products	1,5046
Cultural, Educational and Sports Goods	1,3346
Metal Products	1,3063
Special Purpose Equipment	1,2818
Gas Production and Supply	0,7253
Transportation Equipment	0,7160
Beverage Production	0,6510
Furniture Manufacturing	0,6361
Electric Power, Steam and Hot Water Production and Supply	0,6033
Printing and Record Medium Production	0,5940
Food Production	0,5027
Tap Water Production and Supply	0,4602
Tobacco Processing	0,3972
Petroleum Processing and Coking Products	0,3888
Ferrous Metals Mining and Processing	0,3568
Coal Mining and Processing	0,2465
Petroleum and Natural Gas Exploiting	0,0696
Nonferrous Metals Mining and Processing	0,0393

Source: *THINK!DESK China Research & Consulting*

The private sector in Jiangsu is relatively strong. Production by the non-state sector accounted for around 90% of the province's total industrial output in 2003. The fastest growth in recent years, however, recorded foreign funded enterprises (including Hong Kong, Taiwan and Macau). In 2003 Jiangsu ranked top in attracting foreign direct investments among all provinces and municipalities in China, accounting for 19.7% of China's total. Around 85.6% of the foreign investment was engaged in the manufacturing sector and only 10.9% in the service sector. It is expected that due to the WTO membership of China and the growing integration of Jiangsu into the world economy this percentage might increase rather quickly. The growing importance of wholly foreign owned enterprises in Jiangsu can be seen very clearly in a long term view as in Table 6.

Table 6: Mode of foreign direct investment in Jiangsu (in %)

Mode of FDI	1990	1995	2000	2003
Joint Venture	97.7	69.5	35.4	21.1
Cooperative Operation	1.8	5.8	5.6	2.4
Wholly foreign owned enterprise	0.5	24.7	59.0	76.4

Source: *Jiangsu Statistical Yearbook 2004*

Jiangsu's industries have become more and more oriented to the global economy in recent years. Manufactured goods accounted for 91.7% and 98.1% of the province's total imports and exports respectively in 2003. The amount of exports reached US\$87.6 billion and imports US\$83.2 billion in 2004. Major export markets include the US, the EU, Japan and Hong Kong while the major sources for imports are Taiwan, Japan, Korea, the US and the EU.

Jiangsu Province is well equipped with schools and universities. Jiangsu even has the highest university density of overall China and therefore a comparatively huge output of well educated students in different fields. All together Jiangsu provided 111 high schools, 3,799 middle schools and 6,723 primary schools for its pupils and students in 2004. The following table summarizes some of the most important economic and socio-economic indicators for Jiangsu province between 2000 and 2004.



Table 7: Economic data of Jiangsu Province

Economic Indicators	2000	2001	2002	2003	2004
Unemployment rate	3.40	3.60	4.20	4.10	-
Average wage (RMB)	10,299.00	11,842.00	13,509.00	15,712.00	18,202.00
Export (100 million US\$)	257.70	288.78	384.80	591.40	875.58
Import (100 million US\$)	198.68	224.77	318.25	545.30	832.52
Disposable income (RMB)	6,800.00	7,375.00	8,178.00	9,262.00	10,482.00
Savings (100 million RMB)	4,456.86	5,172.83	6,276.20	7,368.16	8,863.10
Tax revenue (100 million RMB)	409.14	523.84	565.30	690.53	-
VAT	108.64	131.99	153.23	181.43	148.13
Enterprise income tax	88.66	140.81	94.87	92.69	138.52
Personal income tax	33.28	44.54	40.93	40.15	52.83
Number of residences (10.000)	7,069.28	7,097.63	7,127.32	7,163.93	7,206.05
GDP per Capita (10.000 RMB)	1.18	1.29	1.44	1.68	2.09
Consumption (RMB)	5,323.00	5,533.00	6,043.00	6,709.00	7,332.00
Consumption for services (RMB)	-	1,472.73	1,743.23	2,152.18	2,293.00
Consumer price index	100.10	100.80	99.20	101.00	104.10
Investment (100 million RMB)	2,995.43	3,302.96	3,849.24	5,335.80	6,827.59
in primary sector	116.20	136.60	162.71	67.62	25.12
in secondary Sector	1,358.56	1,429.52	1,786.31	2,841.76	3,640.63
in tertiary Sector	1,520.67	1,736.84	1,900.22	2,426.42	3,161.85
Welfare Services	-	-	-	-	-
Schools	-	-	-	-	-
High Schools	71	78	94	105	111
Middle Schools	4,345	4,255	4,129	3,713	3,799
Primary Schools	19,110	15,754	13,372	7,845	6,723

Source: Nanjing Statistical Bureau

### 3.2 Economy of Nanjing City (南京市)

Nanjing, with a total area of 6,598 km<sup>2</sup>, is located in the largest economic zone of China, the Yangtze River Delta. The city is 300 km away from Shanghai and 1,200 km from Beijing. According to the "Nanjing Statistical Office" the city has got 5.83 million inhabitants including 1.3 million registered migrant workers. The unemployment rate was around 4% in 2004. All together there are 3,000 foreign funded companies in Nanjing including 17 R&D centers and 60 of the global Top 500 companies. 70% of the investments in Nanjing are in the manufacturing industry while more than 50% of the Nanjing GDP is coming from the manufacturing industry. Compared to the primary and tertiary sector the manufacturing sector is still the fastest growing sector in the city. The following table shows some of the most

important economic and socio-economic indicators for the city of Nanjing between the years 2000 and 2004.

Table 8: Economic data of Nanjing city

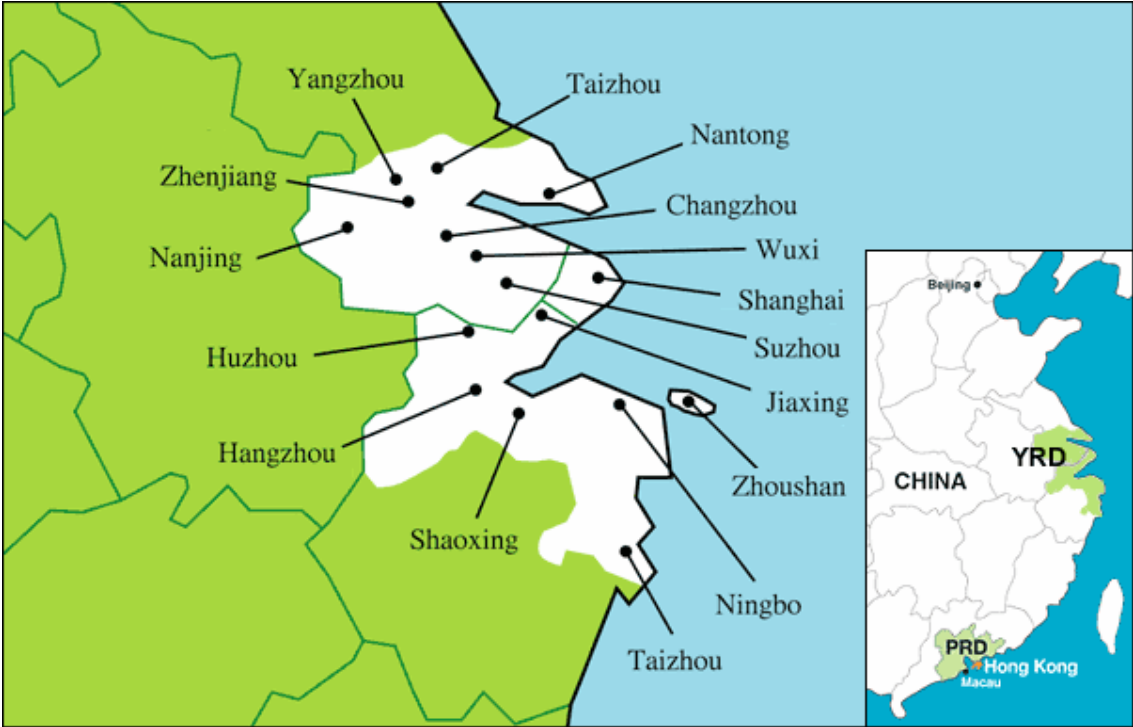
Economic Indicators	2000	2001	2002	2003	2004
Unemployment rate	-	-	-	4.20	4.00
Average wage (RMB)	11,897.00	14,103.00	16,220.00	18,853.00	22,180.00
Export (100 million US\$)	53.69	57.51	60.11	76.65	104.60
Import (100 million US\$)	37.33	38.37	40.83	70.47	101.79
Disposable income (RMB)	8,233.00	8,848.00	9,157.00	10,196.00	11,802.00
Savings (100 million RMB)	596.70	716.13	1,031.01	1,133.62	1,382.24
Tax revenue (100 million RMB)	-	-	-	-	149.66
VAT	18.22	22.93	24.80	28.71	28.09
Enterprise income tax	15.83	25.17	14.08	13.45	21.48
Personal income tax	-	-	-	6.70	8.60
Number of residences (10.000)	544.89	563.04	563.28	572.23	583.60
GDP per Capita (10.000 RMB)	1.85	2.06	2.29	2.73	3.31
Consumption (RMB)	7,048.00	7,326.00	7,323.00	77.25	8,350.00
Consumption for services (RMB)	1,842.00	2,007.00	2,104.00	2,359.00	-
Consumer price index	100.00	99.90	97.90	101.40	103.00
Investment (100 million RMB)	412.20	464.91	602.95	954.04	1,201.88
New Accomodations (10.000 sqm)	766	702	744	595	631
Welfare Services	-	-	-	-	-
Schools	1,551	1,375	1,159	932	836
High Schools	28	31	35	39	38
Middle Schools	423	411	381	355	348
Primary Schools	1,100	933	743	538	450
Kindergarden	601	545	505	486	479
Hospitals	278	286	294	294	165
Beds per inhabitants	40	40	38	39	45

Source: Nanjing Statistical Bureau

The petrochemical industry is one of the major columns of Nanjing's economy. Today around 200 petrochemical companies are doing business in Nanjing. All together more than 600 product categories are produced. The overall sales volume of the petrochemical industry in 2004 was RMB 96.3 billion which equals 30% of the total of Nanjing's sales volume. All together the petrochemical industry submits 34% of Nanjing's total tax revenue. According to the "Nanjing Municipal Economic Commission" the sales volume of YPC alone was RMB 31.8 billion in 2004 which equals 33% of Nanjing's petrochemical industry. YPC, which started business in Nanjing in 1984, submitted RMB 7.4 billion of tax and profits whereof RMB 1.8 billion were taxes only. It is expected that BYC can reach a similar size within five years and as such contribute to the local community to a similar extend – especially after the tax exemptions will be run out. According to the "Nanjing Municipal Economic

Commission” this goal is realistic since the market in China is big enough for the joint venture’s products.

Map 3: Nanjing within the Yangzi river delta



Source: Hong Kong Trade Development Council

Because of the high concentration of petrochemical industry in Nanjing the environmental situation of the city has to be under strict control. According to the “Nanjing Environmental Protection Agency” 2004 90.3% of industrial waste water and 92.6% of smoke and dust in Nanjing reached national standards. The total cost for environmental protection measurements in Nanjing was around RMB 233 million in 2004. Nanjing is promoting itself to the outside world as a “Green City”, which in combination with the large amount of chemical industry in Nanjing raises special challenges and responsibilities for the city government as well as the industry itself.

### 3.3 Economy of Luhe District (六合区)

Luhe district is located in the north of Nanjing and faces Yangzhou and Yizheng in the east. According to the “Luhe City Planning Office” the local government contributed a lot to BYC especially in terms of infrastructure. The express highways of Nanjing-Yangzhou, Nanjing-Lianyungang and Nanjing-Huai’an are directly joined with the district and the Jingjiang highway even runs throughout the whole Luhe district from north to south. Luhe is so far connected with Nanjing city by three bridges (construction finished in 1968, 2001 and 2005). Three more bridges are in

planning as well as one tunnel under the Yangzi river (planned opening 2007). The Nanjing-Qidong Railway and two other railways connect Luhe with the Shanghai-Nanjing and Tianjin-Pudong railway lines. The forest coverage ratio amounts to 22% while the green ratio amounts to 42%. The price of the labor force in Luhe is comparatively low. The average monthly wages of a skilled worker are about RMB 500.

Map 4: Luhe District including the “Nanjing Chemical Industrial Park”



Source: Luhe City Planning Office

**Box: Major preferential policies in the “Luhe Economic Development Zone” (LEDZ)**

- 1. Land: The land for an industrial project will be sold at a price 40%-50% lower than that provided by the province. The tenure of the land for an industrial project is 50 years. The charge for the extension of water capacity and the subsidiary charge for power supply will be exempted.
- 2. Tax: In the first 3 years after an enterprise goes into operation, 50% of its value added tax and 30% of its business tax retained by the zone will be returned to it. In the second 3 years, 50% of the increased part of its value added tax and 30% of the increased part of its business tax retained by the zone will be returned to it. In the first 5 years starting from the

profiting year, 100% of the enterprise income tax retained by the zone will be returned to it. In the second 5 years, 50% of its income tax retained by the zone will be returned to it.

Source: Nanjing City Government

Luhe district exists since 2002 and was built of Luhe and Dachang. It covers 22% of Nanjing's total area. There exist two centers for residents: 100,000 people are living in the southern part and 60,000 in the northern part of the "Nanjing Industrial Chemical Park". The long term planning is for 300,000 residents in the northern and 230,000 in the southern center. Most people moving to Luhe lived on the countryside before. All together, including the residential centers, Luhe has 860,000 registered residents whereas 483,000 are employees from all over China and foreign countries. 261 large enterprises are doing business in Luhe of which 30 are foreign invested enterprises.

Table 9: Economic and social data of Luhe district

Indicators	2002	2003	2004
Export (100 million US\$)	0.25	0.36	0.80
Import (100 million US\$)	0.31	0.21	0.44
Savings (100 million RMB)	-	-	86.28
Tax revenue (100 million RMB)	4.17	6.72	9.31
VAT	-	0.88	1.06
Enterprise income tax	-	0.49	0.85
Personal income tax	-	0.52	0.78
Number of residences (10.000)	86.29	85.85	86.02
New Accomodations (10.000 sqm)	-	21	46
Welfare Services	-	-	-
Schools	177	111	102
High Schools	-	-	-
Middle Schools	43	39	39
Primary Schools	131	72	62
Kindergarden	57	48	43
Hospitals	8	8	7
Beds per inhabitants	25	24	24

Source: Nanjing Statistical Bureau

The "Luhe Economic Development Zone" (LEDZ) is a development zone on a provincial level. It is both a part of the so called "South Jiangsu Plate" developed by the provincial government and a part of the Industrial City in the north of the Yangtze River developed by the municipal government. The zone includes branches of all

major banks, a customs house, hospitals from grade one to grade three as well as large scale supermarkets. Luhe owns middle or higher rank technical professionals of various special fields, which number over 10,000, and middle schools at the state level, vocational schools, ordinary senior middle schools as well as branches of the TV University. There are more than 10,000 students joining these schools.

According to the numbers the environmental record of Luhe is better than the one for Nanjing as a whole. In 2004 94.2% of industrial waste water and 97.5% of smoke and dust in Luhe reached national standards. The total cost for environmental protection in Luhe was RMB 67 million for 2004. Table 9 on page 29 shows some more economic and social indicators of Luhe district.

### **3.4 “Nanjing Chemical Industrial Park” 南京化学工业园区 (NCIP)**

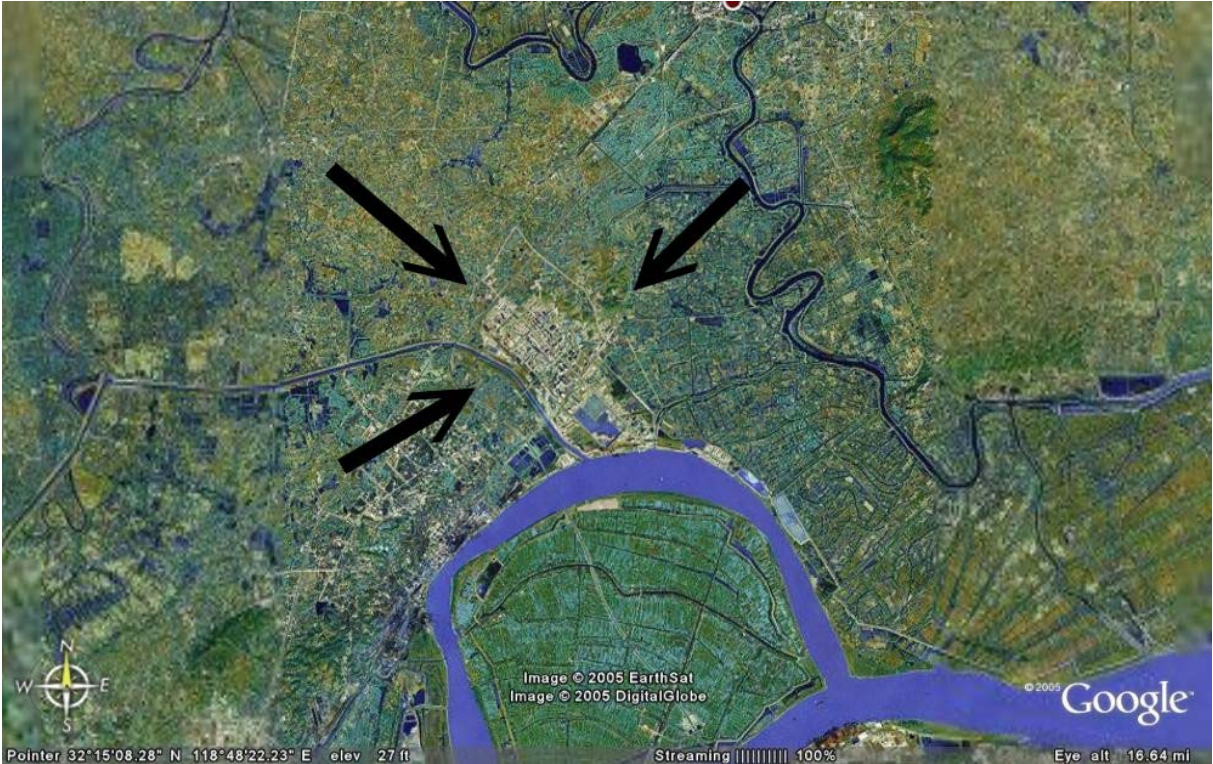
The “Nanjing Chemical Industrial Park” is situated at the northern part of Nanjing within Luhe District, which is on the north bank of the Yangtze River. It is about 30 kilometers away from downtown Nanjing and links to the Ninglu and Yonglu Highways in the north. In the south, it faces the “Jinling Petrochemical Corporation” (JPC) across the Yangtze River. In the west, it is connected with the “Nanjing Chemical Company”. And in the east, it neighbours “Yizheng Chemical Fiber Company”. There are 22 wharves with over 1,000 t capacity, where 3,000 to 30,000 t ships can anchor all the year. The Park is 25 kilometers away from Nanjing Port, which is the biggest inland-river container terminal in China. Joined by the recently built network of highways and pipelines, a synthetic riverside region of petrochemical industry will be formed with a total area of around 100 km<sup>2</sup>. 45 km<sup>2</sup> will be dedicated for industrial use in the Changlu zone (长芦片区) in the north and the Yudai zone (玉带片区) in the south. The rest is planned as a “green ecological belt” within the park. So far only 30% of the area for industrial use is already covered. BYC covers 2,2 km<sup>2</sup>.

The NCIP counts as a “Development Zone” jointly under the Jiangsu Provincial and Nanjing Municipal government. The EIA for the development of the park has been approved by the government, but there are still major improvements in infrastructure necessary. The park focuses on the development of the six key industries: petrol and natural gas production, basic organic chemical material, refine chemical industry, high polymer material, biological medicine and new chemical materials. More than 30 enterprises with FDI settled already within the park. Only big projects with an investment volume of over RMB 20 million will be approved since smaller investments might have a comparatively higher impact on the environment as big



investments with state-of-the-art safety regulations and waste treatment possibilities. It is also the goal to move smaller, already existing chemical companies from Nanjing into the park. A “Hazardous Product Treatment Center”, which is approved by the national government and can handle 252 t of toxic waste per year, will be built within the park. Up to now the individual plants are responsible for the treatment of their toxic waste. Although the “Hazardous Product Treatment Center” is not built because of BYC, it is built faster because of BASF-BYC according to the “Luhe City Planning Office”.

Figure 2: The area of “Nanjing Chemical Industrial Park” viewed from a satellite



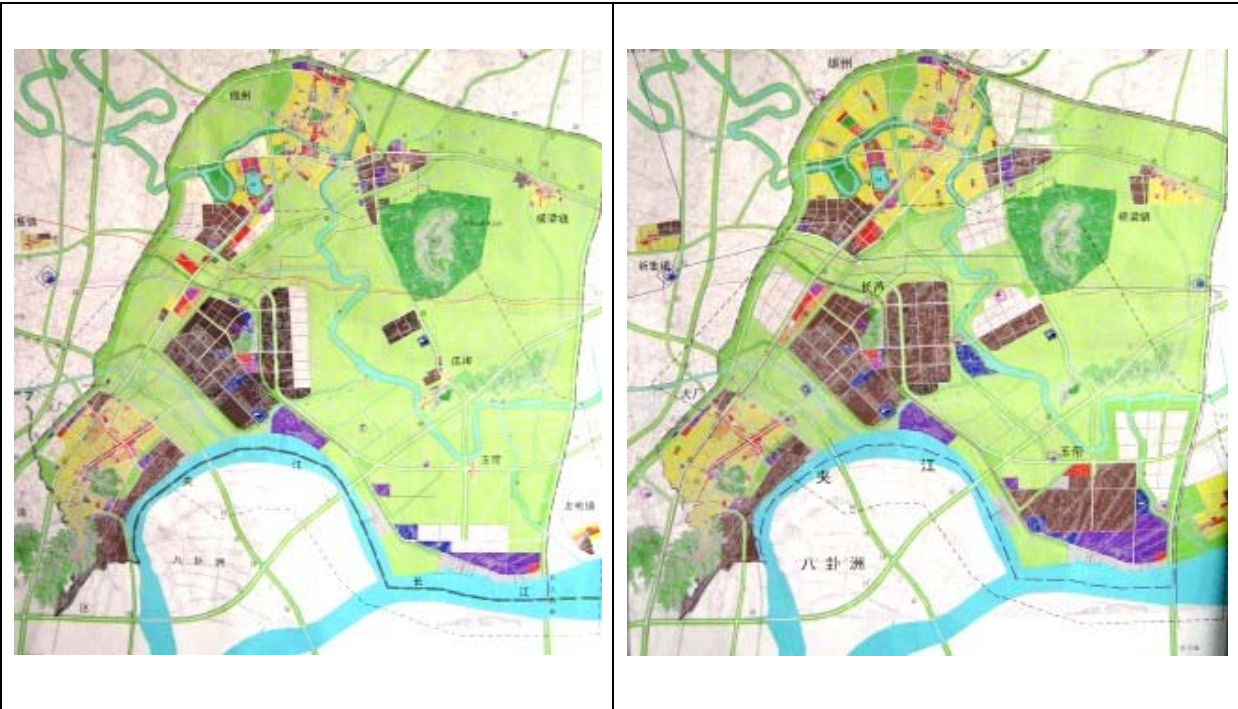
Source: [earth.google.com](http://earth.google.com)

The different stages of the development of the “Nanjing Chemical Industrial Park” in 2004 and later can be seen on Map 5. In the northern and south-western part lie the residential areas. The darker areas represent the space dedicated to industrial use. The rest is planned as a “green ecological belt” with grassland and woods. Residence is only allowed in the yellow parts.

There apply several tax related incentives for enterprises investing in the “Nanjing Chemical Industrial Park”. According to the official sources all enterprises which invest and keep their taxes in the park are entitled to the following preferential policies: After the period of two tax-free years is expired, the enterprises which have invested in the Park will enjoy a reduced enterprise income tax at the rate of 15%,

and 50% of the enterprise income tax kept by the Park is to be returned as a reward from the third to the fifth years.

Map 5: “Nanjing Chemical Industrial Park” 2004 and later



Source: Luhe City Planning Office

Overall BYC has a positive impact on the development of the park since it improves the general investment environment and is a strong representative also for the demands of the chemical companies within the NCIP. So far the park is not surrounded by a fence and as such more or less open to the public. Although the chemical companies within the park already demanded strongly a fence, the local people oppose it. Since the park is located between residential areas and fields, a lot of the farmers have to cross the park in order to get to their fields. Since most of them don't have a car or even a bicycle a detour because of a fence around the park means a much longer “commuting” time. On the other hand theft is not uncommon on the park's site. Parts of pipeline racks or other metal parts have already been dismantled and sold as “scrap” at the market which means a major danger for the overall park safety.



## 4 Description of the impacts

### 4.1 Economic impacts

The first column of the sustainable development approach which was intensely investigated through the interviews in Nanjing consists of the economic impacts resulting from the US\$ 2.9 billion investment. It might be expected that due to the size of the project alone the neighbouring regions of Luhe district, Nanjing city and Jiangsu province must have enjoyed major positive spill-over effects in terms of money-flows spent in the region. However a simple quantification of these effects is impossible due to several reasons: First BYC is only one part of a whole chemical park with a lot of synergies between the companies. Second, since there is a massive general economic boom in Nanjing it is difficult to identify impacts of the joint venture itself. Third, some effects themselves are hard to measure. For example the earlier completion of the west-east pipeline is clearly an economic effect of the BYC project although the pipeline would have been built anyways but not at this speed. Fourth it is nearly impossible to measure indirect effects of the BYC plant along the upstream and downstream value chain as well as the service providers. Nevertheless the following table gives an impression of the dimensions of the construction phase on the FDI statistics of Nanjing city which are clearly visible for the years 2001 to 2004.

Table 10: FDI to Nanjing and Jiangsu 2000-April 2005; US\$ 1 billion

Year	Foreign Direct Investment					
	Nanjing City			Jiangsu Province		
	Number	Contracted	Realized	Number	Contracted	Realized
2000	313	2.08	0.81	2,645	10.61	6.42
2001	410	1.07	0.90	3,583	15.09	7.12
2002	646	2.17	1.50	5,801	19.67	10.37
2003	843	4.01	2.21	7,301	30.81	15.80
2004	803	4.52	2.57	7,170	36.08	12.14
2005.01-04	181	1.12	0.45	2,058	14.34	4.70

Source: Bureau of Foreign Trade and Economic Cooperation, Nanjing Municipality

The following results of the interviews give a differentiated picture of the direction of direct and indirect economic effects related to BYC. The results can be summarized under the following topics:

- Infrastructure
- Impact on existing enterprises
- Impact on attraction of new businesses
- Impact on local sales market
- Impact on job market
- Impact on overall business standards
- Impact based on tax exemptions
- General economic impacts in Luhe district, Nanjing city and Jiangsu province.

*INFRASTRUCTURE RELATED IMPACTS:* During the last years the infrastructure within and around the “Nanjing Chemical Industrial Park” developed in an impressive way. Transportation volumes increased significantly and so did the capacities of roads and bridges around the industrial park and especially between Nanjing and Luhe. Although according to several local institutions the capacities would have been expanded also without BYC, BYC is one important cornerstone in the planning process for the infrastructure projects. BYC is mostly considered as a major contributor to the integration of the local economy into the international economy. An extensive infrastructure is a prerequisite for the development of the “Nanjing Chemical Industrial Park”. Some of the infrastructure projects are financed by the land leasing revenue from BYC, which means that BYC not only influenced the speed of the infrastructure construction but also contributed indirectly to a certain extent to the financing of the projects. Yet the bad road conditions in China as well as the poor knowledge of transportation companies in terms of transportation safety is still a challenge to BYC.

But not only is the road system a favourable part of the investment environment for BYC but also the direct connection to the railway system. Since the railway already reached into the “Nanjing Chemical Industrial Park”, BYC only had to build a 6.5 km kilometre short branch to its own site. The close connection with the Yangzi-river by the jetties gives BYC the possibility to use deep sea ships for the transport of raw materials and products. According to the interviewed government officials all of this infrastructure would have been built by any petrochemical company in the “Nanjing Chemical Industrial Park”.

One road construction within the “Nanjing Chemical Industrial Park” however was financed by BYC. Nowadays the road from the production site to the tank farm and jetties is also used by the public living in and around the park. A different contribution

of BYC to the region's infrastructure consists of the occasional support of the public electricity system through the power plant.

Although the power plant is not used for a continuous support of the public electricity grid BYC already supported the need for power in times of shortage on the demand of one of Nanjing's vice-mayors. 2004 BYC sold excess power to the public grid. This kind of help only occurs during shortages and not on a regular basis. The power is sold at cost price and subsidized by the Nanjing government to reach the purchase price.

*IMPACTS ON EXISTING ENTERPRISES:* The governmental institutions in the region expect that the BYC investment will have a major impact on existing companies as well as the founding of new companies in the petrochemical related field. The supplier of 1.7 million t Naphta as a feedstock for the steam cracker for example is the Jinling refinery (JPC) across the Yangzi river. JPC supplies Naphta needed by pipeline and is responsible for 90% of the whole Naphta purchase by BYC (the other 10% come by jetty from other suppliers in China). In order to fulfil the demand by BYC, JPC already had to increase its capacities. In general, long term contracts secure the supply of the raw materials from JPC. The following table lists a selection of third party contracts for raw materials according to the "IPS Commissioning & Startup Plan":

Table 11: Selection of third party contracts according to the "IPS Commissioning & Startup Plan"

<b>Product</b>	<b>Contractor</b>
Ethylene	Outside supplier through YPC
Propylene	Outside supplier through BYC Jetty
Naphtha	Jingling Petrochemical Company (JPC)
Natural Gas	PetroChina
Oxygen	Nanjing BOC-YPC Gas (NBYG) Company
Nitrogen	Nanjing BOC-YPC Gas (NBYG) Company
Hydrogen	YPC
Solid Waste Incineration	Jiangsu Fuchang Chemical Waste Treatment Company Ltd.
Production and Contaminated Water Treatment	YPC

220kV Power	JPEPC (Jiangsu Provincial Electrical Power Company)
Rain Water Drainage	YPC
Production Water (Low pressure fire water)	YPC

Source: BYC

On the other hands BYC usually offers shorter term frame contracts for local maintenance and service companies (cleaning, guards, cars, canteen, etc.). It is estimated that 80% of the maintenance and services (forecast for 2006: US\$ 23 m) goes to the local market and 20% are imported. Of the technical goods (forecast for 2006: US\$ 40-50 m) 60% were imported and 40% came from regional suppliers. A lot of 3<sup>rd</sup> party service provider contracts already exist with the joint venture partner YPC. BYC has a relatively strong influence on service providers not only in terms of the transfer of knowledge and safety standards but also in terms of the expansion of their business. For example the “Jiangsu Foreign Transportation Company” is one of the major contractors of BYC who also invested in its own business in order to fulfil the demands of BYC. An additional example for some positive economic spill-over effects is the external security company which was hired during the construction phase. During this phase up to 412 guards were on the site to assure security.

*IMPACT ON ATTRACTION OF NEW BUSINESSES:* Several local authorities mentioned their expectations concerning the development of new businesses in and around the “Nanjing Chemical Industrial Park” which are closely related to the BYC joint venture and its value chain. The local MOFCOM for example expects new companies settling within and around the park especially for BYC downstream products. As a different example Nanjing MOFCOM mentioned the case of the Ford/Mazda factory which attracted more than 100 additional companies around the production site. According to MOFCOM BYC has a very good reputation which already led to the starting of downstream production by some companies in Nanjing. Also smaller chemical companies are about to move their whole plant into the “Nanjing Chemical Industrial Park” in order to profit from synergies between the petrochemical companies in the park and as a result to be able to offer competitive prices.

According to the “Luhe District Planning Commission” there exists a mutual impact between BYC and the “Nanjing Chemical Industrial Park”. BYC is an important centre of attraction also for other (foreign invested) petrochemical companies. So far among others companies like Nanjing DSM Eastern Chemicals Ltd., SASOL Chemicals Ltd., BOC Nanjing Chemical Industry Park Gas Ltd., SINOPEC Shaw Pipeline Ltd.,

Nanjing Chemical Industry Park Ganghua Steam Ltd., Nanjing Shengke Water Treatment Ltd., DyStar, Celanese, Sembcorp, The BOC Group, etc. are already in the park or are building their plants. Since some government officials mentioned the importance of the overall investment environment in contrast to financial incentives for the investment and since it is a fact that the petrochemical industry needs close partners both upstream and downstream the importance of BYC for the development of the “Nanjing Chemical Industrial Park” is considered to be very high.

BYC attracted not only upstream and downstream related businesses to Nanjing but also some foreign funded engineering companies as well as foreign funded and Chinese maintenance companies. Since most of the machineries at the site were built by foreign companies they also had to open a branch in Nanjing in order to maintain the running machineries at BYC. Up to now there are no data available how many companies started their business in Nanjing because of BYC. Especially the indirect effects are although existing only hard to measure. For the construction of the AA/AE plant for example Japanese “Toyo Engineering” was hired as a subcontractor on an EPC (engineering, procurement, construction) basis. Although “Toyo Engineering” itself is a Japanese company with Japanese employees, the company also opened a new branch in Nanjing and hired local staff through its own local subcontractors.

*IMPACTS ON LOCAL SALES MARKET:* The local sales market for BYC products like ethylene will be heavily influenced especially in the short to medium term. The local market is still much larger than the contribution of BYC. Nevertheless BYC exports some small percentages of some products. As long as BYC can maintain its “pole position” the local market will be influenced by this project alone. A Beijing analyst with chemical industry researcher “SRI Consulting” however figures that China's ethylene capacity is expected to grow by 22% annually through 2009, while domestic demand will climb by just under 13%. Since several new joint ventures will start their business in the coming years the influence of each plant will shrink the more producers will be active in China.

*IMPACTS ON JOB MARKET:* Already during the phase of construction BYC had a significant impact on the job situation in the region. All together around 85 m men-hours were spent for the construction of the “Verbund” whereas 60 m men-hours were directly related with the construction work and the rest was management. At peak time there were 14,000 construction workers on the site at the same time. During construction 15 major subcontractors were hired which again hired subcontractors within their own responsibility. Out of the 15

major subcontractors 5-6 were registered locally, the rest came from other parts of China or foreign countries. According to the “Integrated Management Team” around 15% of the total construction costs were salaries which were paid to the Chinese workers (in western countries it is estimated that 60% of the construction costs are paid for salaries). At least during the construction phase therefore BYC had a significant direct and indirect impact on the local community. The “Nanjing Municipal Economic Commission” even expected increasing incomes in the region because of the salary levels of employees at BYC during construction and also in the future during production.

*IMPACTS ON BUSINESS STANDARDS:* Several interviewees at the government institutions also mentioned the influence of BYC in terms of the introduction of western economic and business standards (e.g. accounting standards) to Chinese employees. This rather invisible impact is reflected in management and also human resources concepts as well as the increasing capabilities of management. For example the concept of “vacation days” is new for most Chinese employees at BYC. Offering the possibility to work for an international joint venture is widely considered as a contribution to the internationalization of the population. The business standards which are introduced so far are widely accepted by the employees and related businesses and institutions. However there is no guarantee that these standards will be also supported after the expatriates will be gone back to their home countries.

*IMPACT BASED ON TAX EXEMPTIONS:* Since BYC enjoys all general financial incentives for a joint venture in China a major tax-related direct financial impact to the region could not be realized. BYC enjoyed exemption from VAT, VAT refund for equipment purchased from local suppliers as well as exemptions for duties during the construction phase. Based on local laws BYC also had not to pay into several local funds like the education fund or the flood prevention fund. The local MOFOCM also raised the concern that these tax exemptions are unfair to newly established local businesses in similar fields. According to latest news from Chinese media, the tax exemptions for foreign companies are going to expire in 2007.

Table 12: Imports to Nanjing and by BYC from 2000-2004 in 10,000 RMB

Year	Nanjing imports	BYC imports	Share
2000	231,357	-	-
2001	228,518	0.18	0.000%
2002	240,069	2,387	0.994%

2003	480,769	48,579	10.104%
2004	766,769	30,076	3.922%

Source: Bureau of Foreign Trade and Economic Cooperation, Nanjing Municipality

**GENERAL IMPACTS & CONCLUSION:** According to some governmental institutions interviewed, BYC in general has a strong influence on the economic development of the region. BYC helps to raise the importance of the Yangzi Development Area. This is not only because the “Verbund” is the largest single investment in Nanjing but also because BYC also contributes indirectly to the technological development in Nanjing. Other institutions mentioned the fact that most of the equipment for the construction of the site was imported and so the economic impact to the local community from this perspective was not very large. However the direct impact of the workers from the site is considered as visible in terms of rising personal income tax revenues, expenses and increasing prices in Luhe during the construction phase. During the time of construction new apartments were built in Luhe for the accommodation of construction workers. 1/3 of the foreigners working at the “Integrated Management Team” lived in hotels or apartments during the construction phase. Prices in Luhe seem to be higher also after having finished the construction and only slowly tend to decrease again. All in all there was a rather opaque one time economic impact during the construction phase – the economic impact of the production phase to the local community is expected to be lower in terms of the situation of individuals but nevertheless strongly significant in terms of direct and indirect business related impacts.

Table 13: The three major economic impacts of BYC

<b>During Construction</b>	<b>During Production</b>
Strong influence on the speed of public infrastructure projects	Strong influence on local sales market
Job opportunities for construction workers	Attraction of new businesses to the NCIP and Nanjing
Road within NCIP financed by BYC	Later: increasing tax incomes for the governmental institutions

## **4.2 Socio-economic impacts**

The socio-economic effects by BYC cover a wide range from health, safety and giving employment to trainings in different fields. Since the petrochemical industry has to deal with hazardous chemicals on a daily basis BYC stresses the importance of workplace safety for its own employees as well as 3<sup>rd</sup> party service providers' employees. On the other hand it is expected that BYC contributes to the labour market in Nanjing by providing jobs which are in general well paid. One major spill-over effect consists of the knowledge transfer by BYC through trainings as explained later in detail. The following kinds of socio-economic impacts can be identified:

- Impact on safety regulations
- Health service related impacts
- Impacts on the employment situation
- Impacts on wage level, benefits, trainings and vacations
- Impacts on gender questions
- Labour Union related impacts
- Impacts for disabled employees
- Sponsorship
- Relocation related impact

*IMPACT ON SAFETY REGULATIONS:* Already during the construction phase safety regulations for all workers on the site were implemented and strictly monitored. The safety program during the construction phase is considered to be one of the most rigorous ever in China. More than 100,000 workers got safety training during the construction phase which was held by DuPont as a safety consultant and trainings partner. A special building for safety trainings was built and every construction worker had to pass a test after the safety training. Only 20-30% passed the test at the first time but it was possible to repeat the test after some weeks waiting time. The overall sum of expenses for safety trainings accounted for about RMB 20 m. The personal protection equipment (PPE) during the construction phase was paid for by the 3<sup>rd</sup> party contractors. BYC developed a punishment system to ensure that the personal protection equipment is used. If the safety regulations were not followed by a worker once, his batch was punched. After the second time the batch was taken away and he had no chance to enter the site again. In some cases it can be seen that workers who worked on the construction site keep the knowledge about safety also after they have left the site.

All together BYC held 15,000 courses on occupational safety so far. Until November 2004 the plant reached 20 m safety hours without any major accidents (all together there were 1 death in traffic, 14 smaller accidents and 243 smaller incidents). For regular safety trainings during the commissioning and production phase 5-8 trainers



are available who give trainings besides their normal jobs. The personal protection equipment during the production phase is provided by BYC. The safety record of the Nanjing plant is also reported to the Responsible Care® database. Besides the strict internal checks the national requirements are also checked by the “Nanjing Safety Supervising Bureau”, the “Nanjing Fire-Fighter Bureau” and the “Hygiene Safety Supervising Bureau”.

All external transport companies have to pass a three step process in order to be accepted by BYC as a service provider. The target within distribution safety is to reach international standards by applying a combination of BYC standard guidelines and Chinese regulations. Incoming and outgoing goods are treated the same and divided into non dangerous packaged goods, dangerous packaged goods, non dangerous bulk goods and dangerous bulk goods. Currently eight transportation contracts exist. All transportation companies are audited and selected by BASF since BYC wants to be in full control of the transport. All drivers receive trainings. If a road is too dangerous for chemical transports detours have to be taken into account.

Some service providers - usually partners with other JVs – already have safety standards implemented. In general service providers are very much interested in keeping the standards set by BYC because it also means a good reference for them. Usually contracts with service providers are limited to one year when new negotiations start. The BYC logistics department alone employs six full time employees for safety: one BASF safety advisor, one auditor, three gate inspectors who control the safety of the trucks and one captain who also gives safety trainings and emergency drill trainings for ship owners.

All in all BYC invests in safety conditions much more than legal requirements demand which leads to an overall improvement of safety and transportation standards also at partner companies. Another example here are the seminars given to AA/AE purchasers who learn how to cope with the products they buy. There are also training materials as well as leaflets for e.g. transportation standards available as downloads for the AA/AE purchasers from the website – although most of the clients don't use internet access yet. Twice a year a customer meeting with seminars and workshops is held. A major target here is to teach standards to the customers. BYC also wants to serve the customer directly to have a better control of what happens with the products.

*HEALTH SERVICE RELATED IMPACTS:* Besides safety measures BYC is also offering health services for its employees. At the site a company physician is available. There is a free Hepatitis B check possible for every employee. In at least one case also Hepatitis B infected applicants were accepted for work at BYC. In this

case however the communication of possible Hepatitis B risks and the possibilities of vaccination is absolutely necessary. The company physician also supports vaccination campaigns as well as other activities for example the distribution of masks and Chinese medicine during the SARS epidemic. The physical examination of new employees during recruitment is outsourced to a 3<sup>rd</sup> party. For chemical plant employees working on the site every two years a medical health check is held. In general the BYC health standards again have impact on local companies which improve their own EHS standards. This can be supported by a positive communication with the local public about EHS standards.

*IMPACTS ON EMPLOYMENT SITUATION:* The impact of the BYC joint venture on the employment situation in the region is somewhat surprisingly low. The chemical industry is highly capital intensive and has a rather low labour intensity. The invested capital per employee at BYC is around US\$ 2 m. Since the joint venture partner is YPC, BYC always first has to ask YPC if it wants to hire new employees. BYC has its own recruitment procedure which means that not everybody who is offered by YPC is accepted by BYC. So far about 90% of all employees at BYC are originally coming from YPC. Most of them are experienced workers with a long year working record at YPC. About 18,000 people are working at YPC and today BYC accepted about 1,400 of them for their own site. According to some departments at BYC the social impact in the field of job creation or safe jobs for possibly unemployed is rather low since the 1,400 workers would have possibly also been taken by other petrochemical companies within the “Nanjing Chemical Industrial Park”. However it is expected that BYC creates far more indirect jobs than direct ones, although the number of indirect jobs is not measurable.

Photo 2: Donation for Fighting SARS



Source: BYC

According to the human resources department only 20-25 new university graduates were hired at BYC. On the other hand BYC for example contributes to the improvement of the living situation of some students at Nanjing University by offering scholarships. In general Jiangsu province offers a relatively huge pool of highly qualified graduates since Jiangsu province has got most universities in China. Since most of the employees at BYC are not directly coming from the university but former YPC employees the turn-over-rate is very low. Most employees have already settled down in the Luhe area several years ago and are not willing to change the job or the location they live at. Additionally BYC offers attractive salary structures where the development of each employee according to his achievements is guaranteed.

Of course BYC created a lot of direct jobs during the time of construction. All in all around 85 m men-hours were spent during the whole construction period. Different departments mentioned the difficulty of finding qualified construction workers during this time. In the end construction workers came from all over China and not only from the Nanjing region. After the construction phase and the successful start-up of the plant also most of the expatriates will go back to their home countries.

*IMPACT ON WAGE LEVEL:* BYC is in direct competition with YPC in terms of the wage level offered to its respective employees. BYC considers its wages as relatively high compared with YPC which might have been true during the beginning of the joint venture project. Today it can be said that BYC surely had an impact on the wages of

YPC. It is estimated that fixed wages at YPC are still lower than at BYC but YPC is much more flexible in monthly and yearly bonuses. Additionally YPC offers a much higher percentage of a so called “grey salary” consisting of presents, free tickets, natural produces or free social events. The higher the position of an employee the higher is also the percentage of his “grey salary”. According to the Human Resources department the difference between the total salaries is not that big in the end. In general it can be stated that BYC still offers relatively high wages compared to other companies in Nanjing where the average monthly income is 1,800 RMB. Additionally BYC offers high job security, relatively good career development possibilities and a huge number of trainings for its employees including technical trainings in Nanjing and Germany, English classes, safety courses, management training, etc.

*BENEFITS:* Additionally to the salary, employees at BYC enjoy a number of benefits. BYC contributes together with the individual employee to the basic pension and unemployment fund (30% and 11% of the salary respectively), the insurance against work related injuries which covers 24 hours as well as a medical insurance and a maternity support for women. Supplementary BYC offers pension allowance, additional medical insurance, employer’s liability insurance, overseas travel insurance as well as payments to a public reserve fund (12% employee, 12% employer) and housing subsidies (18% employer). BYC also offers a “One Child Award” as every Chinese company does. As a matter of fact all employees at BYC have only one child. A final example of supplementary is transportation to and from work offered by BYC.

Former YPC employees, who make 90% of the whole BYC staff, can keep their benefit packages they enjoyed already at YPC. In order to keep up these benefits BYC made a one time payment of RMB 30 m according to the joint venture contract. For former YPC employees who keep their packages although they change to BYC RMB 8,000-10,000 are paid per employee.

Since BASF paid a lump-sum to the construction contractors, it only can be estimated that wages for the workers at the construction site were US\$ 7-8 per day on average. Most of the workers worked 10 to 12 hours per day and seven days a week. Every worker got one day off per month. Although these working conditions seem to be somewhat critical in western eyes a lot of migrant workers took the chance to make as much money as possible during the time of the assignment on the construction site.

*TRAININGS:* BYC offers different kinds of trainings for its employees. Depending on their job, new employees receive also a training at the headquarter at Ludwigshafen and other BASF sites. All new employees go through an orientation phase on a

general company level and then receive specific training at their departments. The training plan is developed by three employees at the human resources department who also organize most of the internal trainings. The trainings are held by specialists from the respective BYC departments.

*VACATION:* An interesting detail in introducing western management and employment conditions in China is the fact that all employees get 12 vacation days per year. At YPC most employees spend their vacation together with colleagues at team events. It was mentioned that at the beginning the Chinese staff at BYC didn't really know what to do with 12 days off and expected the company to organize some group trips for the vacation days.

*GENDERS:* Officially there is no difference between genders at BYC. For women also shift work is possible. Only during the construction phase there were no women working at the construction site. Interestingly, new recruits from the university are often female because their English knowledge is usually much better than the male one's. All women also continued their jobs after having their child. Having a well paid job like at BYC also supports the possibility of hiring a maid who can take care of the child during working time. Nevertheless especially in higher ranking positions nearly all employees are men.

*LABOUR UNION:* In China only one labour union exists officially. There is also a labour union law which is applicable for all employees at BYC. Membership is not mandatory and also open to non-Chinese. Practically all employees at BYC are members of the union. In contrast to western countries there are no negotiations about wages between the labour union and the employer, but if there are disagreements between the employer and an employee the labour union is acting as the mediator. In general members of the labour union enjoy some advantages like using the union representatives as mediators or joining team building activities organized by the union. 2% of each employee's monthly salary go to the labour union's fund as membership fee.

*DISABLED:* According to Chinese law 1.5% of all employees at a company have to be disabled; otherwise the company has to pay a fine as compensation to the government. According to this regulation BYC should have 20 disabled employees but had only one in the past and is therefore paying a fine.

*SPONSORSHIP:* BYC also built its own reputation as a sponsor of different projects in Nanjing. BYC employees for example collected RMB 320,000 to sponsor a multimedia education classroom at a school in Nanjing. Another important initiative is the sponsorship of the "Pfrang Association" by individual employees. The association

was established in November 2000 in memory of the Pfrang family who was murdered in Nanjing. It is a non-profit organization with the intention to provide funds and activities for poverty-stricken families in northern Jiangsu province in order to support children to finish the 9-year compulsory education program. By this it is hoped to break the cycle of poverty, lack of education, unemployment and crime. Until August 2003 already around 80 pupils were sponsored (several examples of sponsorship activities by BYC can be found in the addendum).

*IMPACT ON RELOCATION:* One major socio-economic impact by BYC is the necessary relocation of farmers having lived on and still living next to the site. According to the "Luhe Municipal Planning Commission" 30,000 people have to be relocated because of the building of the chemical park. The general concern is that still too many farmers are living close by the chemical plants. According to BYC between 1,500 and 2,000 people had to be relocated from the area where the "Verbund" is now built on. BYC paid a lump sum for land leasing (*tudi fei*) to the local government in order to subsidize indirectly the relocation and compensation of the farmers. According to the "Nanjing Municipal Economic Commission" still most people are unsatisfied with the handling of the relocations. Despite the advantage of moving to the city and receiving a city "hukou" (which means the permission to live in a city) a life in the city doesn't necessarily attract everybody. Especially older people have difficulties to adjust to the life in a city after having spent their whole life on the countryside. A change of the mindset of the farmers still living within the boundaries of the park is only slowly possible.

In order to create new and non-farming job possibilities the local government tries to attract more labour intensive industries like textile factories. The pressure to relocate and to change the job sector can also be seen as a positive push to the direction of work in more promising industries.

In general the compensation for relocation is paid by the local government. People living on a future site are compensated by the money the government receives by land leasing fees. People living next to a site must be compensated by the government directly although the budget for compensation from the government is very limited. Additionally the newer the houses of the farmers are the higher is the compensation which leads to a clearly visible "boom" of building new houses next to the fields. According to the "Luhe Municipal Planning Commission" the relocation topic got "a little bit out of control" since some farmers even had to be relocated twice: once because of the construction of the highway and a second time because of the construction of a petrochemical plant. Within the "Nanjing Chemical Industrial Park" not all of the land will be used for new plants but a big area of fields will be replaced by grassland and forests.

All in all BYC has a very strong impact in socio-economic terms on Luhe district and Nanjing city, its population and the employees working at the joint venture. Although the direct impact to the local labour market might be small, the effects in knowledge transfer concerning safety and health standards are very strong. This concerns not only BYC itself but furthermore to a significant extend also the 3<sup>rd</sup> party service providers. Herein lays a major contribution of BYC to the region.

Table 14: The three major socio-economic impacts of BYC

During Construction	During Production
Implementation of safety regulations	Implementation of safety regulations for production and transportation
Relocation and compensation of farmers	Guaranteeing job security
Expenses by workers in Luhe and Nanjing	Sponsorship in Luhe and Nanjing

**4.3 Environmental impacts**

Since the BYC joint venture project is a petrochemical plant a lot of attention is paid to possible environmental impacts by the site. In general the environmental standards in China for new companies are considered to be very strict. BYC not only completed several “Environmental Impact Assessments” during the application phase for the project but also introduced the worldwide BASF monitoring standard Responsible Care<sup>®</sup> starting with the production phase. Using a multilevel monitoring system consisting of BYC own monitoring, monitoring by third parties as well as monitoring by the local “Environmental Protection Agency” a production at very high environmental protection standards can be assured. Since BYC is a 50:50 joint-venture only half of all emissions are taken into account for Responsible Care<sup>®</sup>.

*ENVIRONMENTAL IMPACT ASSESSMENT:* At the beginning of the project BYC conducted a mandatory “Environmental Impact Assessment”. Because of changes during the planning phase additional “Environmental Impact Assessments” had been necessary. Due to the size of the investment volume the “National Environmental Protection Agency” instead of the Nanjing branch was responsible for the acceptance of the “Environmental Impact Assessment”. Today the plant so far complies with the “Environmental Impact Assessments”. BYC is not certified according to the ISO

14,000 standard although the management system is considered as the same with the ISO standard.

*WASTE WATER:* A major concern not only of the “Nanjing Environmental Protection Agency” but also of BYC is the risk of pollution of the “mother river” Yangzi by waste water from the petrochemical plants in the “Nanjing Chemical Industrial Park”. All waste water by BYC is treated by the waste water treatment plant of the joint venture partner YPC. Therefore YPC has the final responsibility for the quality of the waste water which goes back to the Yangzi river. The standards for return of waste water are supposed to be higher than in Europe. BYC has no insight into the waste water treatment plant of YPC, but it is supposed to be very advanced and even one of the best in China. However BYC demands regularly waste water analyses from YPC but only gets irregular ones. In order to control the quality of the waste water from BYC, YPC monitors the waste water at the entrance point to its treatment plant.

The waste water flow between BYC and YPC however is not monitored by the “Nanjing Environmental Protection Agency”. It only controls the waste water which is returned to the Yangzi sidearm. There is continuous online monitoring available and detailed COD controls are conducted four times a year as well as randomly in-between. If standards are surpassed a report is filed to BYC. If the water quality continues to be bad for a longer time (2-3 days) a supervision team visits the site. According to the “Nanjing Environmental Protection Agency” this procedure is only very seldom implemented. YPC for example is now monitored for 10 years and 98.8% of its waste water was below the necessary level. Concerning the BYC waste water there was no excess of the limits during the commissioning phase. All in all it can be said that so far the impact of BYC to the Yangzi river seems to comply with the limits set for the IPS. However it is difficult to measure BYCs contribution to the waste water which is finally returned to the Yangzi river since all waste water is treated by YPC’s plant.

*AIR EMISSIONS:* Among the substances measured and controlled by BYC on a regular basis are NH<sub>3</sub>, SO<sub>x</sub>, NO<sub>x</sub> as well as CO. Concerning CO<sub>2</sub> there is no limit for emissions but a mandatory audit according to the “Clean Production Promotion Law”. Government institutions evaluate all plants according to CO<sub>2</sub> emissions although there is no clear limit. According to BYC the control is carried out more from the input side. BYC established an air monitoring spot within the BYC site at the edge to the neighbours which is accredited by “Nanjing Environmental Protection Agency”. All data are also sent to the “Nanjing Environmental Protection Agency”.

A special example for the reduction of CO<sub>2</sub> is the use of a gas power plant instead of a coal based power plant. Although the gas power plant also produces CO<sub>2</sub>



emissions those are much lower than any applicable standard. As a result the current power plant emissions reach only 5% of the World Bank limit. Generally it is a demand by the lenders that World Bank standards have to be followed. If a Chinese standard is higher than the World Bank standard then the Chinese standard is chosen as the benchmark.

*RESIDUALS:* Most other residuals are treated by registered 3<sup>rd</sup> party service providers. However BYC operates a liquid waste incinerator with steam recuperation, smaller incinerators for gases in CLTF and a thermal oxidizer for waste gases from LDPE. For example the heavy residuals of the AA/AE plant are either burnt or sold to a local purchaser. The light residuals however are burnt while the heat is recovered and used for high pressure steam which again is used on the site. Toxic waste is also bought by a 3<sup>rd</sup> party and buried in the ground. For solid waste incineration a contract with the “Jiangsu Fuchang Chemical Waste Treatment Company Ltd.” was signed.

BYC is always trying to select service providers which implement up-to-date standards in terms of safety and environmental protection although it is still difficult to find service providers with high standards implemented. If a local purchaser doesn't have fully compliant standards yet, BASF sells the waste for less than the market price so that the local company can invest in building up the standards. By this BYC not only raises the awareness for safety and environment but also helps to improve the technology at the service providers' side. BYC also offers trainings for 3<sup>rd</sup> parties and audits the quality of the services. All these measures already created several positive results with the service providers like for example new trucks at a transportation company or a new furnace at a waste treatment plant. Additionally some solid waste subcontractor expanded his capacities because of BYC.

**Box: The Second IPS Environmental Dialogue**

BASF-YPC Company Limited hosted "IPS Second Environmental Dialogue" among BASF-YPC Company Limited, the local authorities and representatives of residents from Luhe Districts on June 18, 2004 in Yangtze Guest House. Dr. Blumenberg, president of the company, introduced the company's values and Sustainable Development strategy. IPS project is designed and constructed according to the strict standards and requirements of the National and International codes in order to achieve the further development and profits and minimize environmental impact at the same time. Therefore, IPS project adopts clean production process and advanced equipments to control and reduce pollutants.

Mr. Shao Xuehua, Director of EHS/Utilities Department, introduced environmental protection measures of the company. Meanwhile, the company has set up a

comprehensive environment protection organization and management system, performing effective self-management and supervision.

The atmosphere of the open meeting was cordial, and the representatives expressed their opinions frankly. They highly praised and advocated the company's communication with the authorities and local residents through open dialogue, the company gives the public the rights of knowing and participating and wins the public trusts at the same time.

Finally, Dr. Blumenberg declared to hold regularly open-communication to report our activities, achievements of safety and environmental performance to eliminate misunderstanding and appreciate public input or comment, which could contribute to the continuous improvement of environmental protection performance of the company. The company expects to strengthen the cooperation with all relevant parties to ensure company's "Sustainable Development".

*Source: BYC*

*NOISE:* One major problem concerning environmental protection during the commissioning phase is the noise created by a flare on the site of BYC. The flare exceeds the noise limits especially during the evening time. Although the noise is only created during the commissioning phase farmers living next to the site hold regular protests in front of the gate. BYC already held several community dialogues also in order to communicate the reason and "time frame" for the noise. Still, farmers demand compensation for the noise pollution created.

*TRANSPORT:* The "Nanjing Environmental Protection Agency" has generally to agree on transport of heavy residuals from the site. The importance and success of the implementation of BYC's safety and environmental protection standards also with the transport companies already proofed to be reasonable at a truck accident where no hazardous chemicals spilled out of the tank. As already mentioned BYC also instructs the transportation companies to take detours if the roads are too dangerous in order to protect the safety of the trucks and the environment.

*ENVIRONMENTAL MONITORING:* In order to monitor the environmental protection standards "Nanjing Environmental Protection Agency" set up its own monitoring stations within and around the "Nanjing Chemical Industrial Park". Waste water is constantly monitored by these stations but there in no constant monitoring of air. However YPC monitors air quality on the basis of a service contract. BYC in general follows the national standards. The BYC plant is designed to reach only 80% of the

allowed limits of 100% while in general Chinese companies are designed to reach 90% of the allowed limits on average.

The “Nanjing Environmental Protection Agency” is working closely together with BYC in order to assure the compliance of the plant with the national and international standards. Every year the emission plan from the past year is discussed with the “Nanjing Environmental Protection Agency” and a new plan is negotiated. During the commissioning phase the limits are broader than they will be during the production phase. BYC sends a monthly as well as a yearly report about all emissions by the waste water pre-treatment facilities, boiler and furnace, process waste gas, flare to the “Nanjing Environmental Protection Agency”.

More than 100 EPA employees work at the monitoring stations of the “Nanjing Environmental Protection Agency”. The municipal environmental monitoring center is under Nanjing EPA, the district level environmental monitoring center is under the “Luhe Environmental Protection Agency” and there is daily monitoring on the enterprise level. Within the chemical park there is a branch of the municipal environmental monitoring center established with four employees. According to the “Nanjing Environmental Protection Agency” it doesn’t have any knowledge about BYC internal monitoring methodologies like Responsible Care<sup>®</sup>.

According to BYC it invests much more in safety conditions than legal requirements demand; for environmental protection BYC keeps up with environmental standards (see the examples given in this report). The compliance of the plant with BYC internal standards is audited by both Sinopec and BASF. BASF also audits the plant according to its Responsible Care<sup>®</sup> methodology.

Through an efficient and environmentally friendly production BYC has in general a relatively small impact on the local environment compared to the size and the output of the whole IPS. According to the “Nanjing Environmental Protection Agency” BYC had a positive impact in terms of setting high standards for EHS already during the bidding phase which can be used as a “best practice” for the whole industry. The investment in environmental protection also benefits the whole local community. Although there was a lot of traffic and production of dirt involved in the construction phase “Nanjing Environmental Protection Agency” emphasized that BYC takes all possible environmental effects very seriously. However “Nanjing Environmental Protection Agency” pointed out that this has to be one of the major tasks since the Yangzi river is very close and a lot of small Chinese companies have problems with environmental protection which leads to the general fears among the population.

The overall conclusion from the local “Environmental Protection Agency” sees the future discharges within the national and provincial levels. According to the Agency BYC can be considered as a model for other enterprises at the environmental management system level. BYC definitely increases emissions in the region, but it also has a very good sense for environmental protection. For example monitoring of soil is not very strongly requested by the government, but BYC already made detailed investigations. All in all the “Nanjing Environmental Protection Agency” appreciates the attitude and immediate action by BYC if there is a problem.

Table 15: The three major environmental impacts of BYC

<b>During Construction &amp; Commissioning</b>	<b>During Production</b>
Dirt and noise directly related to the construction site	Implementation of environmental standards also for third parties
Noise of the flare during commissioning	Creation of additional waste, but relatively low compared to the production volumes
Interference of the eco-system at the site	Power plant uses gas instead of coal which reduces emissions

**4.4 Impressions collected during interviews with residents in Luhe District**

One objective of the project was to determine the impact of the recently constructed BYC plant on the lives of local residents in the context of a sustainability assessment of the plant. The economic aspect in particular was stressed, and local businesspeople were selected to discuss the impact of the plant on both their business and their living conditions.

For the interviews three areas were considered as candidates. The first, located inside the NCIP, is a village district known as Luchang. The second, located about 20 km northeast of NCIP, is the city of Luhe. The third, located about 10 km south of the entrance of NCIP, is the town of Dachang, where most YPC workers are housed.

Both large and small enterprises were targeted, with annual incomes ranging from five thousand RMB to thirty million RMB. Nine interviews were conducted in total, including two female respondents and seven male respondents.

**Box: Quotes by interviewed residents at Luhe district**

“The chemical industry is an efficient, high profit industry, and provides many opportunities for employment...With the construction of the BYC plant, local transportation infrastructure has improved significantly.”

*-Jiafu Chen, Changlu, owner, automotive repair and truck rental*

“Living here is like slow suicide.”

*-Ling Zhou, Changlu, taxi driver*

“The most important aspect for us is stability. When incomes are stable, customers are more willing to buy. The BYC plant provides stability for local workers. We expect this positive influence will continue in the future.”

*-Jiang Li, Dachang, manager, home appliance store*

*Changlu (长芦):* Responses varied widely according to district. Obviously, the largest impact was felt in Changlu, which is less than two kilometers away from the plant itself. Economic impacts could largely be attributed to six sources: compensation paid to local residents for land use; hiring during the construction phase; improved traffic and transportation infrastructure; long term hiring of labour at the plant; inflow of nonlocals during the construction phase; and outflow of locals after construction. Aside from the last point, all events yielded positive impacts on the local economy in terms of overall income levels. On the other hand, many of these impacts are temporary, making the long-term economic prospects of the community look dim. Many residents are leaving the community, or wish to leave the community, because of the poor environmental conditions evident in the constant noise and the acrid air that are a constant presence in the area.

Locals complained that the ground often vibrated and the constant noise kept them awake at night. They can no longer eat fish from the local rivers or use the local water. Many also complained of lung or health problems. There was no local school, and no possibility to construct a local school because of the proximity of the plant. It is unclear whether these problems are all a direct result of the BYC plant, or whether the larger problems of being located in the Chemical Industrial Park were merely exacerbated by the construction of the plant. Regardless, the future of the community does not look bright.

*Luhe (六合)*: The economic impact of the plant in the city of Luhe appeared to be negligible. Although the NCIP is less than 30 km away from the city, most workers in the plant live in Dachang. Workers tend to shop in either Dachang or Nanjing, rather than Luhe city. Major employers in Luhe are the companies in the economic development zone, which include toy factories, food processing factories and other light industry.

The city streets and buildings appeared worn and unkept. In spite of the city's somewhat bedraggled appearance, though, the economy in Luhe appeared to be fairly healthy. The interviewees noted increased competition and had recently increased the number of employees in their stores. A new "green" hotel had been built in the city, and a luxury housing development was under construction.

Two large stores were interviewed in Luhe. While both were aware of the BYC venture, both entrepreneurs claimed that the impacts of the plant on Luhe were more environmental than economic. They attributed their current business success to the overall improvement in the national economy rather than any specific local effects.

*Dachang (大厂)*: Economic impacts were more evident in Dachang, the city housing most of the YPC and BYC employees. Dachang, in spite of its small size, seemed to be a fairly prosperous, bustling town. The town was cleaner and wealthier than Luhe city, with tree-lined streets and a busy pedestrian square boasting its own McDonald's and KFC. A large and a small business were interviewed in the main commercial centre. Business seems to have benefited from the overall economic security provided by the BYC plant. Here, too, however, economic benefits were counterbalanced by negative environmental effects. Relatively high, stable incomes have promoted general consumption and income growth in the town. On the other hand, all respondents complained of poor air quality and water pollution in the area.

The overall impressions given by the residents in Luhe district can be summarized as follows:

- The environmental impact of the plant on local residents is currently unequivocally harmful.
- These impacts may be masked by the overall influence of the Chemical Industrial Park.
- There has been a positive impact on local transportation infrastructure.
- There has been a positive impact on the level and stability of local income.

- The economies in Luhe and Dachang seem healthy, with good business prospects and increasing numbers of competitors/ entrepreneurs in the past few years.
- The future of the Changlu community does not look bright, with many locals leaving or wishing to leave because of environmental degradation.

## 5 Application of the “Sustainability Triangle” for BYC

### 5.1 Indicators identified for future research

An important goal of the discussions with the representatives of BASF as well as the government institutions in Nanjing was the identification of clear indicators in order to be able to measure the sustainability of the IPS in Nanjing. In the following some selected indicators from economics, environment and social economics, which can be consulted as a basis for future investigations during the production phase, are presented. It is recommended to gather the values of all indicators at the beginning of the production phase and to accomplish an appropriate investigation regularly, in order to be able to seize possibly measures for the control of the sustainability strategy.

The selected indicators correspond for the most part to international standards, e.g. the Global Reporting Initiative (GRI). Each of the indicators fulfils the following conditions:

- It is quantitatively measurable
- Data for the calculation of the indicator are present either at BASF or at the local authorities
- The indicator is useful for investigations over time

According to these requirements the following list with altogether 37 indicators was compiled to measure the degree of sustainability of an IPS:

Table 16: List of indicators relevant for BYC

1	Sales volume	19	Air emissions <sup>3)</sup>
2	Export quota	20	Waste water <sup>4)</sup>
3	Procurement quota domestic	21	Amount of waste
4	Wages	22	Unscheduled release of chemicals
5	Bonuses	23	Transport safety <sup>5)</sup>

6	Share of profit distribution domestic	24	Penalties for failure to comply with legal regulations
7	Taxes	25	Employment of school-/ university-graduates
8	Customs	26	Accidents at work
9	Subsidies	27	Work related diseases
10	Donations	28	Health programme (HIV, Hepatitis) <sup>6)</sup>
11	Number of employees	29	Employment of disabled
12	Labour productivity <sup>1)</sup>	30	Complaints by neighbours
13	Material consumption	31	Sick days
14	Expenditures for Social Security	32	Number of training hours per employee
15	Share of Recycling	33	Share of women in leading positions
16	Primary energy	34	Payments for political institutions
17	Preliminary energy consumption	35	Infrastructure payments
18	Water consumption <sup>2)</sup>	36	Transport of employees to the work place <sup>7)</sup>

<sup>1)</sup> Output/employee

<sup>2)</sup> Usage + cooling

<sup>3)</sup> CO<sub>2</sub>, SO<sub>x</sub>, NO<sub>x</sub>, CO, NH<sub>3</sub>, VOC

<sup>4)</sup> Measured at the entrance to the purification plant

<sup>5)</sup> Number of accidents

<sup>6)</sup> in RMB

<sup>7)</sup> Number or Percentage

The indicators take all three columns of the sustainable development concepts into account. For some indicators data are already available from other methodologies which are already used at BASF in order to measure the sustainability of projects. Among these are in particular the Responsible Care Program as well as the Eco-Efficiency Analysis. All data necessary for the Responsible Care data base are also collected and passed on by BYC in Nanjing. Further data are available from the accounting department and/or by selective interviews with the management. Another indicator which can be used but is difficult to measure measures the establishment of new enterprises because of BYC in Nanjing. Most new enterprises also profit from other chemical companies in the NCIP.



In order to be able to conduct a first assessment of the state of sustainability conditions at the IPS, the methodology of the "Integrative Sustainability Triangle" can be applied. Using this methodology also defining necessary actions for a balanced sustainability strategy can be derived in later steps.

## **5.2 The concept of the “Integrative Sustainability Triangle”**

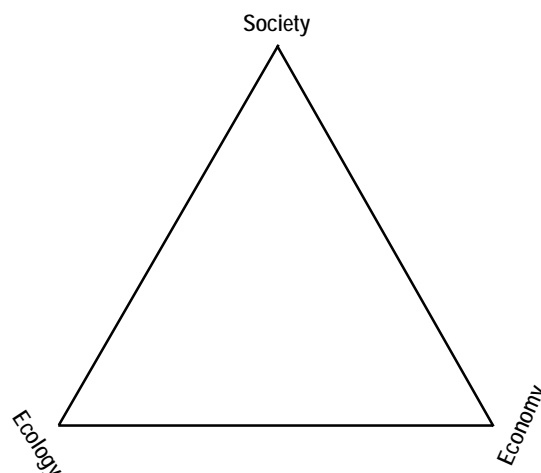
The "Integrative Sustainability-Triangle" helps to systematize issues and indicators related to the three pillars of Sustainable Development.

Sections inside the triangle combine two aims:

- First, to set a distinct focus on one or more pillars of Sustainable Development.
- Second, to take the integrative character of the discussion into account.

This approach may be used for all discussions on Sustainable Development, especially for the development of a Sustainability Strategy.

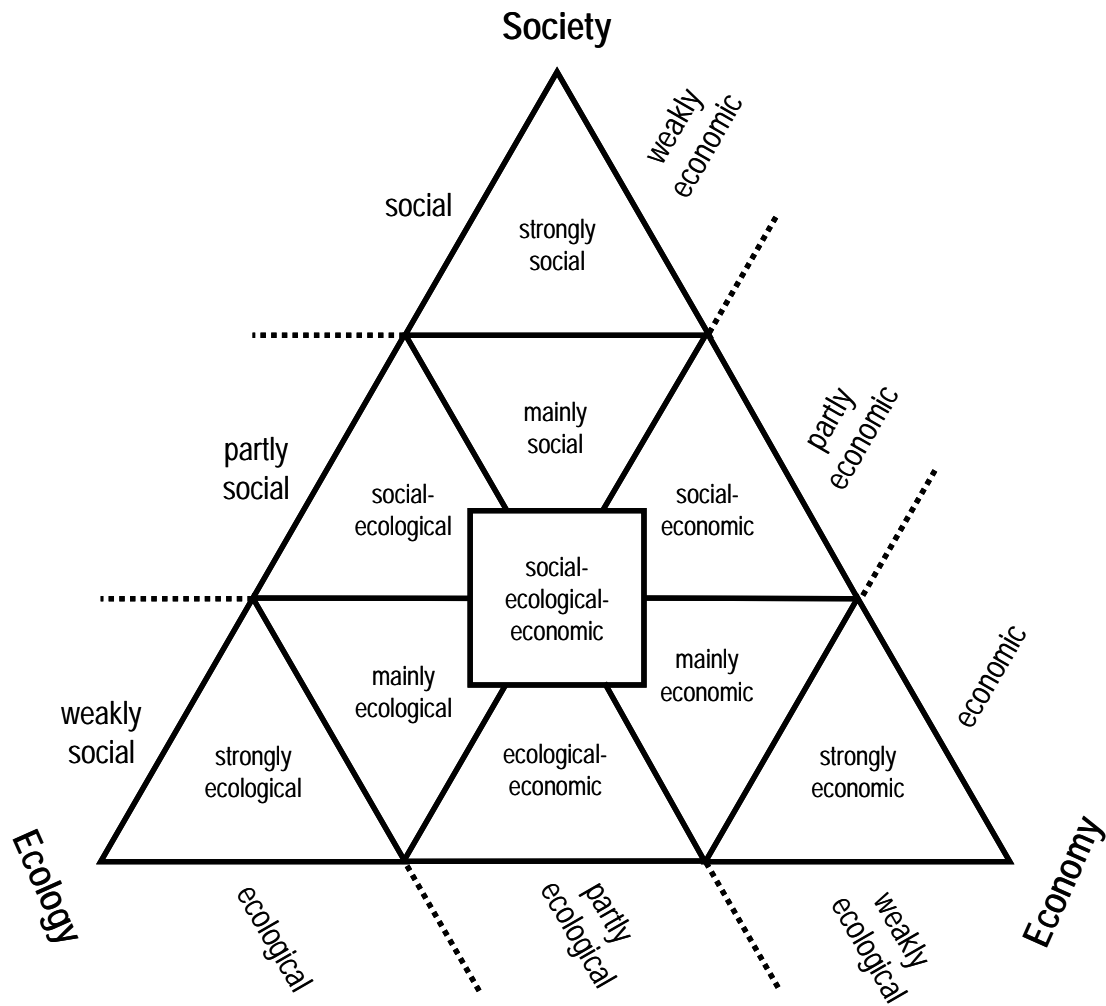
Figure 3: The basic concept of the "Integrative Sustainability Triangle"



*Source: Prof. Michael Hauff and Alexandro Kleine, University of Kaiserslautern 2005*

Using the "Integrative Sustainability Triangle" the three columns of the sustainability are placed in relationship to each other. Since all three fields of the sustainable development are evenly weighted. Within this context effectiveness and efficiency of measures in the reference to their sustainability can be illustrated. Thereby effectiveness applies to the individual areas of economics, environment and socio economics. Efficiency applies to economic relevant mixed areas, where effects of one action on two columns of the sustainability concept can be described. The following illustration shows all allocations possibilities for the selected indicators.

Figure 4: The “Integrative Sustainability-Triangle” and its fields



Source Prof. Michael Hauff and Alexandro Kleine, University of Kaiserslautern 2005

Thus it is possible to carry out a differentiated allocation of the selected indicators. This differentiated allocation is meaningful, since a sustainable development is in the end not only multidimensional but also multi-causal. Between the different aspects complex relations exist which can be of harmonious, neutral or conflict-filled nature. The dissolution of conflicting aims is facilitated by this differentiating perception. In the end all selected indicators can be assigned to one of the fields in the differentiated "Integrative Sustainability Triangle".

### **5.3 First assessment for BYC**

The idea if the "Integrative Sustainability Triangle" was up to now only used on the national level. The following chapter will reflect ideas to use this concept on firm level.

The preceding two sections provided a conception of the identified indicator set for BYC as well as an introduction to the methodology of the "Integrative Sustainability

Triangle". On this basis an allocation of the selected indicators into the individual fields of the "Integrative Sustainability Triangle" can now be made. The allocation is done partially according to subjective criteria. In order to ensure continuity with the investigation the indicators should be further specified at the beginning of a possible long-term observation and afterwards not be changed.

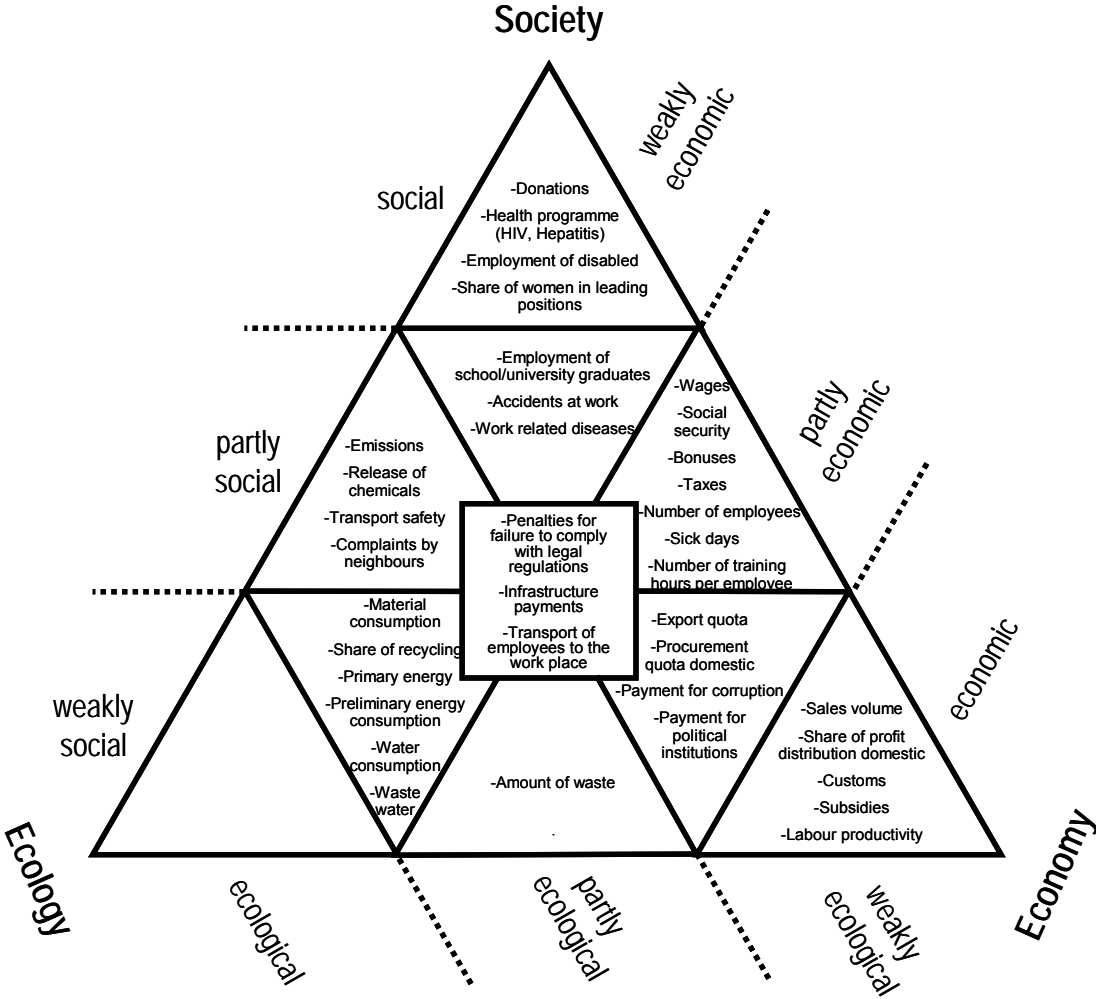
Table 17: Assignment of BYC indicators to the "Integrative Sustainability-Triangle"

<b>Category</b>	<b>Indicator</b>
Strongly social	<ul style="list-style-type: none"> <li>- Donations</li> <li>- Health programme (HIV, Hepatitis)</li> <li>- Employment of disabled</li> <li>- Share of women in leading positions</li> </ul>
Mainly social	<ul style="list-style-type: none"> <li>- Employment of school/university graduates</li> <li>- Accidents at work</li> <li>- Work related diseases</li> </ul>
Social-economic	<ul style="list-style-type: none"> <li>- Wages</li> <li>- Expenses for social security</li> <li>- Bonuses</li> <li>- Taxes</li> <li>- Number of employees</li> <li>- Sick days</li> <li>- Number of training hours per employee</li> </ul>

Mainly economic	<ul style="list-style-type: none"> <li>- Export quota</li> <li>- Procurement quota domestic</li> <li>- Payment for political institutions</li> </ul>
Strongly economic	<ul style="list-style-type: none"> <li>- Sales volume</li> <li>- Share of profit distribution domestic</li> <li>- Customs</li> <li>- Subsidies</li> <li>- Labour productivity</li> </ul>
Ecological-economic	<ul style="list-style-type: none"> <li>- Amount of waste</li> </ul>
Mainly ecological	<ul style="list-style-type: none"> <li>- Material consumption</li> <li>- Share of recycling</li> <li>- Primary energy</li> <li>- Preliminary energy consumption</li> <li>- Water consumption</li> <li>- Waste water</li> </ul>
Strongly ecological	-
Social-ecological	<ul style="list-style-type: none"> <li>- Emissions</li> <li>- Release of chemicals</li> <li>- Transport safety</li> <li>- Complaints by neighbours</li> </ul>
Social-ecological-economic	<ul style="list-style-type: none"> <li>- Penalties for failure to comply with legal regulations</li> <li>- Infrastructure payments</li> <li>- Transport of employees to the work place</li> </ul>

For the field "strongly ecological" in the context of the analysis no indicators were identified. Here it would concern indicators, which concern the Flora and fauna directly and to those no data are present. An occupation of this field with an indicator is not necessary also, since from the other fields measures for a sustainable can be already derived strategy. The following illustration shows the allocation of the selected 28 indicators to the individual fields of the "Integrative Sustainability Triangle".

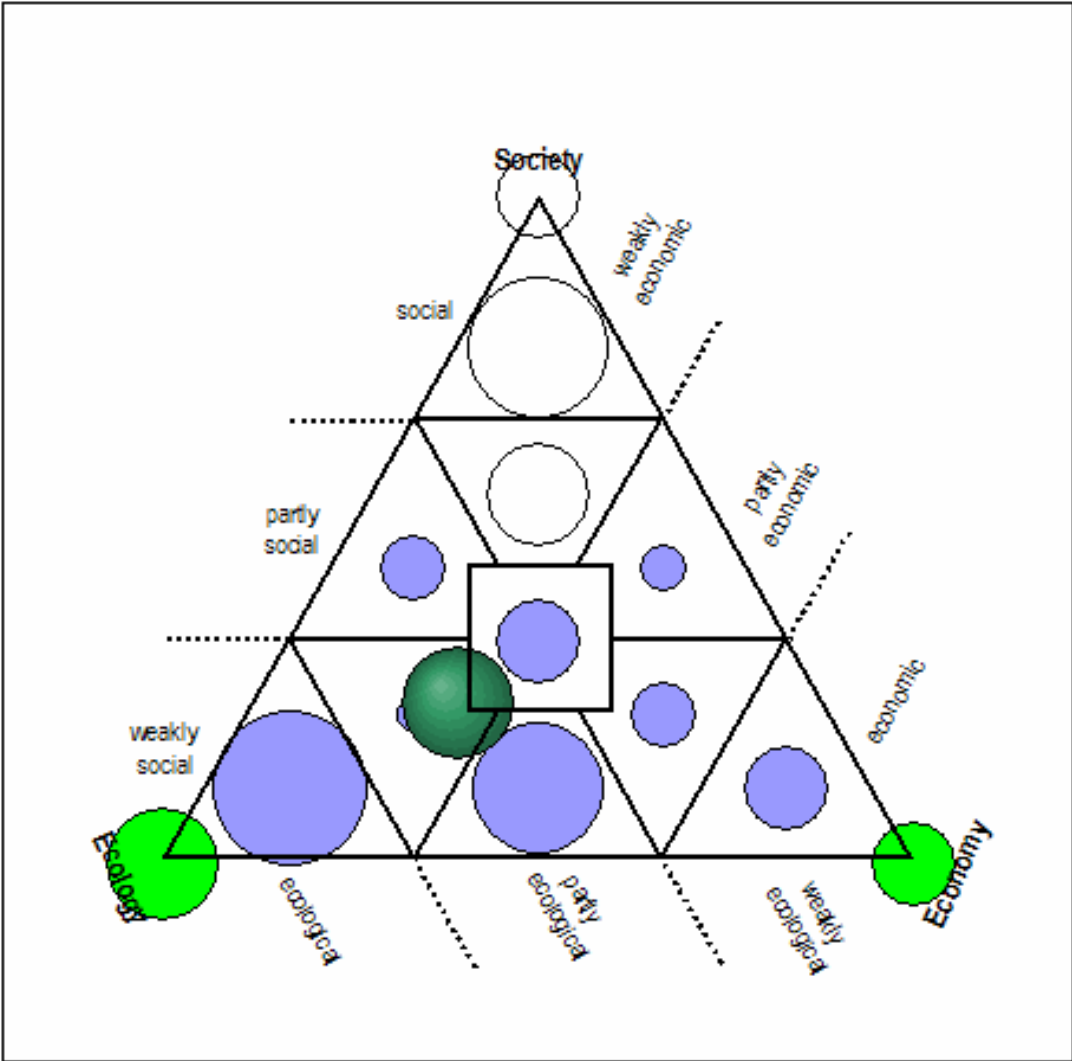
Figure 5: Assignment of BYC indicators to the “Integrative Sustainability-Triangle”



Source: Kleine, Kurz, Schmidkonz based on Hauff, Kleine 2005

Based on this classification an evaluation of the indicators is now possible, as soon as first data from the production phase are available. The quality of the sustainable strategy represented by each indicator can be illustrated simply in each individual field. The size and the color of the bubbles give information about the size and impact of each indicator individually. The following illustration gives an example of an “Integrative Sustainability Triangle” including some example-bubbles. Note that this example has no connection with the indicators determined above and serves only for visualisation.

Figure 6: Example of an “Integrative Sustainability-Triangle” with indicator bubbles



Source: Kleine, Kurz, Schmidkonz based on Hauff, Kleine 2005

As it was shown, the "Integrative Sustainability Triangle" can be consulted as basis for the development of a balanced sustainability strategy. The implementation of the tools requires however first a fundamental agreement of all groups involved at BASF. BASF is here in the optimal starting position, since first a number of the necessary data are already collected in the context of other sustainable development initiatives and second the IPS in Nanjing just started, so that a basis collection of the data is possible. This is the optimal beginning for a long-term investigation of BASF’s impact on the region and society around its new site.

## 6 Conclusion

The IPS established by BASF in Nanjing affects the Chinese chemistry landscape to a significant degree. The output volumes are that large that within certain ranges the market prices in China can easily be affected. With an enterprise in this industry and of such a dimension it is of central importance that the influence of the environment and the social surrounding is observed and analyzed in a detailed way. In this regard it is useful to apply the "sustainable development" methodology to investigate the new site. For the evaluation of the environmental -, socio-economic and economic effects on the neighbourhood it is essential to identify indicators, which, periodically measured, can give evidences of an increasing or decreasing level of "sustainability".

In the context of this project interviews with the management of the IPS in Luhe district as well as representatives of different governmental institutions in Nanjing and Luhe had been conducted. The economic and socio-economic effects of the plant were judged as particularly positive by the latter. In most cases however they still expressed their expectations, which still have to be confirmed by the IPS during its production stage. In addition, the environmental office of the city of Nanjing expressed its doubts and concerns over the possible negative environmental influences of the site. This topic is already taken very seriously within BYC. For example in the context of the Responsible Care® initiative a set of data under the topic of EHS is collected and is thus available for further analyses.

Altogether it can be stated that in the building phase BYC produced in particular short term economic effects and long-term socio-economic effects. The largest volume of these effects affected the directly surrounding community of the construction site or in addition, in the reference to the migrant workers, also other regions in China. Concerning socio-economic effects in particular the topic of security on the building site was emphasized. The accomplished safety precautions were successful to the highest degree - however it cannot be tracked in what respect construction workers obeyed the safety precautions only on the BASF building site or also maintain them after this particular project on other construction sites.

Far more important effects of both economic, socio-economic as well as ecological nature will however emerge during the production phase of the project which is starting from now on. Here the ecological aspects surely are of special relevance. The reputation of the industry combined with the experiences of the neighbouring resident require strict monitoring, analyzing and reaction to changing environmental indicators as well as open communication to the public. Regular community talks can

help to inform the population about the intensity of the environmental effects. After all, the concerns and fears of the population here are large.

In this connection the aspect of safety on the site and during transport is of great importance. Here BASF is probably unparalleled in China. BASF has also large positive impacts on third party contractors of all kind, which are forced to implement BASF standards since they would otherwise lose the contract with BASF. Here BASF takes a pioneer role in the Chinese chemical industry in terms of safety, whose value cannot become highly enough prized. The importance of the safety topic for BASF must therefore in detail be communicated to the public, also in order to give the population the appropriate safety feeling.

The direct economic and especially socio-economic effects, which are of a monetary kind, are estimated as rather small. For example essentially no new jobs are created, but most employees are former employees of YPC. In what respect BYC will directly contribute to an increase of the prosperity in the region is also doubtful. However the indirect economic and socio-economic effects by for example the settlement of new enterprises, which BYC co-operate with, will be of a much larger extend.

Last but not least BASF realises positive effects for the local community in Luhe, Nanjing and Jiangsu by its donation activities. BASF invests in particular in education and training of children and young people. In addition, some cultural events are sponsored by BASF. Combined with community talks, with open communication and information between BYC and the population as well as a strict adherence to environmental guidelines BASF can achieve an absolutely positive contribution also to the overall acceptance of chemical enterprises in China.

All in all it can be stated that BYC takes the topic of "sustainable development" very seriously and has already set up a detailed monitoring system in a broad range of fields. The beginning of the production phase is an optimal time to identify an indicator set for long-term measurement, which can be used as a basis for recommendations for the development of a final sustainability strategy for BASF. An implementation of this vision would mean a further important step for the pioneering work of BASF in China.



## **Appendix:**

### ***List of further documents available at BYC:***

1. Soil and groundwater Investigation (final report)
2. Feasibility Study Report on third party Utility Center Project
3. Rescoping of Utility Center Project
4. Master Plan, Logistics, Utilities and Auxiliary Systems, Process plants individual plant, e.g. AA/AE, DMF, OXO, etc.
5. Feasibility Study Report of railways
6. Feasibility Study Report of Waste Water Treatment Plant

## ***Selection of relevant Worldbank and PRC guidelines***

<b>Worldbank guidelines</b>	
Environmental guidelines	<p>Environmental Assessment, Safeguard Policy OP 4.01, IFC, October 1998</p> <p>Environmental Assessment Process (Pollution Prevention and Abatement Handbook, World Bank Group, July 1998)</p> <p>Natural Habitats, Safeguard Policy OP 4.04, IFC, June 2001</p> <p>Water Resources Management OP 4.07, World Bank, February 2000</p>
Social guidelines	<p>Peoples, Safeguard Policy OD 4.20, IFC, September 1991</p> <p>Child and Forced Labour, Safeguard Policy IFC Policy Statement, March 1998</p> <p>Cultural Property, Safeguard Policy OPN 11.03, September 1986</p> <p>Involuntary Resettlement, Safeguard Policy OD 4.30, IFC, June 1990</p> <p>Poverty Reduction Operational Directive, World Bank 1991 (updated 1993)</p>
Guidelines for the petrochemical industry	World Bank Guidelines for Petrochemical Plant (1998)
EHS guidelines	Environmental, Health and Safety Guidelines for Port and Harbor Facilities, International Finance Corporation (IFC), 1998

**Selection of additional environmental guidelines of the People's Republic of China**

PRC Environmental Protection Law (Dec. 26 1989)

PRC Construction Law (March 1 1996)

PRC Marine Environmental Protection Law (April 1 2000)

PRC Land Management Law (Jan. 1 1999)

Code on The Environmental Protection Management of Project Development (Nov.29 1998)

The Notice on Publishing The Environmental Protection Classification List for Projects (April 19 1999)

Management Procedure for The Environmental Protection of Construction Projects (June 1990)

Design Specification on Environmental Protection of Construction Projects (March 20 1987)

PRC Code on Nature Reserve (Dec.1 1994)

The Notice on Environmental Management for Exploration and Construction Project Involved in Nature Reserve (Aug.3 1999)

Management for the Environmental Functional Zoning of Nearshore Areas (Dec 10, 1999)

PRC Management Code on The Continental Pollutants Polluting and Damaging Marine Environment (Aug.1, 1990)

## ***Notes from the interviews with residents in Luhe district***

### **Questionnaire Response 1: Jiashan Zhen, Changlu**

1. **Name:** Jiashan Zhen
2. **Age:** 31-40
3. **Sex:** M
4. **Name of business:** Jiangsu Huacheng Chaoshi
5. **Type of business:** Grocery store (one of 3 that he owns in the area)
6. **Place:** Changlu
7. **Distance from BYC:** Less than 2 kilometers
8. **Number of employees:** 52
9. **Recently, the number of employees:** has fluctuated according to business and availability of labour
10. **Income:** RMB 20 million/ year for all three stores
11. **Year of establishment:** 2000
12. **Reason for establishment:** Profit
13. **Heard of BYC:** Yes
14. **Recently, number of clients:** Basically unchanged, now fewer local customers, and more customers from outside the area
15. **Clients are:** Somewhat regular
16. **If clients are regular, they visit:** Weekly
17. **In the last 3 years, revenue has:** Increased
18. **The number of competitors has:** Increased
19. **Business directly related to chemical park:** No
20. **BYC impact on business:** When construction on the plant was going on, business was good. Now that construction is complete and operations are steadier, there are fewer customers. It is also more difficult to hire workers in the area.
21. **BYC impact on business will:** Now that construction is complete, he expects that his income will drop off. He plans on cutting back the scale of his operations (he currently runs three stores). The influence of the plant is fairly large in his decision making process.
22. **The future of the business:** See above.
23. **BYC impact on personal life:** Not very large. He says that the environmental impact on his workers is probably large, because they live and work near the plant. His own income is high enough to allow him to live outside the industrial park.
24. **BYC impact on personal life will:** See above.

Jiashan Zhen owns three medium-sized grocery stores in the area. The plant played a large role in his decisions to expand the business. Now that the construction phase of the plant is over, though, he plans to cut back his operations. He now has fewer customers and finds it difficult to hire labour in the area. Many locals have left the area, for both economic and environmental reasons. If hired by BYC, workers generally live in Dachang, the nearby town housing most YPC workers.

## Questionnaire Response 2: Jiafu Chen, Changlu

1. **Name:** Jiafu Chen
2. **Age:** 31-40
3. **Sex:** M
4. **Name of business:** None
5. **Type of business:** Automotive repair and truck service rental
6. **Place:** Changlu
7. **Distance from BYC:** Less than 2 kilometers
8. **Number of employees:** 2
9. **Recently, the number of employees:** unchanged
10. **Income:** Undisclosed
11. **Year of establishment:** 2002
12. **Reason for establishment:** To support the development of local transportation
13. **Heard of BYC:** Yes
14. **Recently, number of clients:** Increasing
15. **Clients are:** Somewhat regular, largely BASF-BYC
16. **If clients are regular, they visit:** At the beginning of construction, almost daily, now that construction is complete, only about once a week
17. **In the last 3 years, revenue has:** Slowly increased
18. **The number of competitors has:** Increased
19. **Business directly related to chemical park:** Yes
20. **BYC impact on business:** Increased clients, income
21. **BYC impact on business will:** Be about the same
22. **The future of the business:** Optimistic- "The chemical industry is an efficient, high profit industry, and provides many opportunities for employment."
23. **BYC impact on personal life:** The environmental impacts have been serious- air pollution and noise being the primary culprits. However, the plant has provided improved transport in the area and new work opportunities.
24. **BYC impact on personal life will:** Remain much the same.

Jiafu Chen operates a very small scale repair shop just outside the plant in Changlu. He also hired trucks to BYC for moving earth or heavy loads during construction. He was very hesitant about talking to us, and I think he was still under the impression that we were working for BYC in spite of our assurances. This may account for some of the positive, almost formulaic responses about the benefits of the chemical industry. He did seem to feel sincerely about the benefits of the plant on transport and traffic in the area. He felt that the greatest beneficiary of the plant was the local government, and that they should be doing more about environmental protection.

### Questionnaire Response 3: Jun Li, Changlu

1. **Name:** Jun Li
2. **Age:** 31-40
3. **Sex:** M
4. **Name of business:** Yangzhou Jiujiu
5. **Type of business:** Restaurant
6. **Place:** Changlu
7. **Distance from BYC:** Less than 2 kilometers
8. **Number of employees:** 7
9. **Recently, the number of employees:** unchanged
10. **Income:** About RMB 3,000/ month, or RMB 36,000/ year
11. **Year of establishment:** 2004
12. **Reason for establishment:** Profit
13. **Heard of BYC:** Yes
14. **Recently, number of clients:** Decreasing
15. **Clients are:** Regular, local customers
16. **If clients are regular, they visit:** Daily
17. **In the last 3 years, revenue has:** Decreased
18. **The number of competitors has:** Remained about the same
19. **Business directly related to chemical park:** No
20. **BYC impact on business:** Increased noise, but the impact on local incomes is probably positive
21. **BYC impact on business will:** Grow stronger
22. **The future of the business:** Not very optimistic
23. **BYC impact on personal life:** Negative: air pollution, noise, water pollution, health problems.
24. **BYC impact on personal life will:** Increase

Jun Li runs a small restaurant in Changlu. Most of his customers are regular locals. He has not noticed any direct positive impact from the construction of the factory, but concedes that the general increase in income probably has a good impact on the local economy in general. The direct impacts he is most concerned about are the negative environmental impacts, particularly air pollution and noise.

#### Questionnaire Response 4: Ling Zhuo, Changlu

1. **Name:** Ling Zhuo
2. **Age:** 31-40
3. **Sex:** M
4. **Name of business:** None
5. **Type of business:** Taxi
6. **Place:** Changlu
7. **Distance from BYC:** Less than 2 kilometers
8. **Number of employees:** 1
9. **Recently, the number of employees:** unchanged
10. **Income:** About RMB 5000/ year
11. **Year of establishment:** 2002
12. **Reason for establishment:** Mr.Zhuo is a resident in the area. The government paid him compensation for land that was used in the construction of the plant. He used this money to buy a taxi.
13. **Heard of BYC:** Yes
14. **Recently, number of clients:** About the same
15. **Clients are:** Regular, local customers
16. **If clients are regular, they visit:** Daily
17. **In the last 3 years, revenue has:** Slightly decreased
18. **The number of competitors has:** Increased
19. **Business directly related to chemical park:** No
20. **BYC impact on business:** Rise in general incomes
21. **BYC impact on business will:** Be about the same
22. **The future of the business:** Not very optimistic about the future in general
23. **BYC impact on personal life:** Very negative. The noise prevents him and his family from sleeping at night; air and water pollution are serious; he can't leave his chickens and ducks outside anymore; and the proximity to the plant means that there is no local school available for his children.
24. **BYC impact on personal life will:** Increase, in a negative way.

Ling Zhuo owns one of several new taxis that populate the main intersection in Changlu. He was very nervous about talking to us, but very outspoken in his complaints about the environmental effect the plant had on him and his family. He described it as “manxing zisha,” or “slow suicide.” The plant has obviously had a very direct impact on his life, economically, environmentally, and socially speaking, although none of these impacts have been positive. He feels the government should help relocate citizens in the area, and may have speaking under the impression that we would be able to offer some form of compensation.

### Questionnaire Response 5: Jisheng Chen, Liuhe

1. **Name:** Jisheng Chen
2. **Age:** 51-60
3. **Sex:** M
4. **Name of business:** Nanjing Shi Liuhe Renyuan Shangchang Youxian Gongsi
5. **Type of business:** Large supermarket
6. **Place:** Liuhe
7. **Distance from BYC:** About 20 kilometers
8. **Number of employees:** 180
9. **Recently, the number of employees:** Increased
10. **Income:** High (undisclosed)
11. **Year of establishment:** 2003
12. **Reason for establishment:** Increase income/ expansion is part of good management
13. **Heard of BYC:** Yes
14. **Recently, number of clients:** Increased
15. **Clients are:** Both regular and occasional customers
16. **If clients are regular, they visit:** Weekly
17. **In the last 3 years, revenue has:** Remained the same
18. **The number of competitors has:** Increased
19. **Business directly related to chemical park:** No
20. **BYC impact on business:** Not much
21. **BYC impact on business will:** Not change
22. **The future of the business:** Sees an increase in business over the next three years. After three years a new business plan will have to be made.
23. **BYC impact on personal life:** Some impact on environmental quality.
24. **BYC impact on personal life will:** Increase, in terms of environmental impact. He plans to retire and move to Nanjing with his wife.

Mr.Chen owns the largest supermarket in downtown Liuhe. He did not feel that YPC had a direct economic impact on the citizens in Liuhe, although he was aware of the plant's construction. He said that the economy has been improving generally, and he wouldn't attribute increasing business to the YPC plant in particular. The most notable effects of the plant (and the chemical industrial park in general) were environmental. The air is particularly bad, he said, in the summer, when the wind blows from the park. He does not plan to stay in Liuhe for much longer, and will retire with his wife to Nanjing.



### Questionnaire Response 6: Aimin Zhou

1. **Name:** Aimin Zhou
2. **Age:** 41-50
3. **Sex:** F
4. **Name of business:** Liuhe Shangsha
5. **Type of business:** Department store
6. **Place:** Liuhe
7. **Distance from BYC:** About 20 kilometers
8. **Number of employees:** 200
9. **Recently, the number of employees:** Increased
10. **Income:** RMB 30 million/ year
11. **Year of establishment:** 2002
12. **Reason for establishment:** Opportunity for expansion- previously operated a shoe store in Liuhe
13. **Heard of BYC:** Yes
14. **Recently, number of clients:** Has remained about the same
15. **Clients are:** Both regular and occasional customers
16. **If clients are regular, they visit:** Weekly
17. **In the last 3 years, revenue has:** Remained the same
18. **The number of competitors has:** Increased
19. **Business directly related to chemical park:** No
20. **BYC impact on business:** Not much
21. **BYC impact on business will:** Not change
22. **The future of the business:** Looks bright- incomes in Liuhe are increasing and consumers are more willing to spend money now than in the past.
23. **BYC impact on personal life:** Decrease in environmental quality.  
Opportunities for work (her brother lives in Dachang and works for YPC)
24. **BYC impact on personal life will:** Probably increase.

Aimin Zhou was a very competent, friendly woman. We spent three hours talking with her when she invited us out to lunch. She did not feel that YPC had a big impact on business in Liuhe. The workers in the plant are generally not consumers in Liuhe: they either shop in Dachang, where most of them live, or go to Nanjing, which is only about an hour by bus away from Dachang. One of the main employers in the city of Liuhe is the Economic Development District, which houses some toy factories, food processing companies, etc.

### Questionnaire Response 7: Jiang Li, Dachang

1. **Name:** Jiang Li
2. **Age:** 31-40
3. **Sex:** F
4. **Name of business:** Suning Company
5. **Type of business:** Electrical/ home appliance chain store
6. **Place:** Dachang
7. **Distance from BYC:** About 10 kilometers
8. **Number of employees:** 300 workers/ about 3,000 sq.m. of floor space
9. **Recently, the number of employees:** About the same
10. **Income:** Undisclosed
11. **Year of establishment:** 2001
12. **Reason for establishment:** Profit
13. **Heard of BYC:** Yes
14. **Recently, number of clients:** Has remained about the same
15. **Clients are:** Both regular and occasional customers
16. **If clients are regular, they visit:** Yearly
17. **In the last 3 years, revenue has:** Remained the same
18. **The number of competitors has:** Increased
19. **Business directly related to chemical park:** Sometimes sales of electrical appliances
20. **BYC impact on business:** By improving the overall local economy and providing employment opportunities, the BYC plant had a generally positive effect on her business: "The most important aspect for us is stability. When incomes are stable, customers are more willing to buy. The BYC plant provides stability."
21. **BYC impact on business will:** Hopes that there will continue to be a positive impact
22. **The future of the business:** Very good: sees an increase in business
23. **BYC impact on personal life:** Air and water quality poor, noise, perhaps work opportunities.
24. **BYC impact on personal life will:** Remain about the same.

Ms. Li manages a large branch of the Suning Electrical Appliance chain in the commercial centre of Dachang. As many residents of Dachang work in the Chemical Industrial Park, the BYC plant obviously has a large effect on local business. Her business, in particular, is particularly sensitive to high, stable income levels: "The most important aspect for us is stability. When incomes are stable, customers are more willing to buy. The BYC plant provides stability. We expect this positive influence will continue in the future."

### Questionnaire Response 8: Changzheng Zhang

1. **Name:** Changzheng Zhang
2. **Age:** 31-40
3. **Sex:** M
4. **Name of business:** Dachang Geteng Chuju Laobao Wujin Gongs
5. **Type of business:** Kitchen/ hardware store
6. **Place:** Dachang
7. **Distance from BYC:** About 10 kilometers
8. **Number of employees:** 5
9. **Recently, the number of employees:** About the same
10. **Income:** Undisclosed
11. **Year of establishment:** 1997
12. **Reason for establishment:** Profit
13. **Heard of BYC:** Yes
14. **Recently, number of clients:** Has remained about the same
15. **Clients are:** Regular customers
16. **If clients are regular, they visit:** Monthly
17. **In the last 3 years, revenue has:** Remained the same
18. **The number of competitors has:** Increased
19. **Business directly related to chemical park:** No
20. **BYC impact on business:** Probably positive, nothing direct
21. **BYC impact on business will:** Decrease
22. **The future of the business:** Just so-so.
23. **BYC impact on personal life:** Air and water quality poor, perhaps some job opportunities
24. **BYC impact on personal life will:** Remain about the same.

Mr. Zhang runs a very small “odds and ends” store in the commercial centre of Dachang, selling mostly kitchen supplies. He has not noticed any direct economic impact resulting from the construction of the plant. He did, however, voice concerns about environmental quality.

### Questionnaire Response 9: Mr.Pan

1. **Name:** Mr. Pan (first name not given)
2. **Age:** 31-40
3. **Sex:** M
4. **Name of business:** Huaneng Nanjing Binguan
5. **Type of business:** Hotel
6. **Place:** Dachang
7. **Distance from BYC:** About 10 kilometers
8. **Number of employees:** 40
9. **Recently, the number of employees:** Increasing
10. **Income:** Undisclosed
11. **Year of establishment:** 1995
12. **Reason for establishment:** With the establishment of the chemical industrial park, there was an opportunity to make money.
13. **Heard of BYC:** Yes
14. **Recently, number of clients:** Has remained about the same
15. **Clients are:** Not regular customers
16. **If clients are regular, they visit:** NA
17. **In the last 3 years, revenue has:** Remained the same
18. **The number of competitors has:** Increased
19. **Business directly related to chemical park:** No
20. **BYC impact on business:** Negative environmental impact
21. **BYC impact on business will:** Probably increase
22. **The future of the business:** Fairly positive
23. **BYC impact on personal life:** Air and water quality poor, health impacts, better traffic facilities in the area, more opportunities for work
24. **BYC impact on personal life will:** Probably increase.

Of the three large hotels in Dachang, two are directly linked to YPC. Most direct business related to YPC thus stays with these two hotels. The Huaneng Hotel has no affiliation with YPC. Although he was aware of its existence, Mr. Pan did not feel that the BYC plant had a large direct impact on his own business. Again, he pointed out the environmental problems associated with living next to an industrial park. When asked why he stayed there, he said that everyone would leave Dachang if it weren't for the income provided by the nearby Chemical Industrial Park.

## ***Internet links***

Jiangsu Province

<http://www.jiangsu.gov.cn/>

Nanjing City

<http://www.nanjing.gov.cn/>

Luhe District

<http://www.luhequ.net/english/>

Nanjing Environmental Protection Agency

<http://www.njhb.gov.cn/>

Nanjing Statistical Bureau

<http://www.njtj.gov.cn/>

Luhe Economic Development Zone

<http://www.nanjing.gov.cn/cps/site/nanjing/052004/english/index8-2.htm>

Investment in Nanjing – Nanjing Chemical Industrial Park (NCIP) (English)

<http://218.94.6.179/cps/site/nanjing/English/k4.html>

Nanjing Chemical Industrial Park (NCIP) (Chinese)

<http://www.ncip.cn/>

China Business Council for Sustainable Development

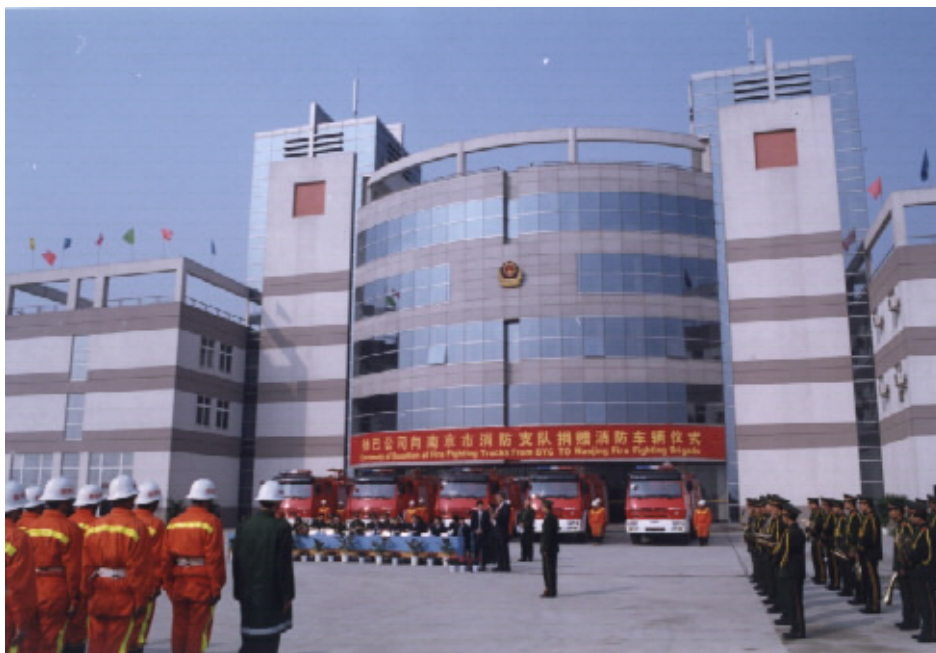
<http://english.cbcsd.org.cn/>

## ***Selected Examples for BYC's sponsorship activities***

1.)

BYC Company Ltd. Donates 5 Trucks to Nanjing Fire-Fighting Brigade (January 17, 2003, Nanjing) BYC Company Limited donated five fire fighting trucks to Nanjing Fire Fighting Brigade (NFFB) in Dachang District at a donation ceremony held at the camp of the Brigade. Attending the ceremony were Dr. Bernd Blumenberg, Company President and NFFB Director Mr. Ji Chengbao.

Photo 3: Donation to fire brigade



Source: BYC

“The purpose of the donation is to help the Brigade further upgrade its local fire-fighting facilities and bring long-term benefits to the neighboring enterprises, residents and the Company itself,” said Dr. Blumenberg, “This donation, based on a resolution made by the BYC Board of Directors, is living evidence of the Company’s continued commitment to being a responsible corporate citizen.”

In his return speech, Mr. Ji expressed his appreciation of the company’s donation and said that the Nanjing Fire Fighting Brigade would use the donated trucks to ensure effective cooperation with local enterprises as well as the safety and security of local residents.

2.)

Jan 12, 2002: BASF hands out donation to Nanjing International School

BASF has donated USD 20,000 for Nanjing International School, a non-profit organization founded in 1992 with 180 students from 23 nationalities. Donation has been used to sponsor the School's Science laboratories for chemistry to purchase data logging equipment and science software. That equipment could help to connect the experiment result to a computer and processing the data for analyzing and obtaining result on different types of experiment. Equipment has already arrived for student use.

At the donation presentation ceremony on Jan 11, Dr. Dietmar Nissen, President of BASF East Asia Headquarters Ltd., said, "BASF owes its success to the emphasis it has placed on research and development of new products, and to its encouragement of talented young people." Dr. Nissen added that BASF was committed actively to the development of the Chinese economy, especially in the chemical industry. BASF supports schools in their efforts to achieve high quality education and research, which focusing on chemistry and chemical engineering.

3.)

BASF sets up scholarship program at Nanjing University to boost efforts in research and development

(27 May 2002, Nanjing) The efforts of BASF and Nanjing University in forging ahead for greater collaboration in research and development reached a new milestone today with the establishment of the NJU-BASF Scholarship program under the official signing of standing vice president Prof. Shi Jianjun of Nanjing University.

BASF and Nanjing University have since 1997 been collaborating on catalysts research which have already led to one patent award. The Department of Chemistry at Nanjing University has also been identified as an excellent center in the field among Mainland universities. The establishment of the scholarship program coincided with the 100th anniversary celebration of Nanjing University.

Under the program, 3 PhD and 20 graduate students from the college of chemistry and chemical engineering, and the departments of biotechnology, material science and environmental protection will be awarded. Among the PhD students to be awarded scholarships, one will be selected to attend a 3-week exchange program "104th BASF International Summer Industrial Seminar" to be held at BASF's headquarters at Ludwigshafen, Germany in August 2002.

Photo 4: BASF Scholarship at Nanjing University



Source: BYC

4.)

**Donation to Community:** BASF-YPC Company Limited made contribution to Dongwang Primary School in Luhe District, Nanjing, to improve the teaching condition of this school located in the under-developed region, and to help dozens of poor pupils continue their study.

On June 18, 2004, the donation was held in Dongwang Primary School with the attendance of Dr. Blumenberg, the company president, Mr. Qiu Shoupeng, director of Luhe District, etc. The 600 pupils, wearing the red hats made for them by the company, sat on the playground to welcome these guests.

Social responsibility being one component of our company's value of sustainable development, helping these pupils demonstrates fully our affection and responsibility towards the society

The overwhelming applause echoed in the playground as Dr. Blumenberg presented to Mr. Zhu Fuping, the schoolmaster, the RMB 200,000 worth of computers and multi-media teaching facilities and Mr. Chen Zhilong, chairman of the company Trade Union, presented to the representative of the donated pupils another sum of RMB 120,000 voluntarily donated by the company employees. This is the best reward from the pupils to the company's affection on these pupils and the hearty appreciation from the community to this young joint venture!

Source: BYC



## ***Further Maps***

Map of Luhe district



*Source: Luhe City Planning Office*

Map of the "Nanjing Chemical Industrial Park" 2004

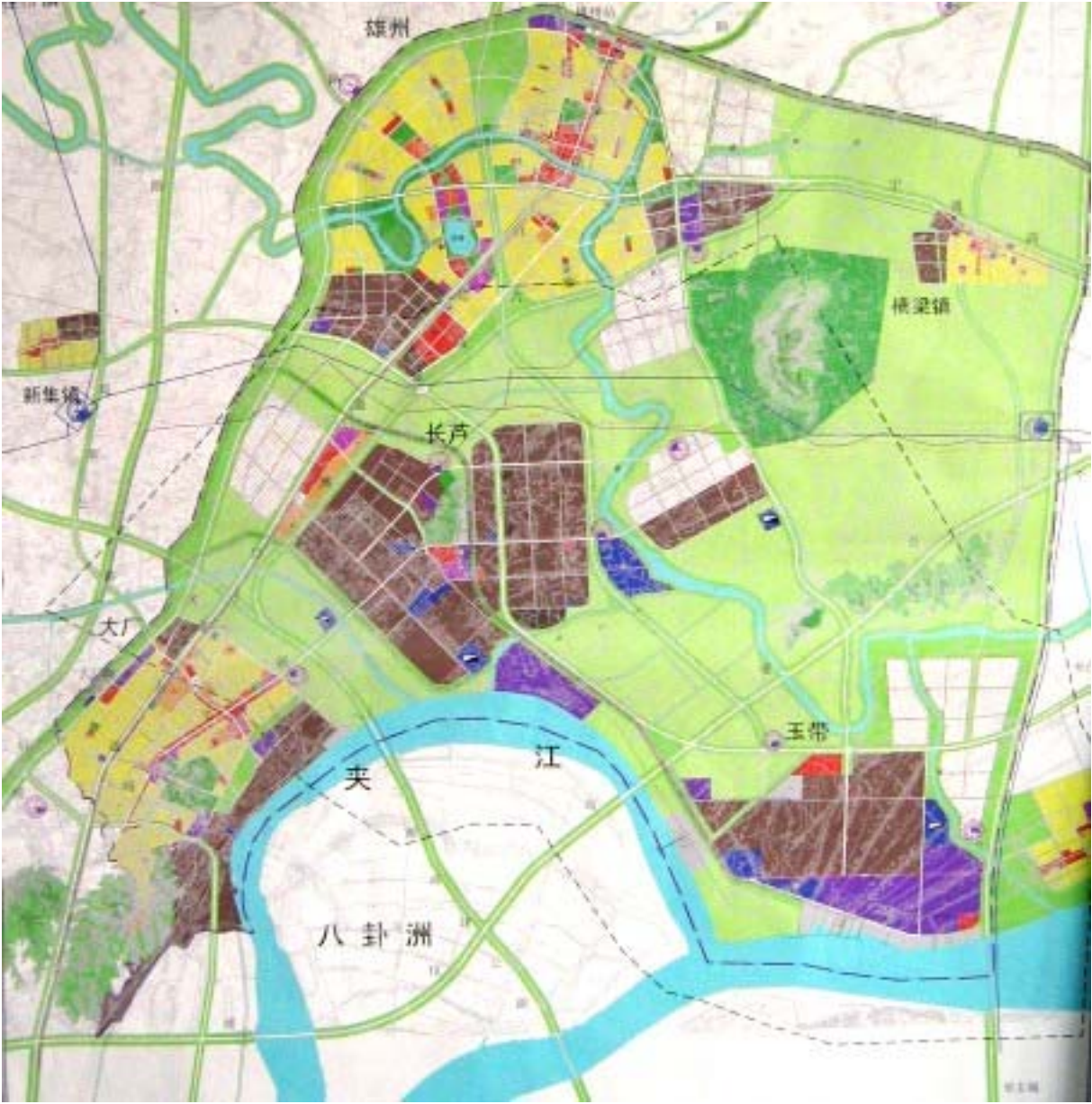
Source: Luhe City Planning Office





Map of the “Nanjing Chemical Industrial Park” planning

Source: Luhe City Planning Office



Map of Changlu and Yudai Zone within the NCIP



Source: <http://www.ncip.cn/>

Map of the location of the NCIP within Jiangsu province



Source: <http://www.ncip.cn/>

## ***List of interviewees from May 23rd to June 2nd 2005***

Dr. Bernd Blumenberg	BYC Company Ltd. President
Tony D. J. Chen	BYC Company Ltd. General Manager AA/AE
Wu Wenxin	BYC Company Ltd. Project Director IPS
Wang Liqiu	BYC Company Ltd. Director of Finance
Li Chengfeng	BYC Company Ltd. Vice President / General Manager Finance, Accounting, EDP and Materials
Xie Xiaolong	BYC Company Ltd. Financing Management Manager
Wu Youjin	BYC Company Ltd. Finance Budget Manager
Tang Yusheng	BYC Company Ltd. Director Purchasing Department
Paul Van Hoyweghen	BYC Company Ltd. Director Coordination and Planning Department
Shao Xuehua	BYC Company Ltd. Director Safety, Health and Environment
Michael Dries	BYC Company Ltd. Logistics Director
Paul Jacobs	BYC Company Ltd. Director Human Resources Department
Dr. Kurt Raschka	BYC Company Ltd. General Manager Engineering, Maintenance, EHS & Utilities Division
Steward Cameron	Fluor Daniel, Director Production Plants Integrated Management Team
Sylvia Zhang	BASF, Senior Manager Controlling, Planning and Procurement Yangzi-BASF Styrenics Comp. Ltd.

Byeong - Chul Lee	General Manager Yangzi-BASF Styrenics Company Limited
Benny Y. Song	BASF Office-Manager Production&Maintenance Division Yangzi-BASF Styrenics Comp. Ltd.
Zhai Shanxi	Bureau of Foreign Trade and Economic Cooperation, Nanjing Minicipality Deputy Director
Liu Xiaosi	Bureau of Foreign Trade and Economic Cooperation, Nanjing Minicipality Director Department of Foreign Investment Management
Xu Yangwen	Bureau of Foreign Trade and Economic Cooperation, Nanjing Minicipality Vice Director Department of Foreign Investment Management
Mao Qin	Nanjing Municipal Economic Commission International Economic Cooperation Division Director
Yang Xiaoming	Environmental Protection Bureau of Nanjing Vice Director Pollution Control Dept.
Ding Guangyuan	Environmental Protection Bureau of Nanjing Director Division of Monitoring Sci & Tech.
Zhou Wei	Nanjing Industrial & Commercial Administration Director Division for supervision of Foreign Funded Enterprises
Gao Jinjian	Planning Bureau of Nanjing City Director Luhe Office
Jiang Ming	Statistical Bureau of Nanjing Department Director
Chen Guhua	Statistical Bureau of Nanjing Department Director
Hans-Juergen Cassens	GTZ Eco City Planning and Management Programme Yangzhou Environmental Protection Bureau