

Introduction of Wuxi New District (China)

Wuxi city, located close to the metropolis of Shanghai (160 km west of Shanghai) has developed a new industrial township called the Wuxi New District (WND). WND is one of top ten national level development zones. As per 2006, it covered an area of 200km², housed more than 2,000 enterprises and had a population of 250,000 including 140,000 industrial workers. The total output of WND was more than RMB 166 billion.

Since its foundation in 1992, WND has evolved to be a major industrial park in the Yangtze River Delta. WND has been a strong showcase for the rapid industrial development that the People's Republic of China has achieved in the last few decades. A broad range of industries has been set up in the WND, and its economic growth has spurred the entire region, including the Microelectronic, precision machinery and auto-parts sectors. Related service/supporting industry sectors are also emerging rapidly in WND. WND is owned and managed by the New District Administrative Committee of Wuxi People's Municipal Government, second largest city in Jiangsu Province of the People's Republic of China.

The rapid and high industrial development of WND has attracted not only domestic and international companies, but it also increased its population to support the growth. This multifaceted growth resulted in a drastic increase in the quality and quantity of wastes generated by the industries in WND and by the communities that depend on the district, causing therefore problems in the proper management of such wastes. The city was seeking to combine the current streams of waste management with an integrated waste management system, so that wastes were recycled and reused to the maximum possible extent, and the broader development of the city could take place in harmony with the environment.



Figure 1 - Location of WND (Wuxi New District) with Wuxi City

1 Baseline Data (2006)

The municipal solid waste data collection and analysis for WND was undertaken by local staff of the WND Project Team, who was trained for this purpose through a series of workshops and field training based on the ISWM Guidelines “*Developing Integrated Solid Waste Management Plan – Training Manual - Volume 1: Waste Characterization and Quantification with Future Projections*”

The team carried out source identification, quantification and characterization of all the different types of waste from different sectors such as industrial, municipal and commercial sectors. Additionally, projections for future waste generation were also included.

The Industrial and Health Care waste data was gathered from secondary sources.



Figure 2: Waste Characterization



Figure 3: Waste Characterization

2 Waste Generation: Quantification and Characterization

2.1 Waste Quantification

The findings of the quantification of the waste in WND indicated the following:

- As expected, waste generation rates in WND had been rapidly increasing over the years due to urbanization and industrialization. This trend was likely to continue over the next 15 years with an expected increase of 18% from 2006 to 2010 and further 42% from 2010 to 2020.
- In 2006, the per capita waste generation in WND was 0.8 kg per day from residential sources; however, it was approximately 1 kg per day for combined municipal waste from residential, commercial and industrial sources.
- The total amount of municipal solid waste of WND is about 415 t/d, including 333 t/d of waste from residential and commercial sources and 82 t/d waste from industrial sources.
- Hospitals generated waste at the rate of approximately 0.77 kg/day/bed including 0.5 kg/day/bed of hazardous waste.
- Generation rate for wastewater sludge was about 3000 tons/year. This amount is generated by three wastewater treatment plants treating about 15 million tons of wastewater per annum. It is assumed that quantity of sludge will also increase, inline with future trends for municipal solid waste, up to about 3,500 tons/annum in 2010 and up to 7,000 tons/annum in 2020.
- There was a huge quantity of industrial non-hazardous waste (processing waste) - 213,826 tons per year. Industrial waste generation rate was about 20.15 tons/year per million Yuan production output.
- Hazardous waste generation from industries is at the rate of about 2.45 tons/year per million Yuan production output which corresponds to approximately 30,000 tons/annum.
- Hazardous waste from hospitals is about 72 tons/annum and it is predicted to increase to 133 tons/annum in 2010 and to 168 tons/annum in 2020.
- In WND, construction and demolition waste is generated from three sources: municipal works, residential construction and industrial construction. Most of this waste is recycled within this sector (Please refer to Annexure I, Table A10-A14 for additional information (Chinese)).
- The projections of waste generation for the coming years estimate that the amount of waste from residential and commercial sources will increase from 333 tons/day to 390 tons/day in 2010 and up to 560 tons/day in 2020. Out of this that kitchen and yard waste will increase from the current 233 tons/day to 280 tons/day in 2020. The rest of the waste, including paper and plastics, currently generated at 118 tons/day will increase to about 160 tons/day in 2010 and up to 280 tons/day in 2020.

- Food waste within the municipal waste from the industrial sector will increase from 12 tons/day to about 15 tons/day in 2010 and up to 20 tons/day in 2020. Other wastes which are currently being generated at about 70 tons/day and will increase to about 85 tons/day in 2010 and up to 120 in 2020.

The overall summary of the current waste being generated along with future projections is given in Table 1.

Table 1: Waste Generation and Future Projections

TYPES OF WASTE ACCORDING TO GENERATION SOURCE	WASTE GENERATION (tons/day)		
	Baseline Study	Future Projections*	
	(2006)	2010	2020
Municipal waste from residential and commercial sources	333	390	560
Municipal waste from industries	82	100	140
Municipal waste from all sources	415	490	700
Industrial non-hazardous waste	586	692	988
Industrial hazardous waste	82	97	138
Hospital waste – total	0.3	0.4	0.5
Hospital waste – hazardous	0.2	0.3	0.4
Sludge	8	10	19
Construction & demolition debris	32,805	38,733	55,333

* The future trends were calculated by using two indicators, economic and population growth in line with the World Bank Report 2005: Waste Management in China – Issues and Recommendations.

2.2 Waste Characterization

With regards to the composition of the waste:

- Organic waste was the dominant component of municipal and commercial waste representing 70% of the total waste generated by these sources and just 13% of the municipal waste generated by the industrial sector.
- Plastic waste was another major component as residential, commercial and industrial (municipal) waste contained 17%, 14% and 22% of plastics respectively.
- Paper constituted 6% of the waste from residential and commercial sources, while it was more than 50% from industrial sources.
- Quantities of metal and glass waste were not substantial in municipal waste.

Table 2 presents the composition of municipal waste from different sectors.

Table 2: Composition of Municipal Waste from Domestic, Commercial and Industrial Sources

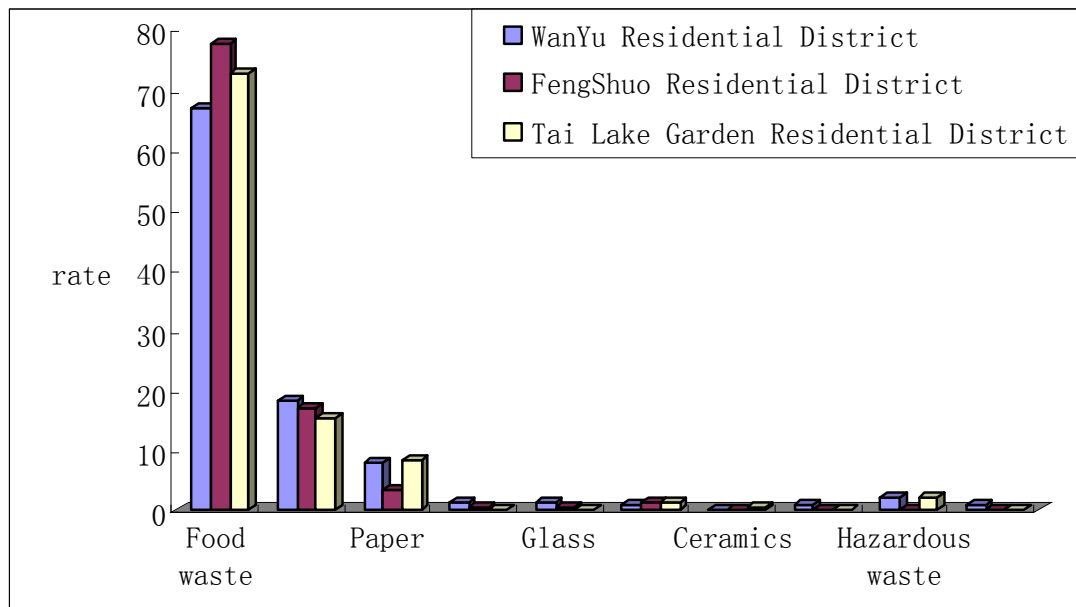
COMPONENTS	INDUSTRIAL		DOMESTIC AND COMMERCIAL		TOTAL	
	%	Weight (tpd)*	%	Weight (tpd)	%	Weight (tpd)
Food waste	13.4	10.99	71.4	237.75	59.92	248.74
Plastic	21.2	17.38	16.85	56.11	17.71	73.49
Paper	53.4	43.79	6.62	22.05	15.85	65.84
Metal	1.6	1.31	0.38	1.28	0.60	2.59
Glass	0	0	1.71	5.68	1.36	5.68
Textile	10.4	8.53	2.37	7.9	3.96	16.43
Ceramics	0	0	0.51	1.69	0.40	1.69
Hazardous waste	0	0	0.26	0.86	0.20	0.86
Total	100	82	100	333	100	415

* tpd: tons per day

The following tables illustrate the composition of the waste in specific residential districts, commercial and industrial areas within WND.

Table 3: Composition of Municipal Solid Waste in Selected Residential Districts

Sample component	WanYu Residential District		FengShuo Residential District		Tai Lake Garden Residential District	
	Weight (kg)	Percentage (%)	Weight (kg)	Percentage (%)	Weight (kg)	Percentage (%)
Food waste	91.25	66.9	122.8	77.5	125.1	72.5
Plastic	24.8	18.2	26.7	16.8	26.25	15.2
Paper	10.65	7.8	4.85	3.1	14.55	8.4
Metal	1.6	1.2	0.8	0.5	0.4	0.2
Glass	1.8	1.3	1	0.6	/	/
Textile	1.25	0.9	1.95	1.2	2.25	1.3
Wood	/	/	0.1	0.1	0.75	0.4
Ceramics	1.1	0.8	0.3	0.2	/	/
Hazardous waste	2.9	2.1	/	/	3.3	1.9
Coal residual	1	0.7	/	/	/	/
Total	136.35		158.5		172.6	

Figure 4: Comparison of solid wastes from different residential districts

As it can be observed, in all the three residential districts the waste composition trend follows the same pattern, where organic waste is the major component, followed by plastic and then paper.

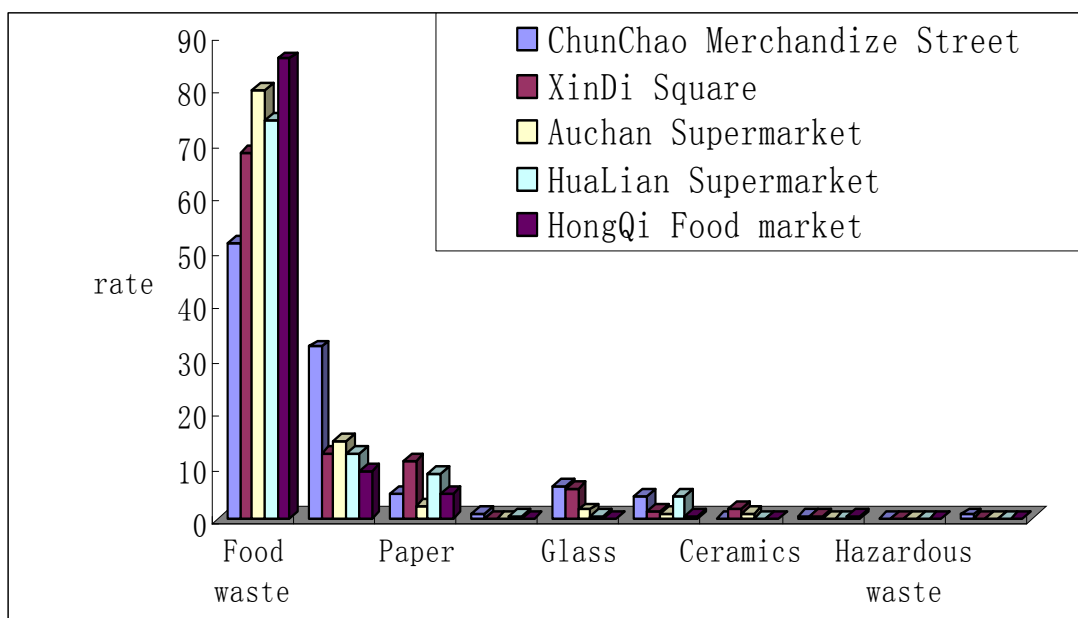
Table 4: Composition of Municipal Solid Waste in Selected Commercial Areas

Sample component	ChunChao Merchandize Street		XinDi Square	
	Weight (kg)	Percentage (%)	Weight (kg)	Percentage (%)
Food waste	67.8	51.4	97.5	67.9
Plastic	42.1	31.9	17.5	12.2
Paper	6.05	4.6	15.4	10.7
Metal	1.3	1	/	/
Glass	7.75	5.9	8.1	5.6
Textile	5.5	4.1	2	1.4
Wood	/	/	2.5	1.7
Ceramics	0.5	0.4	0.5	0.4
Hazardous waste	/	/	/	/
Coal residual	1	0.7	/	/
Total	132		143.5	

Table 5: Composition of Municipal Solid Waste in Selected Commercial Areas

Sample component	Auchan Supermarket		HuaLian Supermarket	
	Weight (kg)	Percentage (%)	Weight (kg)	Percentage (%)
Food waste	111.6	79.9	67.7	74.3
Plastic	20	14.3	11.2	12.3
Paper	3.2	2.3	7.6	8.3
Metal	/	/	0.3	0.3
Glass	2.2	1.6	0.5	0.6
Textile	1.2	0.9	3.85	4.2
Wood	1.4	1	/	/
Ceramics	/	/	/	/
Hazardous waste	/	/	/	/
Coal residual	/	/	/	/
Total	139.6		91.15	

Figure 5: Comparison of solid wastes from different commercial areas



The commercial areas also follow the same pattern; however the percentages representing each of the different types of waste strongly differ due to the nature of the commerce.

Table 6: Composition of Municipal Solid Waste in Industrial Area

JingYi Road Trash Stopover Station		
Sample component	Weight (kg)	Percentage (%)
Food waste	10	13.4
Plastic	15.8	21.2
Paper	39.8	53.4
Metal	1.2	1.6
Glass	0	/
Textile	7.8	10.4
Ceramics	/	/
Hazardous waste	/	/
Total	74.6	

As expected, industrial areas report higher quantities of paper and plastics and lower amounts of food waste.

Additional data on industrial solid waste, hazardous solid waste and C&D waste can be found at Annexure I. Unfortunately those tables are in Chinese.

ANNEXURE I

Data on Industrial Solid Waste and Industrial Hazardous Waste

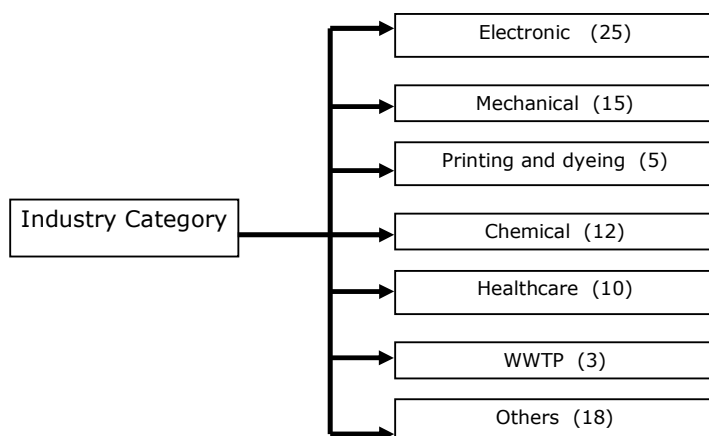


Table A1: Electronic Industrial Solid Wastes

序号	企业名称	生产总值 (万元)	固废产量 (吨/年)	危废产量 (吨/年)	万元产值 固废产生率	万元产值 固废回收率	回收率 (%)	安全处置 率 (%)
1	东芝	5,517	82.32	48.97	0.0149	/	/	59.49
2	东元	36,457	540.00	10.8	0.0148	0.0109	73.33	2.00
3	福群	20,000	95.04	1.49	0.00475	0.00445	93.64	1.57
4	希门凯	37,716	1357.68	1121	0.036	0.0261	72.53	27.47
5	希捷	1,675,765	2495.88	16.1	0.00149	0.00138	92.70	6.76
6	山王	5,047	44.28	35.35	0.00876	0.0016	18.27	79.83
7	TCL	/	1923.12	42.1	/	/	99.95	0.05
8	西门子	15,000	57.696	57.7	0.00385	0.00255	66.21	33.79
9	村田	28,120	329.04	57.3	0.0117	0.00665	56.86	28.11
10	索尼	186,367	684	542.6	0.00367	0.000763	20.67	79.33
11	敦南	81,258	733.32	6	0.00902	0.000713	7.90	2.86
12	新美亚	20,700	866.04	369.51	0.0418	0.0045	10.75	42.67
13	爱普生	19,000	210	9.9	0.0111	0.0019	17.19	0.00
14	华润	23,477	125.04	125	0.00439	0.000213	4.00	96.00
15	住电	7,991	66.6	6	0.00833	0.000204	2.45	9.05
16	夏普	1,426,064	934.8	48.5	0.00066	0.000161	24.57	54.11
17	古河	22,076	4918.56	273.6	0.2228	0.2096	94.09	5.91
18	雅玛可	7,300	71.04	/	0.00973	0.00737	75.73	/
19	宏仁	21,433	987	303	0.0461	0.0461	100.00	0.00
20	尼吉康	37,595	50.16	50.2	0.00134	0	0.00	100.00
21	可标	466.46	30.48	27	0.0653	0.0653	100.00	0.00
22	日立	30,000	416.64	296	0.0139	0.00402	28.95	71.05
23	京瓷	5,000	71.04	7.8	0.0142	0.00048	3.38	15.95
24	开益禧	29,706	950.04	480	0.032	0.0132	41.26	50.52
25	高顶	2,500	29.28	28.75	0.0117	0.0002	1.71	98.29
	总计	3,744,556	18069.10	3964.67				

Table A2: Data on printing and dyeing industrial solid wastes

序号	企业名称	生产总值 (万元)	固废产量 (吨/年)	危废产量 (吨/年)	万元产值 固废产生率	万元产值 固废回收率	回收率 (%)	安全处置率 (%)
1	中深银洋	12,000	867.6	856	0.0723	0.0719	99.45	0.55
2	日东纺	13,980	480	405	0.0343	0.00215	6.25	84.38
3	新潮	5,250	1928.4	/	0.367	0.00006	0.02	99.98
4	天然纺织	30,000	120	/	0.004	0.0007	16.67	83.33
5	大同	762.39	17.04	/	0.0223	0.006558	29.41	70.59
	总计	61,992	3413.04	1261	/	/	/	/

Table A3: Data on mechanical industrial solid wastes

序号	企业名称	生产总值 (万元)	固废产量 (吨/年)	危废产量 (吨/年)	万元产值 固废产生率	万元产值 固废回收率	回收率 (%)	安全处置 率(%)
1	洋马	33,305	319.92	222.91	0.00961	0.00111	11.57	69.68
2	博西威	77,550	1399.2	48.96	0.018	0.0154	85.40	14.60
3	光洋	3,752	178.08	145.1	0.0475	0	0.00	100.00
4	荣理研	2,450	140.7	140	0.0574	0.0574	100.00	0.00
5	松下冷机 压缩机	46,287.80	5418.3	172.956	0.117	0.114	97.44	2.56
6	普利斯通	43,008	484.2	10.16	0.0113	0.011	97.35	2.65
7	德纳	200,000	14523.96	1455.39	0.0726	0.00041	0.56	10.18
8	唐纳森	71,131	32.904	13.1	0.000463	0.000184	60.18	39.82
9	约克	140,000	541.2	291.2	0.00387	0.00143	36.95	63.05
10	三樱	8	137.7	38	17.2125	11.6625	67.76	32.24
11	住友	85,000	1101.96	1096.935	0.013	0.001216	9.40	90.15
12	博世	49,766.60	102	90	0.00245	0.00024	9.80	90.20
13	喜开理	5,845	455.04	62.864	0.0778	0.0671	86.25	13.75
14	松下冷机	58,400	577.56	73.484	0.00989	0.00753	76.11	12.72
15	明思作	24,054	114.24	84.255	0.00475	0.00350	95.62	4.38
	总计	745,372	25412.724	3945.314				

Table A4: Data on chemical industrial solid wastes

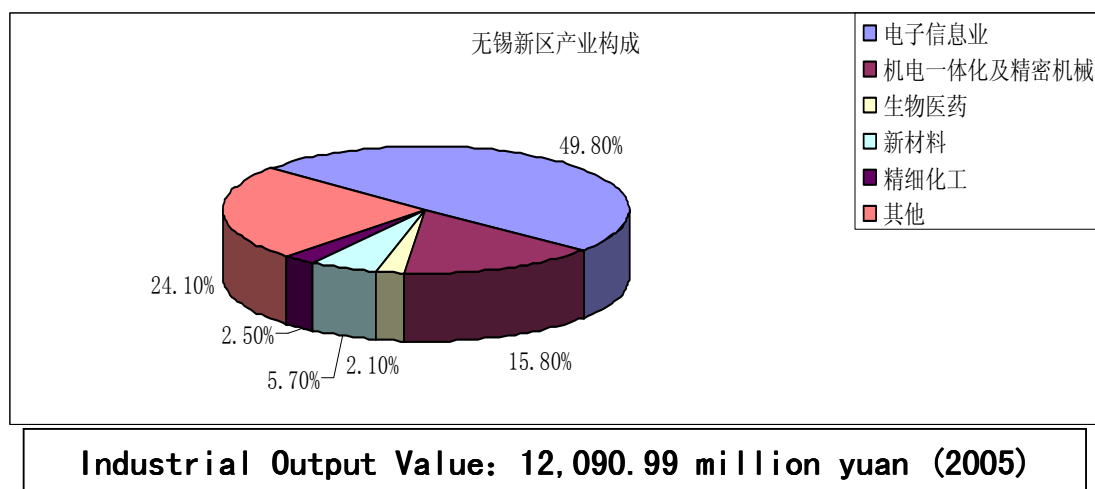
序号	企业名称	生产总值 (万元)	固废产量 (吨/年)	危废产量 (吨/年)	万元产值 固废产生率	万元产值 固废回收率	回收率 (%)	安全处置 率 (%)
1	双象	38,840	1202.76	374	0.031	0.0214	69.24	30.76
2	富士	1,040	1150.68	1144.68	1.106	1.061	95.89	4.11
3	益帆	3,000	4.596	4.6	0.00153	0.0014	91.30	8.70
4	杰士	5,101	123.96	120	0.0243	0.0243	100.00	0.00
5	通用水处理	11,083	362.04	115	0.0327	0.00406	12.43	87.57
6	安特固	1,703	69.96	70	0.0411	0.00587	14.29	85.71
7	柯达	30,664	137.76	137.8	0.00449	0.00255	56.82	43.18
8	爱克发	26,514	3876.48	275.5	0.146	0.136	92.89	7.11
9	新光	24,000	156.96	155	0.00654	0.00	0.00	100.00
10	统一马口铁	50,000	1846.68	1007.7	0.0369	0.0187	50.72	49.28
11	福锋	130	47.04	47	0.362	0.00	0.00	100.00
12	朗盛	15,576	233.04	20	0.015	0.00	0.00	100.00
	总计	207,651	9211.96	3471.28				

Table A5: Data on others industrial solid wastes

序号	企业名称	生产总值 (万元)	固废产量 (吨/年)	危废产量 (吨/年)	万元产值 固废产生率	万元产值 固废回收率	回收率 (%)	安全处置 率 (%)
1	环宇	28,000	41.16	17.7	0.00147	0.00147	100.00	0.00
2	岱棱	13,840	151.44	115.93	0.0109	0.00789	72.59	27.41
3	方天	200	88.8	84.8	0.444	0.424	90.99	9.01
4	中环	2,497	12	11.86	0.00475	0	0.00	100.00
5	尚德	360000	1611.36	1489.05	/	/	100.00	0.00
6	慕斯达	1,978	48.84	42.316	0.0246	0.00327	13.32	86.68
7	中天	400	30	30	0.075	0.075	100.00	0.00
8	君悦	2,300	265.92	/	0.116	0.0287	24.78	75.22
9	艾克赛尔	1,500	0.6	0.6	0.0004	0	0.00	100.00
10	三凤桥	4,118.14	24.96	10	0.00607	0	0.00	100.00
11	通用石英	554	91.56	0.311	0.165	0.136	82.42	17.58
12	纽迪西亚	24,392	146.16	5.6	0.00599	0.00576	96.16	3.84
13	吉奥马	6,983	271.56	25.2	0.0389	0.00358	9.21	18.60
14	阿斯利康	180,000	214.92	49.7	0.00119	0.0005	37.64	43.74
15	罗益	300	37.2	0.75	0.124	0	0.00	100.00
16	YKK	8,108.70	177.72	163.014	0.0219	0.0021	8.59	90.41
17	西姆莱斯	230,000	3155.04	95	0.0137	0.0137	100.00	0.00
18	友联	12,015	26952.96	/	2.243	2.243	100.00	0.00
	总计	877,186	33322.2	2141.831				

Table A6: Comparison between different industry categories

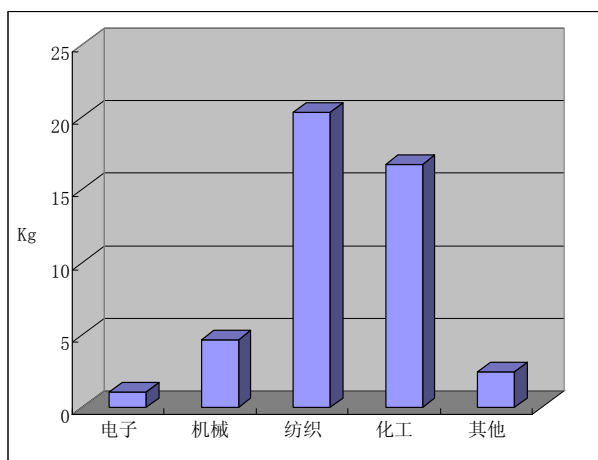
行业名称	万元生产总值 固废产生率	万元生产总值 危废产生率	万元生产总值 固废回收率	回收率	安全 处置率
电子	4.31Kg	1.06Kg	2.88Kg	66.82%	18.95%
机械	30.2Kg	4.69Kg	10.20Kg	33.77%	15.19%
纺织	55.1Kg	20.34Kg	14.81Kg	26.88%	71.78%
化工	44.4Kg	16.72Kg	32.43Kg	73.04%	26.89%
医院	/	/	/	8.12%	91.88%
污水处理厂	/	/	/	/	100%
其他	38.0Kg	2.44Kg	36.93Kg	97.18%	2.08%

Figure A1: Composition of industries in WND**Table A7: Data on WWTP solid wastes**

序号	企业名称	固废产量 (吨/年)	处理污水量 (吨/年)	安全处置 率 (%)
1	梅村污水厂	600	3,000,000	100
2	新城污水厂	1810	9,050,000	100
3	硕放污水厂	560	2,800,000	100

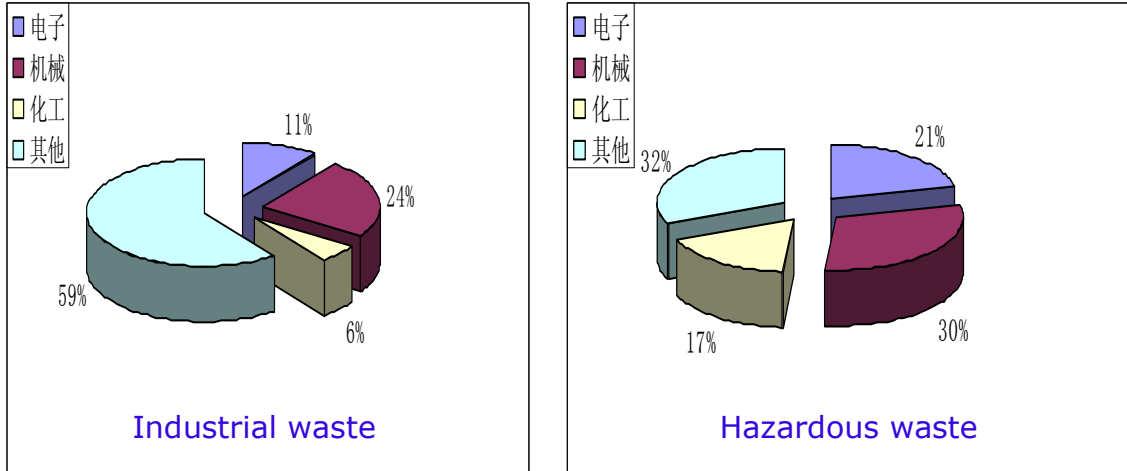
Table A8: Data on healthcare solid wastes

序号	企业名称	门诊人数 (个/天)	固废产量 (吨/年)	危废产量 (吨/年)	回收率(%)	安全处置率(%)
1	凤凰医院	288	18.15	18.15	0	100.00
2	梅村医院	274	9.2	7.2	1.36	98.64
3	虹桥医院	300	25.5	18.5	27.45	72.55
4	南站医院	150	39	9	0	100.00
5	后宅医院	136	2.88	2.88	0	100.00
6	鸿声医院	130	4.12	4.12	0	1.00
7	坊前医院	138	3.06	2.5	18.30	81.70
8	硕放医院	250	3.5	3.5	0	100.00
9	仁德医院	170	2.6	2.6	0	100.00
10	旺庄医院	150	5.1	3.6	19.41	70.59
	总计	1836	113.11	72.05	/	/

Figure A2: Comparison of the hazardous waste production rates from different industry category**Table A9: Amounts of Industrial Solid waste and Hazardous Solid Waste**

行业名称	各产业 比重(%)	工业总 产值(万元)	各行业 总产值(万元)	固废总 产量(吨)	危废总 产量(吨)
电子	49.8	12,090,990	6,021,313	25,951.859	6382.592
机械	15.8		1,910,376	57,693.368	8959.665
化工	2.5		302,274.8	13,421.000	5054.034
其他	31.9		3,857,026	146,566.981	9411.143
总计	100		12,090,990	243,633.207	29807.434

Figure A3: Composition of Industrial Solid Waste and Hazardous Waste



Data on C&D Waste

Table A10: Data on C&D solid wastes

	2005		2006	
	工业	房产	工业	房产
项目个数 (个)	136	12	77	4
建筑面积 (M2)	2,275,054	1,020,447	1,019,203	364,922
工程造价 (万元)	362,051	101,733	107,024	34,858

Table A11: Data on C&D Solid Waste - Residential Building

	产生量 (吨/万M2)	回收量 (吨)	安全处置 量 (吨)	去向
碎砖	909	10,000	/	回填
土方	36,000	180,000	/	回填或外卖 其他工地
PVC管	0.1	/	1	垃圾填埋场
废钢筋	4.55	50	/	外卖回收站
废木料	81.82	900	/	外卖做燃料
涂料桶	0.45	5	/	回用
玻璃	少量	/	/	垃圾填埋场

Table A12: Data on C&D Solid Wastes - Industrial Building

	产生量 (吨/万M2)	回收量 (吨)	安全处置 量 (吨)	去向
碎砖	14.12	18	/	回填
土方	未提供			回填
PVC管	0.16	/	0.2	垃圾填埋场
废钢筋	3.92	5	/	外卖回收站
废木料	3.92	5	/	外卖做燃料
涂料桶	不详	/	/	回用
玻璃	不详	/	/	垃圾填埋场

The calculation of construction solid waste can be calculated according to the following formula:

$$\text{Total Amounts of C\&D solid waste} = \Sigma \text{Total yield of specific component}$$

$$\text{Total yield of specific component} = \text{yield/square meter (t/ten thousand m}^2\text{)} \times \text{total building area (m}^2\text{)}$$

Table A13: Total C&D Waste from Residential Building, 2005

固废组分	产生量 (吨/万M2)	建筑面积 (M2)	固废产生总量 (吨)
碎砖	909	1,020,447	92758.6323
土方	36,000		3673609.2
PVC管	0.1		10.20447
废钢筋	4.55		464.303385
废木料	81.82		8349.297354
涂料桶	0.45		45.920115
玻璃	少量		102.0447
总计			

Table A14: Total C&D Waste from Industrial Building, 2005

固废组分	产生量 (吨/万 M2)	建筑面积(M2)	固废产生总量 (吨)
碎砖	14.12	2,275,054	3212.376248
土方	36,000		8190194.4
PVC管	0.16		36.400864
废钢筋	3.92		891.821168
废木料	3.92		891.821168
涂料桶	不详		/
玻璃	不详		/
总计			

注：土方总量是根据民用建筑的数据得来的