APPENDIX 3, PART I (B/P)

Frameworks of the Study

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APPENDIX 3 FRAMEWORK OF THE STUDY

3.1 Population Projection of Skopje City

Table 3.1 Population Change of Skopje City

		table 3.1				copje Cit			
Municipality	Town	1948	1953	1961	1971	1981	1991	1994	2002
Skopje	all	35,555	42,995	96,553	25,514	442,606	414,990	475,902	502,665
Gazi Baba	all	6,974	9,291	12,690	5,833	64,042	61,161	67,664	72,222
	Bulacani	1,004	1,074	966	943	1,033	1,063	1,080	1,104
	Idrizovo	434	875	1,166	1,562	2,292	1,751	1,789	1,589
	Indzikovo	217	314	1,067	×	×	×	×	3,343
	Jurumleri	542	637	1,057	1,246	2,061	3,256	3,326	2,983
	Kolonija Idrizovo	×	×	×	×	×	×	×	451
	Madzari	996	1,589	3,246	×	×	×	×	12,874
	Naselba Goce Delcev	×	×	×	×	×	×	×	1,405
	Rastak	573	578	468	376	463	435	408	367
	Singelic	882	1,095	1,399	×	×	×	×	23,915
	Skopje - Gazi Baba	×	×	×	×	56,064	52,728	58,458	15,182
	Smiljkovci	×	×	×	×	×	×	×	345
	Stajkovci	327	359	500	×	×	×	×	3,532
	Stracinci	466	500	541	526	650	332	1,038	1,185
	Trubarevo	410	1,047	1,078	×	×	×	×	2,669
	Cresevo	1,123	1,223	1,202	1,180	1,479	1,596	1,565	1,278
Gorce Petrov	all	5,378	7,177	10,969	2,302	2,056	538	1,507	41,490
	Volkovo in	409	524	715	×	×	×	×	6,750
	Gracani out	383	392	414	442	358	×	21	×
	Kuckovo out	1,336	1,394	1,220	927	608	302	249	138
	Nikistane out	606	652	618	704	793	×	1,010	1,114
	Novo Selo	317	355	919	×	×	×	×	8,349
	Orizari	373	469	456	×	×	×	×	15,637
	Orman out	210	215	205	229	297	236	227	461
	Skopje - Gorce Petrov	1,744	3,176	6,422	×	×	×	×	9,041
Karpos	all	2,389	2,769	5,048	0	100,826	97,161	102,409	59,810
Kaipos	Bardovci	614	689	1,079	×	×	× ×	× ×	1,472
	Vlae	243	278	492	×	×	×	×	6,809
	Gorno Nerezi	1,041	1,044	229	×	×	×	×	314
		303	533	2,889					12,418
	Dolno Nerezi			-	X	×	×	X	
	Zlokucani	188	225	359	X			X	1,635
1771. 371.	Skopje - Karpos	× 5 252	× 5.002	X 40 127	× 724	100,826	97,161	102,409	37,162
Kisela Voda	all	5,252	5,962	48,137	724	88,846	120,388	118,079	125,379
	Gorno Lisice	1,849	1,847	2,608	X	X	×	×	18,223
	Dolno Lisice	253	526	630	X	X	X	×	2,440
	Naselba Dracevo	×	×	×	X	X	X	×	10,605
	Selo Dracevo	2,747	3,094	3,482	X	×	X	×	8,641
	Skopje - Kisela Voda	×	×	40,473	×	87,792	119,158	116,877	84,625
	Usje	403	495	944	724	1,054	1,230	1,202	845
Centar	all	×	×	×	X	93,614	67,968	85,021	82,604
	centar	×	×	×	×	93,614	67,968	85,021	82,604
Cair	all	2,819	3,522	4,055	3,185	74,358	66,507	77,676	68,395
	Butel	×	373	903	×	×	×	×	14,005
	Vizbegovo	84	85	150	X	×	×	×	2,817
	Ljubanci	1,364	1,494	1,312	968	942	902	863	928
	Ljuboten	1,183	1,271	1,254	1,452	1,613	169	2,035	2,343
	Radisani	188	299	436	765	1,956	6,688	7,579	9,123
	Skopje Cair	×	×	×	×	69,847	58,748	67,199	39,179
Suto Orizari	all	157	185	365	0	0	0	0	17,357
	Gorno Orizari	157	185	365	×	×	×	×	454
	Dolno Orizari	×	×	×	×	×	×	×	1,550
	Skopje - Suto Orizari	×	×	×	×	×	×	×	15,353
Kondovo	all	4,235	4,849	5,334	5,988	7,872	235	9,840	11,155
	Gorno Svilare	271	284	313	358	505		600	712
	Dvorce	154	142	297	252	213		225	249
	Dolno Svilare	783	885	909	1,123	1,435	3	1,725	2,010
	Kondovo	331	368	451	797	1,857	137	2,890	3,384
	Radusa	929	1,580	1,212	1,565	1,781	5	1,824	1,892
	Rasce	1,474	1,590	1,450	1,581	1,814		2,363	2,697
	Rudnik Radusa	293		702	312	267	90	213	211

Municipality	Town	1948	1953	1961	1971	1981	1991	1994	2002
Saraj	all	8,351	9,240	9,955	7,482	10,992	1,032	13,706	24,253
	Arnaklija	358	348	385	517	699	4	935	1,077
	Bojane	1,128	1,207	1,195	1,306	1,579		1,910	2,230
	Bukovic	611	654	668	871	1,256	28	1,622	1,723
	Glumovo	506	574	700					1,683
	Greec	607	658	569	30	1,315	39	1,805	1
	Kopanica	877	926	941	1,042	1,192		1,478	1,714
	Krusopek	847	929	893	952	1,277	6	1,642	1,902
	Laskarci	585	624	709	762	990	5	1,083	1,190
	Ljubin	153	143	247	374	1,230	947	1,617	2,044
	Matka	423	513	433					468
	Panicari	206	225	240	282	292		271	261
	Raovic	341	377	328	319	244		284	213
	Saraj	327	565	1,015					5,232
	Semeniste	399	410	404	492	408	3	479	559
	Cajlane	443	469	552	535	510		580	580
	Sisevo	540	618	676	·				3,376

Source: State Statistical Office

Table 3.2 Population of Skopje City

Table 3.2 Topulation of Skopje City							
	From	Projection by					
Municipality	Area(km ²)	Population	ST(pop.)				
	(20	05)	(2006)				
Aerodrom	21.85	72,009					
Butel	54.79	36,154					
Gazi Baba	110.86	72,617	74,854				
Gorce Petrov	66.93	41,634	41,084				
Karpos	35.21	59,666	60,089				
Kisela Voda	34.24	57,236					
Centar	7.52	45,412					
Cair	3.52	64,773	Remains				
Suto Orizari	7.48	22,017	(309187)				
Saraj	229.06	35,408	36,973				
Total	571.46	506,926	522,187				

Note 1: Official number announced by Ministry of Local Government is based on 2002 Census (502,665) plus population in two development areas of 4261.
2: Population projection by Statistic Office is based on the 0.074% annual increase.

ST: Statistic Office

^{3:} MLSG: Ministry of Local Self Government

Table 3.3 Population in Sewer Districts

	1401	23.5 T Opui	ation in Sew	CI Districts		
Municipality	Village	Census	Projecti	on by Statistic	Office	Remarks
Municipanty	Village	2002	2006	2020	2030	Kemarks
Centra	l Sewer District					
Aerodrom		69,569	71,697	80,200	86,900	
	Gorno Lisice	18,223				
	Aerodrom	51,346				
Butel		25,945	26,785	29,900	32,400	
	Butel	14,005				
	Vizbegovo	2,817				
	Radisani	9,123				
Gazi Baba		58,846	60,752	67,900	73,500	
	Indzikovo	3,343				
	Madzari	12,874				
	Singelic	23,915				
	Skopje - Gazi Baba	15,182				
	Stajkovci	3,532				
Gorce Petrov		33,027	34,097	38,100	41,300	
	Orizari	15,637				
	Skopje - Gorce Petrov	9,041				
	Novo Selo	8,349				
Karpos		59,352	59,775	66,800	72,300	
Kisela Voda		43,315	44,718	58,000	62,800	
	K.Voda	37,990	39,221	50,480	54,640	Note (1)
	Sopiste	5,325	5,497	7,520	8,160	Note (1) Outside of Skopje
	Soncev Grad	0	0	6,000	6,000	Outside of Skopje
Centar		45,412	46,883	52,400	56,700	
Cair		64,773	66,871	74,800	81,000	
Suto Orizari		22,017	22,730	25,400	27,500	
	Sub-total	422,256	434,307	499,500	540,400	
Saraj	Sewer District	35,408	38,628	52,500	62,820	Note (2)
North Gorce	Petrov Sewer District	8,405	9,800	13,200	16,100	Note (3)
Dracev	o Sewer District	34,551	35,670	39,900	43,200	Including outside of Skopje
	合 計	500,620	518,405	605,100	662,520	

Note:

(1) Figures in Italic: Breakdown by the study team

(2) Source: Saraj Municipality(3) Source: Gorce Petrov Municipality

Source: Vodovod except Saraj Sewer District and North Gorce Petrov Sewer District

 Table 3.4
 Population in Dracevo Sewer District

Municipality		Town	Census	Projection		
Mulli	странту	TOWII	2002	2006	2020	2030
	Kisela Voda	Naselba Dracevo	10,605	10,948	12,250	13,260
Inside of	Kiseia voda	Selo Dracevo	8,641	8,921	9,970	10,800
Skopje City	Aerodrom	Dolno Lisice	2,440	2,519	2,830	3,050
		Sub-total	21,686	22,388	25,050	27,110
		Studenicani	5,786	5,974	6,680	7,240
Outs	side of	Morani	1,715	1,771	1.980	2,140
Skopje City		Batinci	5,364	5,537	6,190	6,710
		Sub-total	12,865	13,282	14,850	16,090
	Total		34,551	35,670	39,900	43,200

Note: Figures in *Italic*: Breakdown by the study team

Source: Vodovod

Table 3.5 Population Projection (Basic Plan Area)

1 y ,						
N	laster Plan		General Urban Plan of Skopje			
Munici-parity	(1998)	(2020)	Munici-parity	(1994)	(2010)	(2020)
Gazi Baba	58,000	68,000	Gazi Baba	42,895	49276	53581
Gorce Petrov	26,000	30,000	Gorce Petrov	29,495	30795	31627
Karpos	58,000	68,000	Karpos	54,927	56148	56927
Kisela Voda	110,000	129,000	Kisela Voda	107,505	113143	116645
Centar	85,000	99,000	Centar	85,021	93012	98499
Cair	50,000	59,000	Cair	54,514	64581	70812
Suto Orizari	14,000	16,000	Suto Orizari	13,044	17849	21473
Sub-total	401,000	469,000	Saraj	7596	8241	9333
	Future urban	area	Total	394,997	433,045	458,897
Saraj etc.	50,400	76,200		•		
Total	451,400	545,200]			

Note 1: Increase rate/year from census 1981 – 1994: 0.56%

2: Increase rate/year applied for Master Plan existing urban area: 0.8%, future development area: 2.0% 3: Increase rate/year applied for GUP 1994 – 2010: 0.58%, 2010-2020: 0.58%

3.2 **Per Capita Domestic Sewage Generation**

Table 3.6 Population and Its Ratio Served by Water Supply

No	Municiparity	Population	Population served	Service ratio
1	Aerodrom	72,009	72,009	100%
2	Butel	36,154	32,883	91%
3	Gazi Baba	72,617	61,966	85%
4	Gorce Petrov	41,634	40,382	97%
5	Karpos	59,666	59,352	99%
6	Kisela Voda	57,236	57,236	100%
7	Saraj	35,408	30,731	87%
8	Centar	45,412	45,412	100%
9	Cair	64,773	64,773	100%
10	Suto Orizari	22,017	21,563	98%
Тс	otal of Skopje	506,926	486,307	96%
11	Sopiste	5,656	2,282	40%
12	Studenicani	17,246	12,865	75%
Tot	al of Outside	22,902	15,147	66%
(Grand Total	529,828	501,454	95%

Source: Vodovod

Table 3.7 Unit Pollution Loading of Domestic Sewage

(g/person-day)

	1	1		1	(g/person-day)
	Data No.	Item	BOD	SS	Data Source
		Excreta	11.4	8.7	
Thailand	1	Gray Water	41.9	16.6	
		Total	53.4	25.3	
		Excreta	10.5		
	1	Gray Water	30.4~14.2		
Indonesia		Total	40.9~24.7		
indonesia		Excreta	11.2		
	2	Gray Water	32.7~15.6		
		Total	43.9~26.8		
India	1	Total	30~45		Duncan Mara
Iliula	2	Total	35		D.A. Okun and G. Ponghis
	1	Excreta	18	20	Japan Sewerage Works
Japan		Gray Water	40	25	Association
		Total	58	45	Association
Zambia	1	Total	36		Duncan Mara
Kenya	1	Total			Duncan Mara
Uganda	1	Total	63	43	D.A. Okun and G. Ponghis
Brazil	1	Total		75	D.A. Okun and G. Ponghis
Biazii	2	Total	44		WHO
Developing Countries	1	Total	45		WHO
Rural Towns in France	1	Total	23~34		Duncan Mara
United Vinadom	1	Total	50~59		Duncan Mara
United Kingdom	2	Total	59	62	D.A. Okun and G. Ponghis
	1	Total	45~78		Duncan Mara
United States of America		Excreta	16.7	27.0	Design Manual - Onsite
Office States of Afficience	2	Gray Water	28.5	17.2	Wastewater Treatment and
		Total	45.2	42.2	Disposal System

Source: JICA Report

3.3 Estimation of Industrial Wastewater Generation and Quality at Present

Estimation of industrial wastewater generation is very difficult because there is no actual data on generation either in factories/enterprises or in supervising office. The Study team estimated it by using various methods.

Sewerage M/P estimated industrial pollution load to be approximately $40,000 \text{ m}^3/\text{d}$ in 1998 and expected it to increase to $53,000 \text{ m}^3/\text{d}$ in 2020.

Vodovod's water supply data indicates that industrial production index increased by 13.5 % in 2006 compared to that in 2002. However, water supply for these enterprises has been decreasing every year. The water supplied to these enterprises was $34,279 \text{ m}^3/\text{d}$ in 2002 which decreased to $26,293 \text{ m}^3/\text{d}$ in 2006.

To collect the information on actual conditions, the surveys of industries and sewage outlets along with the Industrial Survey were conducted in this Project. The Study team estimated industrial wastewater generation on the basis of the results of these surveys.

3.3.1 Industrial Survey

The Study Team carried out industrial survey in December 2007. For this purpose, fifty (50) factories/industries were selected as the target installations (the locations of selected installations are shown in Figure 3.1).

The target installations were selected referring to the followings.

- Enterprises selected under the Study on Sewerage Development Plan in Skopje in 1999 (Sewerage M/P)
- Cadastre of polluters prepared by MEPP (Ministry of Environment and Physical Planning) after the similar survey in 2003
- Enterprises listed under IPPC system by MEPP
- Other installations

Among these references, the enterprises that consume relatively large amount of water were also considered while selection of target enterprises for this survey. Forty two (42) installations are listed as category A and thirteen (13) installations as Category B under IPPC system in Skopje city. Of these; twenty (20) installations of category A and thirteen (13) installations of category B are included as selected target installations for this survey. Types of installations and their scale for category A and category B are listed in Appendix Part I, 3.5 and NACE (Nomenclature des Activities Economiques) code is shown in Appendix Part I, 3.6.

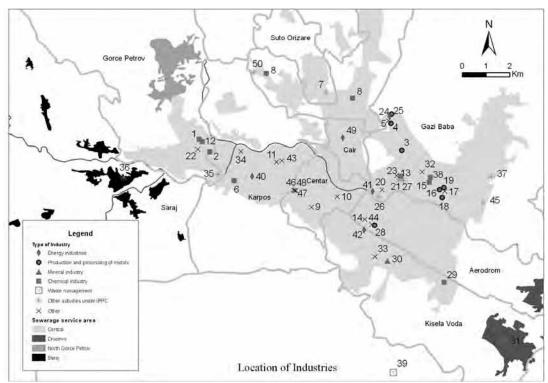


Figure 3.1 Locations of 50 Installations Surveyed

The results of survey are presented and discussed below. Large installations such as steel processing and chemical companies need large amount of water for their processes and therefore depend on their own sources rather than depending on water supply by Vodovod.

(1) Water consumption by source

Total water consumption is 17,878,505 m³/y. Sources of water for these installations are categorized as water supply from Vodovod (WSS in Figure Figure 3.2), own wells and others (Rasche spring). Of the surveyed installations, 16% are using water from Vodovod supply, 19% use water of their own well, and 65 % are using water of other categories such as Rasche spring (Figure 3.2).

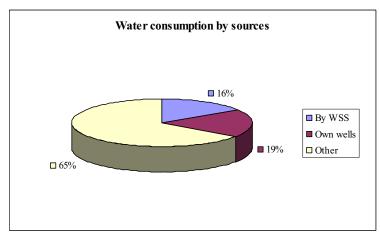


Figure 3.2 Water Consumption by Source

Of the total surveyed installations, about 88% (44 industries) depend on water supply from Vodovod. Komuna AD (paper producing industry) and Drisla (Waste disposal landfill), which are out of Vodovod' water service area, and also MIDA (car washing) use water from their own wells.

Arcelormittal, Makstil, Energetika – ELEM, and Skopski Leguri, the former steel manufacturing complex, are supplied water for their uses directly from Rasche spring. Skopski Leguri is also supplied water by Vodovod.

(2) Water consumption by purpose

The purposes for which these industries use water include production (55%), cooling (30%), sanitary (13%), cleaning (2%) and other (less than 1%) (Figure 3.3).

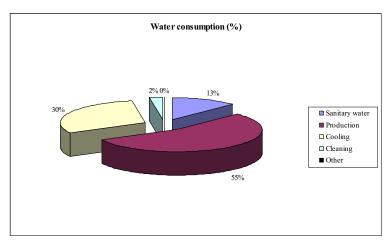


Figure 3.3 Water Consumption by Purpose

(3) Water consumption by type of industry

Table 3.8 Water Consumption by Type of Industry

Type of Industry	Water Consumption (m³/year)	Rate of Water Consumption (%)
Energy Industries	665,491	4
Production and Processing of Metals	11,654,602	66
Mineral Industry	395,000	2
Chemical Industry	2,552,601	14
Waste Management	9,025	0
Other Activities under IPPC (Food, Paper Industry)	1,466,817	8
Other (Services)	1,134,969	6
Total	17,878,505	100

Metals Production and processing industries are the maximum water consuming industries in Skopje. Out of the total water used by surveyed 50 installations, more than 66% is used by only seven metal producing and processing plants (Figure 3.4). It is because 11,351,653 m³/y (64% of total consumption of 50 surveyed installations) is consumed by former steel manufacturing complex including Arcelormittal, Makstil, and Skopski Leguri.

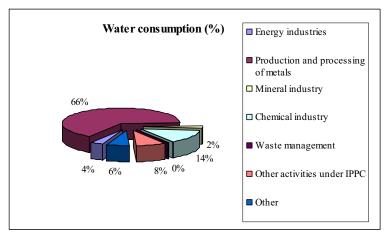


Figure 3.4 Water Consumption by Type of Industry

(4) Wastewater generation and ratio of wastewater generation Wastewater generation from surveyed installations based on their types is presented in Table 3.9, for details "Industrial Survey Report" may be referred.

Table 3.9 Wastewater Generation by Type of Industry and Ratio of Wastewater Generation

Type of Industry	Wastewater Generation (m ³ /y)	Ratio of Wastewater Generation (%)
Energy Industries	100,841	1
Production and Processing of Metals	5,856,897	59
Mineral Industry	368,000	4
Chemical Industry	1,295,777	13
Waste Management	34,254	13
Other Activities under IPPC (Food, Paper Industry)	1,280,821	10
Other (Services)	1,037,429	0
Total	9,974,019	100

Total wastewater generation from surveyed industries is 9,974,019 m³/y. Of this, the wastewater from production and processing of metals contributes 59 % (Figure 3.5). This is due to the reason that 56 % of total wastewater generation from 50 surveyed installations is contributed by former steel manufacturing complex including Arcelormittal, Makstil, and Skopski Leguri.

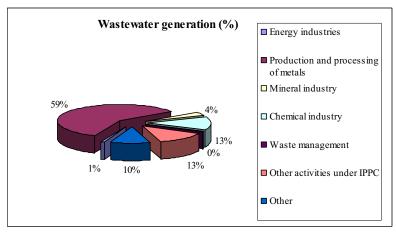


Figure 3.5 Wastewater Generation Ratio by Type of Industry

(5) Wastewater generation ratio by purpose

Percentage of wastewater generated from different purposes of water use is illustrated in Figure 3.6. As can be observed in Figure 3.6, wastewater generation from production units is the highest (59 %), that from sanitary uses (20 %) comes the next and that from cooling purposes contributes 18 %.

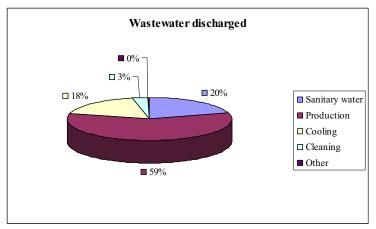


Figure 3.6 Wastewater Generation by Purpose

(6) The ratio of wastewater generation to water consumption by type of industry Figure 3.7 shows the ratio of wastewater generation to water consumption by type of industries using values from Table 3.8 and Table 3.9.

Table 3.10 Wastewater Generation Ratio (Wastewater Generation/Water Consumption %)

	(, , , , , , , , , , , , , , , , , , ,		
Type of Industry	Water Consumption (m³/year)	Wastewater Generation (m³/year)	Wastewater Generation Ratio (%)
Energy Industries	665,491	100,841	15
Production and Processing of Metals	11,654,602	5,856,897	50
Mineral Industry	395,000	368,000	93
Chemical Industry	2,552,601	1,295,777	51
Waste Management	9,025	34,254	380 ^{Note1}
Other Activities under IPPC (Food, Paper Industry)	1,466,817	1,280,821	87
Other (Services)	1,134,969	1,037,429	91
Total	17,878,505	9,974,019	

Note1: Waste disposal site, including leachate

Table 3.10 indicates that among surveyed installations, wastewater generation ratios of energy industries, metal production and processing industries, and chemical industry are relatively lower and those of mineral industry, food industry, paper processing industry and services industries are high.

The average wastewater generation ratio to water consumption is 65 %, excluding the case of waste disposal site.

(7) Wastewater generation and load by Industrial Survey

The data of water quality of industrial effluents is necessary to estimate the current pollution load from industrial sector. However, continuous monitoring record of such data for these industries based on their own sampling and analysis, or even in MEPP central laboratory is not available sufficiently until now. Even if some data are available in MEPP information center, these include information on only some of the general parameters such as pH, COD, SS, NO₃-N, NO₂-N, PO₄, BOD, etc., and heavy metals such as Fe, Mn, Cr, etc. Also, even for these parameters, the levels of recorded values of BOD seem to be too low, if compared to similar cases in Japan. In addition, the reliability of analysis results of other parameters seems to be suspicious.

The Study Team estimated industrial wastewater quality of each surveyed installations by referring to the followings.

- 1) IPPS method (The Industrial Pollution Projection System): This method is normally used by the WB to estimate the levels of BOD, SS and toxic pollution intensity based on the type of industry under ISIC (International Standard of Industrial Classification), amount of generated wastewater, and the number of employees. (Refer to Appendix Part I, 3.7 for estimation of pollutants load by this method)
- 2) Existing analysis results (Refer to "Industrial Survey Report")
- 3) Editorial Committee of Pollution Prevention Techniques and Laws; Table 1.7 to 1.11, Revision 5th of Pollution Prevention Techniques and Laws, Water Quality, for a series of lectures for qualifying pollution controller, 1995 (Refer to Appendix Part I, 3.8)
- 4) List of raw materials, chemicals, etc. in the industrial survey
- 5) Analysis experiences in Japan. BOD level in metal processing industry is ignored in 3); however, anti-erosion, surfactant, etc. are measured as BOD.

On the basis of the result, 1) was evaluated to be inappropriate because calculated BOD level is too low even in case of food industries. As a principle, in case when there are some analysis results, after the comparison of the maximum level and 3), a figure is estimated. In case when there is no data, a figure is estimated with comprehensive considerations of 3) to 5). Detailed estimation process is explained in Appendix Part I, 3.9.

However, it is important to mention here that classification of industry by NACE being used in Macedonia is not always the same as the classification by ISIC or that of 3). Also, all raw materials and chemicals are not completely declared and all information of products is not completely included in this Survey.

Table 3.11 includes the summary of current pollution load of fifty (50) surveyed installations in terms of BOD and SS estimated by the quantity of generated wastewater and using estimations of quality as mentioned above. Table 3.11 shows the ratio of pollution loads by type of industries.

Table 3.11 Current Pollution Load Estimation of 50 Surveyed Industries

Type of Industry	Wastewater Generation (m³/d) *	BOD Load (kg/d)	SS Load (kg/d)
Energy Industries	380	31	94
Production and Processing of Metals	16,199	735	3,936
Mineral Industry	1,008	30	202
Chemical Industry	4,044	1,006	614
Waste Management	94	5.6	11
Other Activities under IPPC (Food, Paper Industry)	3,751	1,821	1,679
Other (Services)	2,988	407	910
Total	28,464	4,039	7,447

* Annual wastewater generation/ operation days of each installation. Calculation of daily and hourly peaks of wastewater generation of each installation needs detailed data processing by water consumption using records of many years of each installation. However, it is impossible to do it due to lack of time and data of each installations. Therefore, the Study Team only calculated daily and hourly wastewater generation of each installation from the Industrial Survey. (Refer to Appendix Part I, 3.12) Regarding the seasonal fluctuation, only five (5) installations answered that they hope to discharge their wastewater into sewer in the future. As a result, it was ignored because their ratio to total amount of wastewater generation from fifty (50) is only 0.2 %, although there will be hourly, daily and seasonal fluctuations. Grasping and supervision of the operations of each installation is the key in IPPC system; the data will be gathered gradually from 2008 with financial resources.

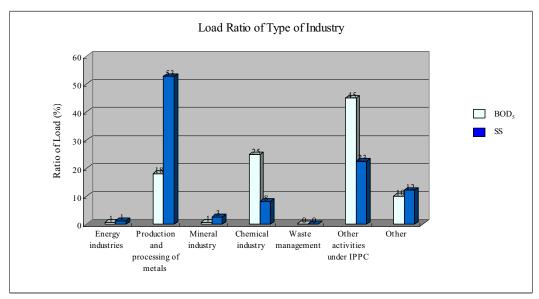


Figure 3.7 Load Ratio by Type of Industry

In Figure 3.7 it is observed that BOD load ratio is high in food industry and paper processing industry among other activities under IPPC (45 %), and chemical industry (25 %). On the other hand, SS load ratio is high in production and processing industries of metals (53 %), and in other activities under IPPC (23 %).

3.3.2 Wastewater Outlet Survey

The Study team firstly confirmed the locations and wastewater discharge quantities of approximately fifty (50) outlets through visual survey (Refer to Appendix Part I, 2.9). After that, the outlets with large amount of wastewater discharge and fairly bad water quality were selected based on the information of Vodovod's water quality laboratory that has been analyzing water quality of major outlets every month. Among the selected outlets, one is the private outlet of Arcelomittal Steel, Makstil, Skopski Leguri and Energetika Elem. Also, a major main sewer on the left bank of the Vardar River, including industrial wastewater from beer and food installations is selected.

The amount of industrial wastewater discharge from Arcelomittal Steel, Makstil, Skopski Leguri and Energetika Elem was calculated to be approximately $0.9~\text{m}^3/\text{sec}$ (approximately $80,000~\text{m}^3/\text{d}$) on the basis of two times survey including 24 hours' continuous measurement, although self-declaration was $15,625~\text{m}_3/\text{d}$ of wastewater discharge. According to Vodovod, this amount is almost the same as the direct water supply from Rasche spring. Rasche spring is the common water supply source of Vodovod but direct supply is out of Vodovod's scope.

3.3.3 Estimation of Current Industrial Wastewater Generation (Correction of the Result of the Industrial Survey)

Total wastewater generation from the 50 installations surveyed was $28,464 \text{ m}^3/\text{d}$. Taking into consideration that the values of industrial wastewater generation gathered from the Industrial Survey is expected to cover 65 % of the wastewater generation of the entire installations within the City. Accordingly, wastewater generation excluding the one from the four steel related companies was estimated $24,300 \text{ m}^3/\text{d}$.

Although the detail estimation process is shown in Appendix Part I, 3.12, the outline of the calculation is as following.

- (1) Total industrial wastewater generation from the Industrial Survey: 28,464 m³/d
- (2) Assuming the amount above is equivalent to 65 % of the total industrial wastewater generation: total generation is $43,791 \text{ m}^3/\text{d}$
- (3) Industrial wastewater generation by self-declaration of the six enterprises: 19,494 m³/d
- (4) Industrial wastewater generation excluding those of the above two enterprises: 24,296 m³/d

3.3.4 Estimation of Current Average Industrial Wastewater Quality for the Estimation of Pollution Load to Sewer in Future

The Study Team estimated that the current average industrial wastewater quality is 209 mg/l of BOD and 355 mg/l of SS, excluding the six specified industries Arcelormittal, MakStill, Skopski Leguri, Energetika Elem, OhisAD, Pivara) that have plan to discharge their wastewater directly to Vardar River after treating by their own treatment plants in future.

Although the detail estimation process is shown in Appendix Part I, 3.11, the outline of the calculation is listed as follows.

- (1) Industrial wastewater generation excluding those of the six enterprises that have plan to discharge their wastewater directly to Vardar River after treating by their own treatment plants in future: 8.970 m³/d
- (2) Current BOD level excluding that of the six enterprises that have plan to discharge their wastewater directly to Vardar River after treating by their own treatment plants: 1,874 kg/d
- (3) Current SS level excluding that of the six enterprises that have plan to discharge their wastewater directly to Vardar River after treating by their own treatment plants: 3,185 kg/d
- (4) From the above, current BOD and SS levels are calculated as 209 mg/l and 355 mg/l, respectively.

3.4 Estimation of Industrial Wastewater Generation and Quality in Future

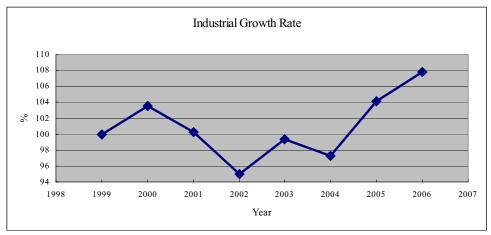
3.4.1 Industrial Growth Rate

In order to estimate the future industrial wastewater generation, it is required to consider industrial growth rate. However, official long-term estimation of industrial growth rate is not available.

In the four year plan (Program of the Government 2006-2010) by the prime minister's office, high value of annual growth rate of 6 - 8 % is presented.

National Development Plan (2007-2009), three year's investment plan, by Ministry of Finance does not mention the current value of growth rate. Although, values of growth rate in past have been described in the Report. It could be said that Macedonian economy is growing positively since 1996 after the initial transition-induced recession. The growth rate has been rather poor between 1996 and 2003. The growth has been increasing since 2004 and about 4% annual growth rate was experienced in 2005.

According to the industrial growth rate (Refer to Figure 3.8), in last few years, the minimum growth was experienced in 2002 and it increased by 13 % (annual average of 3.25 %) from the year 2002 to 2006.



Source: Statistical Review: Industry and Energy, Industry 2001-2006, Republic of Macedonia State Statistics Office, June 2007

Figure 3.8 Industrial Growth Rate by Year

Considering these points, the Study Team assumed the annual industrial growth rate of 3.5 % until year 2020 and the same rate of increase was considered for increase of industrial wastewater generation.

3.4.2 Future Industrial Wastewater Generation to Sewer

In addition, reduction of water consumption and improvement in water quality by the activities of CP (Cleaner Production) was assumed as 15 % and 20 %, respectively until year 2020. Consequently, wastewater generation, the levels of BOD and SS were calculated to be approximately 24,300 m³/d, 167 and 284 mg/l, respectively. Accordingly, the industrial wastewater loads to sewer in year 2020 were computed to be approximately 5,399 and 9,175 kg/d.

Although the detail estimation process is shown in Appendix Part I, 3.12, the outline of the calculation is listed as the followings.

- (1) Industrial wastewater generation excluding those of the six enterprises that have plan to discharge their wastewater to sewer in future: 24,296 m³/d
- (2) Increase in ratio of industrial wastewater generation from 2007 to 2020: 156 % of the current generation (Assuming 3.5 % of annual increase)
- (3) Estimated industrial wastewater generation in 2020: 37,999 m³/d
- (4) Expected decrease in industrial wastewater generation by CP: 15%
- (5) Accordingly, estimated industrial wastewater generation in 2020: 32,299 m³/d
- (6) Current levels of BOD and SS of the enterprises that have plan to discharge their wastewater to sewer in future: BOD 209 mg/l, SS 355 mg/l
- (7) Expected improvement in industrial wastewater quality by CP: 20 %
- (8) Accordingly, BOD 167 mg/l, SS 284 mg/l in 2020
- (9) Consequently, BOD and SS load is calculated as 5,399 kg/d, 9,175 kg/d, respectively.

3.4.3 Receiving Industrial Wastewater to Sewer and Self-treatment

Surveyed fifty (50) installations were classified into two categories. In one of these categories, the effluent from installations can be accepted in public sewerage system with pre-treatment if required and for other category, the enterprises would be required to have its own treatment plant and treated effluent could be discharged directly to Vardar River. Six (6) enterprises were considered to be under later category that can discharge treated industrial effluent directly to Vardar River.

• Enterprises that have their own treatment plants at present or have a plan to construct one in future and want to discharge directly into Vardar River: Ohis AD (No.29 in the Industrial Survey-Refer to Appendix 2.9) that has self treatment plant at present. However, considering the actual data (CODMn: 220 mg/l), estimated BOD of 100 mg/l and 80 mg/l of SS, rehabilitation will be necessary. Another one is Pivara. (No. 27 in the Industrial Survey in

- Appendix 2.9) which has a plan to construct its own treatment plant to discharge effluent directly to Vardar River.
- Installations that discharge large amount of industrial wastewater with little organic matter content in the effluent: Arcelormittal, Makstil, Skopski Leguri, Energetika Elem (steel production related enterprises) want to discharge their industrial wastewater to public sewerage system and are willing to pay for sewerage services. However, industrial wastewater generated from these four (4) factories contributes 55 % of total discharge of fifty (50) surveyed installations. According to the actual wastewater discharge survey, those two factories discharge approximately 88, 000 m³/d. This amount is equivalent to more than 80 % of the total municipal wastewater generation. Estimated BOD is relatively low, 45 mg/l, and their industrial wastewater should be considered as inorganic one with low concentration of organic matters. Even if they construct pre-treatment facilities, it will not be appropriate to allow the effluents from these factories to flow into public sewerage system because this will result into extremely low level of BOD in inflow to the municipal WWTP (wastewater treatment plant) causing deterioration of WWTP treatment performance and increased flow will certainly increase the capacity and cost of WWTP.

Although more accurate data is necessary to arrive at any final conclusion, considering both quality and quantity of wastewater from surveyed installations, which is very limited but only available data now, the Study Team concluded that it would be possible for municipal WWTP to accept industrial wastewater from surveyed installations, except the six (6) specified factories, with necessary pre-treatment¹.

3.4.4 Estimation of Discharge Load to Vardar River with and without Sewage and Industrial Wastewater Treatment

Table 3.13 shows the result of load estimation based on the assumptions listed in Table 3.12. The detail on calculation and result is included in Appendix Part I, 3.11 to 3.13 "Load estimation to sewage treatment plant and environment".

Table 3.12 Assumptions in Load Estimation to the River

Present load	Discharge amount by steel related industries (Arcelormittal Steel, Makstil, Skopski Leguri, Energetika Elem)	$0.935 \mathrm{m}^3/\mathrm{s}$
	Increase of the four steel related industries	No increase because the current operation is almost 100 %.
Load in year	Decrease of wastewater generation of the four steel related industries by CP, etc,	5% compared to the present time
	Water quality improvement of the four steel related industries by CP, etc.	10 % compared to the present time
2020	Wastewater generation from other industries	3.5 % annually
	Decrease of generated wastewater from other industries by CP, etc,	15% compared to the present time
	Water quality improvement of other industries by CP, etc.	20 % compared to the present time
	Increase of the four steel related industries	No increase because the current operation is almost 100 %.
	Decrease of wastewater generation of the four steel related industries by CP, etc,	10 % compared to the present time
Load in Year	Water quality improvement of the four steel related industries by CP, etc.	15 % compared to the present time
2030	Wastewater generation of other industries	3.5 % annually
	Decrease of wastewater generation of other industries by CP, etc,	35% compared to the present time
	Water quality improvement of other industries by CP, etc.	35 % compared to the present time

¹ PE can regulate the discharge criteria to sewer; however; the criteria of the toxic parameters which can not be removed by sewage treatment plant which mainly can treat organic matters in terms of BOD, like heavy metals, should be the same as the discharge criteria from sewage treatment plant.

Table 3.13 Estimated Load by Industrial Wastewater to Vardar River (kg/d)

	Tubic cole Estimated Estat by Industrial (Case Cole Case Case Case Case Case Case Case Cas			o	
		Without Treatment		With Treatment**	
		BOD	SS	BOD	SS
	The two steel related industries	3,660	20,066		
Present	Privala and Ohis AD	1,457	381		
	Others	5,077	8,627		
	Total of present load	10,194	29,074	0	0
In 2020	The two steel related industries	3,130	17,157	1,919	2,686
	Privala and Ohis AD	1,550	405	129	180
	Others*	5,399	9,175	807	1,130
	Total load in 2020	10,078	26,736	2,855	3,997
In 2030	The two steel related industries	2,800	15,351	1,818	2,545
	Privala and Ohis AD	1,358	355	139	194
	Others*	4,732	8,041	871	1,219
	Total load in 2030	8,890	23,747	2,827	3,958

^{*} Installations acceptable to sewer

Although the detail estimation process is indicated in Appendix Part I, 3.11 to 3.13, the outline of the calculation is listed as follows.

- (1) The calculation process of the installations (sewer discharge), excluding the four steel installations and Privevala and Ohis AD is in accordance with the one in 3.4.2.
- (2) Regarding the industrial wastewater generation from the two steel related installations of which industrial wastewater will be discharged directly to Vardar River after their own treatment, actually measured figure of 0.935 m³/sec (80,784 m³/d) is used.
- (3) The estimated current water quality of BOD and SS of 45 mg/l and 248 mg/l of the four steel related installations are used to compute the future water quality in accordance with the process in 3.4.2.
- (4) As for the computation of the future industrial wastewater and quality of Privala and Ohis AD, the current average industrial wastewater generation in Industrial Survey and wastewater quality estimation is used. Average industrial wastewater of the two installations is 3,869 m³/d and estimated average water quality of BOD and SS are 379 mg/l and 98 mg/l, respectively.
- (5) The current and future loads are computed in accordance with the process in 3.4.2

^{**} Tentative discharge criteria. BOD 25 mg/l, SS 35 mg/l (EU Guidline)

CP (Cleaner Production)

CP is the key factor of IPPC and BAT system. Its adoption will be spread to enterprises with the progress of IPPC implementation. The spread of the system is the matter of Macedonian side. The Study Team proposes the establishment of financial resources. EU has been focusing on spread of the concepts of IPPC and BAT. There are some studies on CP in cement industry, etc. without detailed specifications of the facilities and there is no case of implementation of it with financial assistance. The implementation will require selection of a model installation, input of experts with fair time to invest in the current installations within the enterprise, and financial assistance. The Study Team considered such implementation impossible within this study period and only shall concentrate on introduction of examples of simple CP through seminar and workshop and assistance of preparation of examples of operation and maintenance of existing wastewater treatment plants, if the situation allows. MEPP has such ideas as financial assistance for imported wastewater treatment plants with tax reduction; however, it is not materialized because this is the matter of the Government's decision. However, environmental issue is the key point for Macedonia to join EU and Article 174 Purpose of Funds states that the Government shall provide financial assistance to CP. Hence, the Study Team expects that implementation of CP will be proceeded, if the financial assistance system is once established.

The reasons why the decrease rate of wastewater generation and water quality are different in Table 3.12 from the type of industry and the year are based on the following assumptions.

- (1) The steel related enterprises have been promoting water recirculation. This is reason that the decrease rate is set smaller than those of other enterprises.
- (2) Sewerage M/P states that 30 to 40 % of the pollution load reduction will be possible from the EU's experiences by CP, etc., however, the Study Team considered it will be impossible in 2020 with the consideration that the new Law on water will be put in to practice in 2010.
- (3) As for other industries, the Study Team assumed the decease rates of wastewater generation and water quality of the other industries to be 15 % and 20 %, respectively, after estimation of wastewater generation in 2020 with the annual increase of wastewater generation of 3.5 %.
- (4) Food industry has not implemented water recirculation until now; however, the Study Team expects that the assumed figures will be realized as the total through the implementation of IPPC and BAT system in the target year.

3.5 Type of Industry to Classify A and B under IPPC

Based on Article 95 paragraph (1) and article 135 paragraph (5) of the Law on environment (Official Gazette of Republic of Macedonia no.53/05), the Government of the Republic of Macedonia adopted the following

DECREE

For determining the activities of the installations requiring an integrated environmental permit, i.e. adjustment permit with an adjustment plan and time schedule for submission of application for adjustment permit with an adjustment plans

Article 1

- (1) This Decree sets out/determines the activities of the new installations or the substantial changes of the existing installations, which can be carried out only when an integrated environmental permit, i.e. adjustment permit with an adjustment plan is issued by the competent authority, and sets out the time schedule for submission of application for issuing an adjustment permit with an adjustment plan.
- (2) This Decree does not cover the activities of installations or parts of installations used for research, development and testing of new products and processes

Article 2

The activities either involving a new installation or substantial changes to an existing installation which requires an A an integrated environmental permit is set out in Annex I of this Decree, which is part of this Decree.

Article 3

The activities either for a new installation or substantial changes to an existing installation which require a B integrated environmental permit are determined in Annex II of this Decree, which is part of this Decree.

Article 4

The threshold values given in Annex 1 and 2 of this Decree refer to production capacities and to capacities which are part of the production capacities. If one operator carries out several activities falling under a same industrial sector in the same installation or in the same site, the capacities of such activities are added together.

Article 5

- (1) Existing installations that carry out activities for which an A integrated environmental permit, i.e. B integrated environmental permit for installation in a protected area is issued, as well as existing installations for which a B integrated environmental permit is required, submit an application for adjustment permit with an adjustment plan to the competent authority, in a time period of 6 months determined for each industrial sector, as follows:
- 1. Installations set out/determined in:

```
Annex 1 item 2;
Annex 1 item 6.3;
Annex 2 item 2, and
Annex 2 item 6.3, of this Decree,
```

the application for issuing an adjustment permit with an adjustment plan from paragraph (1) of this article have to submit in the time period from 01.01.2006 until 01.07.2006.

2. Installations set out/determined in:

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Annex 1 item 1;
Annex 1 item 6.6 (a);
Annex 2 item 1, and
Annex 2 item 6.6 (a), of this Decree,
```

the application for issuing an adjustment permit with an adjustment plan from paragraph (1) of this article have to submit in the time period from 01.07.2006 until 31.12.2006.

3. Installations set out/determined in:

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Annex 1 item 3;
Annex 2 item 3, of this Decree,
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the application for issuing an adjustment permit with an adjustment plan from paragraph (1) of this article have to submit in the time period from 01.01.2007 until 01.07.2007.

4. Installations set out/determined in:

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Annex 1 item 4;
Annex 2 item 4, of this Decree,
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the application for issuing an adjustment permit with an adjustment plan from paragraph (1) of this article have to submit in the time period from 01.07.2007 until 31.12.2007.

5. Installations set out/determined in:

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Annex 1 item 6.1;
Annex 1 item 6.2;
Annex 1 item 6.4;
Annex 1 item 6.5;
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Annex 1 item 6.6 (b) and (c);
Annex 1 item 6.7;
Annex 1 item 6.8;
Annex 2 item 6.1;
Annex 2 item 6.2;
Annex 2 item 6.4;
Annex 2 item 6.5;
Annex 2 item 6.6 (b) and (c);
Annex 2 item 6.7 of this Decree,
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the application for issuing an adjustment permit with an adjustment plan from paragraph (1) of this article have to submit in the time period from 01.01.2008 until 01.07.2008.

6. Installations set out/determined in:

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Annex 1 item 5;
Annex 2 item 5, of this Decree,
```

the application for issuing an adjustment permit with an adjustment plan from paragraph (1) of this article have to submit in the time period from 01.07.2008 until 31.12.2008.

Article 6

This Decree enters into force the day after its publication in the "Official Gazette of Republic of Macedonia".

President of the Government of the Republic of Macedonia
Vlado Buckovski, PhD

ANNEX I Activities of Installations that Require A Integrated Environmental Permit

1. Energy industries

- 1.1. Combustion installations with a rated thermal input exceeding 50 MW
- 1.2. Mineral oil and gas refineries
- 1.3. Coal gasification and liquefaction plants

2. Production and processing of metals

- 2.1. Metal ore (including sulphide ore) roasting or sintering installations
- 2.2. Installations for the production of pig iron or steel (primary or secondary fusion) including continuous casting, with a capacity exceeding 2,5 tonnes per hour
- 2.3. Installations for the processing of ferrous metals:
 - (a) hot-rolling mills with a capacity exceeding 20 tonnes of crude steel per hour
- (b) smitheries with hammers the energy of which exceeds 50 kilo joule per hammer, where the calorific power used exceeds 20 MW
 - (c) application of protective fused metal coats with an input exceeding 2 tonnes of crude steel per hour
- 2.4. Ferrous metal foundries with a production capacity exceeding 20 tonnes per day
- 2.5. Installations
 - (a) for the production of non-ferrous crude metals from ore, concentrates or secondary raw materials by metallurgical, chemical or electrolytic processes
 - (b) for the smelting, including the alloyage, of non-ferrous metals, including recovered products, (refining, foundry casting, etc.) with a melting capacity exceeding 4 tonnes per day for lead and cadmium or 20 tonnes per day for all other metals
- 2.6. Installations for surface treatment of metals and plastic materials using an electrolytic or chemical process where the volume of the treatment vats exceeds 30 m³

3. Mineral industry

- 3.1. Installations for the production of cement clinker in rotary kilns with a production capacity exceeding 500 tonnes per day or lime in rotary kilns with a production capacity exceeding 50 tonnes per day or in other furnaces with a production capacity exceeding 50 tonnes per day
- 3.2. Installations for the manufacture of glass including glass fibre with a melting capacity exceeding 20 tonnes per day
- 3.3. Installations for melting mineral substances including the production of mineral fibres with a melting capacity exceeding 20 tonnes per day
- 3.4. Installations for the manufacture of ceramic products by firing, in particular roofing tiles, bricks, refractory bricks, tiles, stoneware or porcelain, with a production capacity exceeding 75 tonnes per day, and/or with a kiln capacity exceeding 4 m³ and with a setting density per kiln exceeding 300 kg/m³
- 3.5. Stationary asphalt bases.
- 3.6 Installations for the production of asbestos and the manufacture of asbestos-based products

4. Chemical industry

Production within the meaning of the categories of activities contained in this section means the production on an industrial scale by chemical processing of substances or groups of substances listed in Sections 4.1 to 4.6

- 4.1. Chemical installations for the production of basic organic chemicals, such as:
 - (a) simple hydrocarbons (linear or cyclic, saturated or unsaturated, aliphatic or aromatic)
 - (b) oxygen-containing hydrocarbons such as alcohols, aldehydes, ketones, carboxylic acids, esters, acetates, ethers, peroxides, epoxy resins
 - (c) sulphurous hydrocarbons
 - (d) nitrogenous hydrocarbons such as amines, amides, nitrous compounds, nitro compounds or

- nitrate compounds, nitrites, cyanates, isocyanates
- (e) phosphorus-containing hydrocarbons
- (f) halogenic hydrocarbons
- (g) organometallic compounds
- (h) basic plastic materials (polymers synthetic fibres and cellulose-based fibres)
- (i) synthetic rubbers
- (j) dyes and pigments
- (k) surface-active agents and surfactants
- 4.2. Chemical installations for the production of basic inorganic chemicals, such as:
 - (a) gases, such as ammonia, chlorine or hydrogen chloride, fluorine or hydrogen fluoride, carbon oxides, sulphur compounds, nitrogen oxides, hydrogen, sulphur dioxide, carbonyl chloride
 - (b) acids, such as chromic acid, hydrofluoric acid, phosphoric acid, nitric acid, hydrochloric acid, sulphuric acid, oleum, sulphurous acids
 - (c) bases, such as ammonium hydroxide, potassium hydroxide, sodium hydroxide
 - (d) salts, such as ammonium chloride, potassium chlorate, potassium carbonate, sodium carbonate, perborate, silver nitrate
 - (e) non-metals, metal oxides or other inorganic compounds such as calcium carbide, silicon, silicon carbide
- 4.3. Chemical installations for the production of phosphorous-, nitrogen- or potassium-based fertilizers (simple or compound fertilizers)
- 4.4. Chemical installations for the production of basic plant health products and of biocides
- 4.5. Installations using a chemical or biological process for the production of basic pharmaceutical products
- 4.6. Chemical installations for the production of explosives

5. Waste management

- 5.1. Installations for the disposal, incineration, burning or processing of hazardous waste
- 5.2. Installations for the disposal of hazardous waste with a capacity exceeding 500 kilograms per day
- 5.3. Installations for the incineration of municipal waste or other non-hazardous waste.
- 5.4. Installations for the disposal of communal or other non-hazardous waste, except quarry waste.
- 5.5 Installations for removing animal waste
- 5.6 Installations for mines waste management

6. Other activities

- 6.1. Installations for the production of:
 - (a) pulp from timber or other fibrous materials
 - (b) paper and board
- 6.2. Installations for the pre-treatment (operations such as washing, bleaching, mercerization) or dyeing of fibres or textiles where the treatment capacity exceeds 1 tonnes per day
- 6.3. Installations for the tanning of hides and skins where the treatment capacity exceeds 12 tonnes of finished products per day
- 6.4. (a) Slaughterhouses
 - (b) Treatment and processing intended for the production of food products from
 - animal raw materials (other than milk) with a finished product production capacity greater than 5 tonnes per day
 - vegetable raw materials with a finished product production capacity greater than 50 tonnes per day (average value on a quarterly basis)
 - vegetable oil with production capacity equal or greater than 50 tonnes per day
 - Beer production with production capacity equal or greater than 50 tonnes per day
 - (c) Treatment and processing of milk, the quantity of milk received being greater than 50 tonnes per day (average value on an annual basis)
- 6.5. Installations for the disposal or recycling of animal carcases and animal waste
- 6.6. Installations for the intensive rearing of poultry or pigs with more than:

- (a) 40 000 places for poultry
- (b) 2 000 places for production pigs (over 30 kg), or
- (c) 750 places for sows
- 6.7. Installations for the surface treatment of substances, objects or products using organic solvents, in particular for dressing, printing, coating, degreasing, waterproofing, sizing, painting, cleaning or impregnating, with a consumption capacity of more than 150 kg per hour or more than 200 tonnes per year
- 6.8. Installations for the production of carbon (hard-burnt coal) or electrographite by means of incineration or graphitization

ANNEX II

Activities of installations requiring B integrated environmental permit

1. Energy industries

1 installations with a rated thermal input exceeding 5 MW and less then 50 MW

2. Production and processing of metals

- 2.1. Installations for the processing of ferrous metals:
 - (a) application of protective fused metal coats, regardless of the input of crude steel per hour
- 2.2. Ferrous metal foundries
- 2.3. Installations for the smelting, including the alloyage, of non-ferrous metals, including recovered products, (refining, foundry casting, etc.) with a melting capacity of less than 4 tonnes per day for lead and cadmium, or less than 20 tonnes per day for all other metals
- 2.4. Installations for surface treatment of metals and plastic materials using an electrolytic or chemical process where the volume of the treatment vats exceeds less than 30 m³

3. Mineral industry

- 3.1. Installations for the production of cement clinker in rotary kilns with a production capacity not exceeding 500 tonnes per day or lime in rotary kilns or in other furnaces with a production capacity less than 50 tonnes per day.
- 3.2. Ouaries
- 3.3. Stationary ready mixed concrete plants with aggregate capacity of cement silos bigger than 50m3.
- 3.4. Installations for the production of glass including glass fibre with a melting capacity less than 20 tonnes per day
- 3.5. Installations for melting mineral substances including the production of mineral fibres with a melting capacity less than 20 tonnes per day
- 3.6. Installations for the manufacture of ceramic products by firing, in particular roofing tiles, bricks, refractory bricks, tiles, stoneware or porcelain, with a production capacity less than 75 tonnes per day.
- 3.7. Vapour glazing earthenware or clay with salts.

4. Chemical industry

4.1. Cutting polyurethane foams or polyurethane elastomers with heated wires.

5. Other activities

- 5.1. Installations for the pre-treatment (operations such as washing, bleaching, mercerization) or dyeing of fibres or textiles where the treatment capacity is less than 10 tonnes per day
- 5.2. Installations for the tanning of hides and skins where the treatment capacity is less than 12 tonnes of finished products per day
- 5.3. (a) Slaughterhouses with a carcase production less than 50 tonnes per day
 - (b) Treatment and processing intended for the production of food products from:
 - animal raw materials (other than milk) with a finished product production capacity less than 5 tonnes per day
 - vegetable raw materials with a finished product production capacity between 1 and 50 tonnes per day (average value on a quarterly basis)

- (c) Treatment and processing of milk, the quantity of milk received between 20 and 200 tonnes per day (average value on an annual basis)
 - 5.4. Installations for the disposal or recycling of animal carcases and animal waste.
 - 5.5. Installations for the intensive rearing of poultry or pigs with a capacity between:
- (a) 5000 and 40 000 places for poultry
- (b) 100 and 2 000 places for production pigs (over 30 kg), or
- (c) 50 and 750 places for sows
 - 5.6. Installations for the surface treatment of substances, objects or products using organic solvents, in particular for dressing, printing, coating, degreasing, waterproofing, sizing, painting, cleaning or impregnating, with a consumption capacity between 10 and 150 kg per hour

3.6 NACE Codes

Section A: Agriculture, hunting and forestry

- 01 : Agriculture, hunting and related service activities
 - 01.1: Growing of crops; market gardening; horticulture
 - 01.11: Growing of cereals and other crops n.e.c.
 - 01.12: Growing of vegetables, horticultural specialities and nursery products
 - 01.13: Growing of fruit, nuts, beverage and spice crops
 - 01.2 : Farming of animals
 - 01.21 : Farming of cattle, dairy farming
 - · 01.22: Farming of sheep, goats, horses, asses, mules and hinnies
 - 01.23: Farming of swine
 - 01.24 : Farming of poultry
 - · 01.25 : Other farming of animals
 - 01.3: Growing of crops combined with farming of animals (mixed farming)
 - · 01.30: Growing of crops combined with farming of animals (mixed farming)
 - 01.4: Agricultural and animal husbandry service activities, except veterinary activities
 - 01.41 : Agricultural service activities
 - 01.42: Animal husbandry service activities, except veterinary activities
 - 01.5: Hunting, trapping and game propagation, including related service activities
 - 01.50: Hunting, trapping and game propagation, including related service activities
- 02: Forestry, logging and related service activities
 - 02.0: Forestry, logging and related service activities
 - 02.01: Forestry and logging
 - 02.02: Forestry and logging related service activities

Section B : Fishing

- 05: Fishing, operation of fish hatcheries and fish farms; service activities incidental to fishing
 - . 05.0 : Fishing, operation of fish hatcheries and fish farms; service activities incidental to fishing
 - 05.01 : Fishing
 - 05.02 : Operation of fish hatcheries and fish farms

Section C: Mining and quarrying SubSection CA: Mining and quarrying of energy producing materials

- . 10: Mining of coal and lignite; extraction of peat
 - 10.1: Mining and agglomeration of hard coal
 - 10.10 : Mining and agglomeration of hard coal
 - 10.2: Mining and agglomeration of lignite
 - 10.20: Mining and agglomeration of lignite
 - 10.3 : Extraction and agglomeration of peat
 - 10.30: Extraction and agglomeration of peat
- 11: Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying
 - 11.1 : Extraction of crude petroleum and natural gas
 - 11.10: Extraction of crude petroleum and natural gas
 - 11.2 : Service activities incidental to oil and gas extraction, excluding surveying
 - 11.20 : Service activities incidental to oil and gas extraction, excluding surveying
- 12: Mining of uranium and thorium ores
 - · 12.0: Mining of uranium and thorium ores
 - 12.00: Mining of uranium and thorium ores

SubSection CB: Mining and quarrying, except of energy producing materials

- 13: Mining of metal ores
 - 13.1 : Mining of iron ores
 - 13.10 : Mining of iron ores
 - 13.2: Mining of non-ferrous metal ores, except uranium and thorium ores
 - 13.20: Mining of non-ferrous metal ores, except uranium and thorium ores
- 14: Other mining and quarrying
 - 14.1 : Quarrying of stone
 - 14.11 : Quarrying of stone for construction
 - 14.12 : Quarrying of limestone, gypsum and chalk
 - 14.13: Quarrying of slate

- · 14.2 : Quarrying of sand and clay
- 14.21: Operation of gravel and sand pits
- 14.22: Mining of clays and kaolin
- 14.3: Mining of chemical and fertilizer minerals
- 14.30: Mining of chemical and fertilizer minerals
- 14.4 : Production of salt
- 14.40 : Production of salt
- 14.5 : Other mining and quarrying n.e.c.
- 14.50: Other mining and quarrying n.e.c.

Section D: Manufacturing SubSection DA: Manufacture of food products, beverages and tobacco

- 15 : Manufacture of food products and beverages
 - 15.1: Production, processing and preserving of meat and meat products
 - . 15.11: Production and preserving of meat
 - 15.12: Production and preserving of poultrymeat
 - 15.13: Production of meat and poultrymeat products
 - · 15.2: Processing and preserving of fish and fish products
 - 15.20: Processing and preserving of fish and fish products
 - 15.3: Processing and preserving of fruit and vegetables
 - 15.31: Processing and preserving of potatoes
 - . 15.32 : Manufacture of fruit and vegetable juice
 - 15.33: Processing and preserving of fruit and vegetables n.e.c.
 - 15.4: Manufacture of vegetable and animal oils and fats
 - 15.41: Manufacture of crude oils and fats
 - 15.42: Manufacture of refined oils and fats
 - 15.43 : Manufacture of margarine and similar edible fats
 - 15.5: Manufacture of dairy products
 - · 15.51: Operation of dairies and cheese making
 - 15.52: Manufacture of ice cream
 - 15.6: Manufacture of grain mill products, starches and starch products
 - 15.61: Manufacture of grain mill products
 - 15.62: Manufacture of starches and starch products
 - 15.7: Manufacture of prepared animal feeds
 - 15.71: Manufacture of prepared feeds for farm animals
 - 15.72: Manufacture of prepared pet foods
 - 15.8: Manufacture of other food products
 - 15.81: Manufacture of bread; manufacture of fresh pastry goods and cakes
 - 15.82: Manufacture of rusks and biscuits; manufacture of preserved pastry goods and cakes
 - 15.83 : Manufacture of sugar
 - 15.84: Manufacture of cocoa; chocolate and sugar confectionery
 - 15.85: Manufacture of macaroni, noodles, couscous and similar farinaceous products
 - 15.86: Processing of tea and coffee
 - 15.87: Manufacture of condiments and seasonings
 - · 15.88: Manufacture of homogenized food preparations and dietetic food
 - 15.89: Manufacture of other food products n.e.c.
 - 15.9: Manufacture of beverages
 - 15.91: Manufacture of distilled potable alcoholic beverages
 - 15.92 : Production of ethyl alcohol from fermented materials
 - 15.93: Manufacture of wines
 - 15.94: Manufacture of cider and other fruit wines
 - 15.95: Manufacture of other non-distilled fermented beverages
 - 15.96: Manufacture of beer
 - 15.97: Manufacture of malt
 - 15.98: Production of mineral waters and soft drinks
- 16: Manufacture of tobacco products
 - 16.0: Manufacture of tobacco products
 - 16.00 : Manufacture of tobacco products

SubSection DB: Manufacture of textiles and textile products

• 17 : Manufacture of textiles

- · 17.1 : Preparation and spinning of textile fibres
- · 17.11 : Preparation and spinning of cotton-type fibres
- 17.12: Preparation and spinning of woollen-type fibres
- 17.13: Preparation and spinning of worsted-type fibres
- 17.14: Preparation and spinning of flax-type fibres
- 17.15: Throwing and preparation of silk, including from noils, and throwing and texturing of synthetic or artificial filament yarns
- 17.16: Manufacture of sewing threads
- 17.17: Preparation and spinning of other textile fibres
- 17.2 : Textile weaving
- 17.21 : Cotton-type weaving
- 17.22 : Woollen-type weaving
- 17.23 : Worsted-type weaving
- 17.24 : Silk-type weaving
- 17.25 : Other textile weaving
- 17.3 : Finishing of textiles
- 17.30 : Finishing of textiles
- 17.4 : Manufacture of made-up textile articles, except apparel
- 17.40: Manufacture of made-up textile articles, except apparel
- 17.5: Manufacture of other textiles
- 17.51: Manufacture of carpets and rugs
- 17.52 : Manufacture of cordage, rope, twine and netting
- 17.53: Manufacture of non-wovens and articles made from non-wovens, except apparel
- 17.54: Manufacture of other textiles n.e.c.
- 17.6: Manufacture of knitted and crocheted fabrics
- 17.60: Manufacture of knitted and crocheted fabrics
- 17.7: Manufacture of knitted and crocheted articles
- 17.71: Manufacture of knitted and crocheted hosiery
- 17.72: Manufacture of knitted and crocheted pullovers, cardigans and similar articles
- 18: Manufacture of wearing apparel; dressing and dyeing of fur
 - 18.1 : Manufacture of leather clothes
 - 18.10: Manufacture of leather clothes
 - 18.2: Manufacture of other wearing apparel and accessories
 - 18.21: Manufacture of workwear
 - 18.22 : Manufacture of other outerwear
 - 18.23 : Manufacture of underwear
 - 18.24: Manufacture of other wearing apparel and accessories n.e.c.
 - 18.3 : Dressing and dyeing of fur; manufacture of articles of fur
 - · 18.30 : Dressing and dyeing of fur; manufacture of articles of fur

SubSection DC: Manufacture of leather and leather products

- 19: Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
 - 19.1 : Tanning and dressing of leather
 - 19.10 : Tanning and dressing of leather
 - · 19.2 : Manufacture of luggage, handbags and the like, saddlery and harness
 - 19.20: Manufacture of luggage, handbags and the like, saddlery and harness
 - 19.3 : Manufacture of footwear
 - 19.30 : Manufacture of footwear

SubSection DD: Manufacture of wood and wood products

- 20: Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
 - 20.1 : Sawmilling and planing of wood; impregnation of wood
 - · 20.10 : Sawmilling and planing of wood; impregnation of wood
 - 20.2: Manufacture of veneer sheets; manufacture of plywood, laminboard, particle board, fibre board and other panels and boards
 - 20.20: Manufacture of veneer sheets; manufacture of plywood, laminboard, particle board, fibre board and other panels and boards
 - 20.3 : Manufacture of builders' carpentry and joinery
 - 20.30: Manufacture of builders' carpentry and joinery

- 20.4: Manufacture of wooden containers
- 20.40: Manufacture of wooden containers
- 20.5: Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials
- 20.51: Manufacture of other products of wood
- 20.52: Manufacture of articles of cork, straw and plaining materials

SubSection DE: Manufacture of pulp, paper and paper products; publishing and printing

- 21: Manufacture of pulp, paper and paper products
 - · 21.1 : Manufacture of pulp, paper and paperboard
 - 21.11: Manufacture of pulp
 - 21.12: Manufacture of paper and paperboard
 - 21.2 : Manufacture of articles of paper and paperboard
 - 21.21: Manufacture of corrugated paper and paperboard and of containers of paper and paperboard
 - 21.22: Manufacture of household and sanitary goods and of toilet requisites
 - 21.23: Manufacture of paper stationery
 - 21.24: Manufacture of wallpaper
 - 21.25 : Manufacture of other articles of paper and paperboard n.e.c.
- 22: Publishing, printing and reproduction of recorded media
 - 22.1 : Publishing
 - 22.11: Publishing of books
 - 22.12: Publishing of newspapers
 - 22.13: Publishing of journals and periodicals
 - 22.14: Publishing of sound recordings
 - 22.15: Other publishing
 - 22.2 : Printing and service activities related to printing
 - 22.21: Printing of newspapers
 - 22.22 : Printing n.e.c.
 - 22.23: Bookbinding and finishing
 - · 22.24 : Composition and plate-making
 - 22.25: Other activities related to printing
 - 22.3: Reproduction of recorded media
 - 22.31: Reproduction of sound recording
 - 22.32: Reproduction of video recording
- 22.33: Reproduction of computer media
 SubSection DF: Manufacture of coke, refined petroleum products and nuclear fuel
 - · 23 : Manufacture of coke, refined petroleum products and nuclear fuel
 - 23.1 : Manufacture of coke oven products
 - 23.10: Manufacture of coke oven products
 - 23.2 : Manufacture of refined petroleum products
 - 23.20: Manufacture of refined petroleum products
 - 23.3 : Processing of nuclear fuel
 - 23.30: Processing of nuclear fuel

SubSection DG: Manufacture of chemicals, chemical products and man-made fibres

- 24 : Manufacture of chemicals and chemical products
 - 24.1 : Manufacture of basic chemicals
 - 24.11: Manufacture of industrial gases
 - 24.12: Manufacture of dyes and pigments
 - 24.13: Manufacture of other inorganic basic chemicals
 - 24.14: Manufacture of other organic basic chemicals
 - 24.15: Manufacture of fertilizers and nitrogen compounds
 - · 24.16: Manufacture of plastics in primary forms
 - 24.17: Manufacture of synthetic rubber in primary forms
 - 24.2: Manufacture of pesticides and other agro-chemical products
 - 24.20: Manufacture of pesticides and other agro-chemical products
 - 24.3: Manufacture of paints, varnishes and similar coatings, printing ink and mastics
 - 24.30: Manufacture of paints, varnishes and similar coatings, printing ink and mastics
 - 24.4: Manufacture of pharmaceuticals, medicinal chemicals and botanical products

- 24.41: Manufacture of basic pharmaceutical products
- 24.42: Manufacture of pharmaceutical preparations
- 24.5: Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations
- 24.51: Manufacture of soap and detergents, cleaning and polishing preparations
- 24.52: Manufacture of perfumes and toilet preparations
- 24.6: Manufacture of other chemical products
- 24.61: Manufacture of explosives
- · 24.62 : Manufacture of glues and gelatines
- 24.63: Manufacture of essential oils
- 24.64: Manufacture of photographic chemical material
- 24.65: Manufacture of prepared unrecorded media
- 24.66: Manufacture of other chemical products n.e.c.
- 24.7: Manufacture of man-made fibres
- 24.70: Manufacture of man-made fibres

SubSection DH: Manufacture of rubber and plastic products

- 25 : Manufacture of rubber and plastic products
 - 25.1: Manufacture of rubber products
 - 25.11: Manufacture of rubber tyres and tubes
 - 25.12: Retreading and rebuilding of rubber tyres
 - 25.13: Manufacture of other rubber products
 - 25.2 : Manufacture of plastic products
 - 25.21: Manufacture of plastic plates, sheets, tubes and profiles
 - 25.22: Manufacture of plastic packing goods
 - · 25.23 : Manufacture of builders' ware of plastic
 - 25.24: Manufacture of other plastic products

SubSection DI: Manufacture of other non-metallic mineral products

- 26 : Manufacture of other non-metallic mineral products
 - · 26.1: Manufacture of glass and glass products
 - 26.11: Manufacture of flat glass
 - 26.12: Shaping and processing of flat glass
 - 26.13: Manufacture of hollow glass
 - 26.14: Manufacture of glass fibres
 - 26.15: Manufacture and processing of other glass, including technical glassware
 - 26.2: Manufacture of non-refractory ceramic goods other than for construction purposes; manufacture of refractory ceramic products
 - 26.21: Manufacture of ceramic household and ornamental articles
 - 26.22: Manufacture of ceramic sanitary fixtures
 - 26.23: Manufacture of ceramic insulators and insulating fittings
 - 26.24: Manufacture of other technical ceramic products
 - 26.25: Manufacture of other ceramic products
 - 26.26: Manufacture of refractory ceramic products
 - 26.3 : Manufacture of ceramic tiles and flags
 - 26.30: Manufacture of ceramic tiles and flags
 - 26.4: Manufacture of bricks, tiles and construction products, in baked clay
 - · 26.40 : Manufacture of bricks, tiles and construction products, in baked clay
 - 26.5: Manufacture of cement, lime and plaster
 - 26.51 : Manufacture of cement
 - 26.52 : Manufacture of lime
 - 26.53: Manufacture of plaster
 - 26.6 : Manufacture of articles of concrete, plaster and cement
 - 26.61: Manufacture of concrete products for construction purposes
 - 26.62: Manufacture of plaster products for construction purposes
 - 26.63: Manufacture of ready-mixed concrete
 - 26.64 : Manufacture of mortars
 - 26.65 : Manufacture of fibre cement
 - · 26.66: Manufacture of other articles of concrete, plaster and cement
 - 26.7: Cutting, shaping and finishing of stone

- · 26.70 : Cutting, shaping and finishing of stone
- 26.8: Manufacture of other non-metallic mineral products
- 26.81: Production of abrasive products
- 26.82 : Manufacture of other non-metallic mineral products n.e.c.

SubSection DJ: Manufacture of basic metals and fabricated metal products

- 27: Manufacture of basic metals
 - 27.1: Manufacture of basic iron and steel and of ferro-alloys (ECSC)
 - 27.10: Manufacture of basic iron and steel and of ferro-alloys (ECSC)20)
 - 27.2 : Manufacture of tubes
 - 27.21: Manufacture of cast iron tubes
 - 27.22: Manufacture of steel tubes
 - 27.3: Other first processing of iron and steel and production of non-ECSC20) ferro-alloys
 - 27.31 : Cold drawing
 - 27.32 : Cold rolling of narrow strip
 - 27.33 : Cold forming or folding
 - 27.34 : Wire drawing
 - 27.35: Other first processing of iron and steel n.e.c.; production of non-ECSC20) ferro-alloys
 - · 27.4 : Manufacture of basic precious and non-ferrous metals
 - 27.41: Precious metals production
 - 27.42 : Aluminium production
 - 27.43: Lead, zinc and tin production
 - 27.44 : Copper production
 - 27.45: Other non-ferrous metal production
 - 27.5 : Casting of metals
 - 27.51: Casting of iron
 - 27.52 : Casting of steel
 - 27.53 : Casting of light metals
 - 27.54: Casting of other non-ferrous metals
- 28: Manufacture of fabricated metal products, except machinery and equipment
 - 28.1: Manufacture of structural metal products
 - 28.11: Manufacture of metal structures and parts of structures
 - 28.12: Manufacture of builders' carpentry and joinery of metal
 - 28.2: Manufacture of tanks, reservoirs and containers of metal; manufacture of central heating radiators and boilers
 - 28.21: Manufacture of tanks, reservoirs and containers of metal
 - 28.22: Manufacture of central heating radiators and boilers
 - 28.3: Manufacture of steam generators, except central heating hot water boilers
 - 28.30: Manufacture of steam generators, except central heating hot water boilers
 - 28.4: Forging, pressing, stamping and roll forming of metal; powder metallurgy
 - 28.40: Forging, pressing, stamping and roll forming of metal; powder metallurgy
 - 28.5: Treatment and coating of metals; general mechanical engineering
 - 28.51: Treatment and coating of metals
 - 28.52 : General mechanical engineering
 - 28.6: Manufacture of cutlery, tools and general hardware
 - 28.61: Manufacture of cutlery
 - 28.62: Manufacture of tools
 - 28.63: Manufacture of locks and hinges
 - · 28.7: Manufacture of other fabricated metal products
 - 28.71: Manufacture of steel drums and similar containers
 - 28.72: Manufacture of light metal packaging
 - 28.73: Manufacture of wire products
 - 28.74: Manufacture of fasteners, screw machine products, chain and springs
 - 28.75: Manufacture of other fabricated metal products n.e.c.

SubSection DK: Manufacture of machinery and equipment n.e.c.

- 29: Manufacture of machinery and equipment n.e.c.
 - 29.1: Manufacture of machinery for the production and use of mechanical power, except aircraft, vehicle and cycle engines
 - · 29.11: Manufacture of engines and turbines, except aircraft, vehicle and cycle engines

- 29.12: Manufacture of pumps and compressors
- 29.13: Manufacture of taps and valves
- 29.14: Manufacture of bearings, gears, gearing and driving elements
- 29.2 : Manufacture of other general purpose machinery
- 29.21: Manufacture of furnaces and furnace burners
- 29.22: Manufacture of lifting and handling equipment
- 29.23: Manufacture of non-domestic cooling and ventilation equipment
- 29.24: Manufacture of other general purpose machinery n.e.c.
- 29.3: Manufacture of agricultural and forestry machinery
- 29.31: Manufacture of agricultural tractors
- 29.32: Manufacture of other agricultural and forestry machinery
- 29.4: Manufacture of machine-tools
- 29.40: Manufacture of machine-tools
- 29.5: Manufacture of other special purpose machinery
- 29.51: Manufacture of machinery for metallurgy
- · 29.52: Manufacture of machinery for mining, quarrying and construction
- 29.53: Manufacture of machinery for food, beverage and tobacco processing
- 29.54: Manufacture of machinery for textile, apparel and leather production
- 29.55: Manufacture of machinery for paper and paperboard production
- 29.56: Manufacture of other special purpose machinery n.e.c.
- 29.6: Manufacture of weapons and ammunition
- 29.60: Manufacture of weapons and ammunition
- 29.7 : Manufacture of domestic appliances n.e.c.
- 29.71: Manufacture of electric domestic appliances
- 29.72 : Manufacture of non-electric domestic appliances

SubSection DL: Manufacture of electrical and optical equipment

- · 30: Manufacture of office machinery and computers
 - · 30.0 : Manufacture of office machinery and computers
 - 30.01: Manufacture of office machinery
 - 30.02: Manufacture of computers and other information processing equipment
- 31: Manufacture of electrical machinery and apparatus n.e.c.
 - 31.1: Manufacture of electric motors, generators and transformers
 - 31.10: Manufacture of electric motors, generators and transformers
 - 31.2: Manufacture of electricity distribution and control apparatus
 - 31.20: Manufacture of electricity distribution and control apparatus
 - 31.3: Manufacture of insulated wire and cable
 - . 31.30 : Manufacture of insulated wire and cable
 - . 31.4: Manufacture of accumulators, primary cells and primary batteries
 - 31.40: Manufacture of accumulators, primary cells and primary batteries
 - 31.5: Manufacture of lighting equipment and electric lamps
 - 31.50: Manufacture of lighting equipment and electric lamps
 - 31.6: Manufacture of electrical equipment n.e.c.
 - 31.61: Manufacture of electrical equipment for engines and vehicles n.e.c.
 - 31.62: Manufacture of other electrical equipment n.e.c.
- 32: Manufacture of radio, television and communication equipment and apparatus
 - 32.1: Manufacture of electronic valves and tubes and other electronic components
 - 32.10: Manufacture of electronic valves and tubes and other electronic components
 - 32.2 : Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy
 - 32.20: Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy
 - 32.3: Manufacture of television and radio receivers, sound or video recording or reproducing apparatus and associated goods
 - 32.30: Manufacture of television and radio receivers, sound or video recording or reproducing apparatus and associated goods
- 33: Manufacture of medical, precision and optical instruments, watches and clocks
 - 33.1: Manufacture of medical and surgical equipment and orthopaedic appliances
 - 33.10: Manufacture of medical and surgical equipment and orthopaedic appliances

- 33.2: Manufacture of instruments and appliances for measuring, checking, testing, navigating and
 other purposes, except industrial process control equipment
- 33.20: Manufacture of instruments and appliances for measuring, checking, testing, navigating
 and other purposes, except industrial process control equipment
- 33.3 : Manufacture of industrial process control equipment
- 33.30: Manufacture of industrial process control equipment
- 33.4: Manufacture of optical instruments and photographic equipment
- 33.40: Manufacture of optical instruments and photographic equipment
- 33.5 : Manufacture of watches and clocks
- 33 50 · Manufacture of watches and clocks

SubSection DM: Manufacture of transport equipment

- . 34 : Manufacture of motor vehicles, trailers and semi-trailers
 - 34.1 : Manufacture of motor vehicles
 - 34.10: Manufacture of motor vehicles
 - 34.2: Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semitrailers
 - 34.20: Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semitrailers
 - · 34.3 : Manufacture of parts and accessories for motor vehicles and their engines
 - 34.30: Manufacture of parts and accessories for motor vehicles and their engines
- 35: Manufacture of other transport equipment
 - 35.1 : Building and repairing of ships and boats
 - 35.11: Building and repairing of ships
 - 35.12: Building and repairing of pleasure and sporting boats
 - · 35.2: Manufacture of railway and tramway locomotives and rolling stock
 - 35.20: Manufacture of railway and tramway locomotives and rolling stock
 - 35.3 : Manufacture of aircraft and spacecraft
 - 35.30: Manufacture of aircraft and spacecraft
 - 35.4: Manufacture of motorcycles and bicycles
 - 35.41: Manufacture of motorcycles
 - 35.42 : Manufacture of bicycles
 - 35.43 : Manufacture of invalid carriages
 - 35.5: Manufacture of other transport equipment n.e.c.
 - 35.50: Manufacture of other transport equipment n.e.c.

SubSection DN: Manufacturing n.e.c.

- · 36: Manufacture of furniture; manufacturing n.e.c.
 - 36.1: Manufacture of furniture
 - 36.11: Manufacture of chairs and seats
 - 36.12: Manufacture of other office and shop furniture
 - 36.13: Manufacture of other kitchen furniture
 - 36.14: Manufacture of other furniture
 - 36.15: Manufacture of mattresses
 - 36.2: Manufacture of jewellery and related articles
 - 36.21 : Striking of coins and medals
 - 36.22: Manufacture of jewellery and related articles n.e.c.
 - 36.3 : Manufacture of musical instruments
 - 36.30: Manufacture of musical instruments
 - 36.4: Manufacture of sports goods
 - 36.40: Manufacture of sports goods
 - 36.5: Manufacture of games and toys
 - 36.50 : Manufacture of games and toys
 36.6 : Miscellaneous manufacturing n.e.c.
 - 36.61 : Manufacture of imitation jewellery
 - 36.62: Manufacture of brooms and brushes
 - 36.63 : Other manufacturing n.e.c.
- 37: Recycling
 - 37.1: Recycling of metal waste and scrap
 - 37.10: Recycling of metal waste and scrap

- . 37.2 : Recycling of non-metal waste and scrap
- 37.20 : Recycling of non-metal waste and scrap

Section E : Electricity, gas and water supply

- 40: Electricity, gas, steam and hot water supply
 - · 40.1 : Production and distribution of electricity
 - 40.10: Production and distribution of electricity
 - · 40.2 : Manufacture of gas; distribution of gaseous fuels through mains
 - · 40.20 : Manufacture of gas; distribution of gaseous fuels through mains
 - 40.3 : Steam and hot water supply
 - 40.30: Steam and hot water supply
- 41 : Collection, purification and distribution of water
 - 41.0 : Collection, purification and distribution of water
 - 41.00 : Collection, purification and distribution of water

Section F : Construction

- 45 : Construction
 - 45.1 : Site preparation
 - 45.11: Demolition and wrecking of buildings; earth moving
 - 45.12: Test drilling and boring
 - 45.2 : Building of complete constructions or parts thereof; civil engineering
 - 45.21: General construction of buildings and civil engineering works
 - 45.22: Erection of roof covering and frames
 - · 45.23 : Construction of highways, roads, airfields and sport facilities
 - 45.24 : Construction of water projects
 - 45.25: Other construction work involving special trades
 - 45.3 : Building installation
 - 45.31: Installation of electrical wiring and fittings
 - 45.32: Insulation work activities
 - 45.33 : Plumbing
 - 45.34: Other building installation
 - 45.4 : Building completion
 - 45.41 : Plastering
 - 45.42: Joinery installation
 - 45.43: Floor and wall covering
 - · 45.44 : Painting and glazing
 - 45.45: Other building completion
 - · 45.5 : Renting of construction or demolition equipment with operator
 - 45.50: Renting of construction or demolition equipment with operator

Section G: Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods

- 50 : Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel
 - 50.1 : Sale of motor vehicles
 - 50.10 : Sale of motor vehicles
 - 50.2: Maintenance and repair of motor vehicles
 - 50.20 : Maintenance and repair of motor vehicles
 - 50.3 : Sale of motor vehicle parts and accessories
 - 50.30: Sale of motor vehicle parts and accessories
 - . 50.4 : Sale, maintenance and repair of motorcycles and related parts and accessories
 - 50.40: Sale, maintenance and repair of motorcycles and related parts and accessories
 - 50.5 : Retail sale of automotive fuel
 - 50.50 : Retail sale of automotive fuel
- 51: Wholesale trade and commission trade, except of motor vehicles and motorcycles
 - 51.1: Wholesale on a fee or contract basis
 - 51.11: Agents involved in the sale of agricultural raw materials, live animals, textile raw materials and semi-finished goods
 - 51.12: Agents involved in the sale of fuels, ores, metals and industrial chemicals
 - 51.13: Agents involved in the sale of timber and building materials
 - 51.14: Agents involved in the sale of machinery, industrial equipment, ships and aircraft
 - 51.15: Agents involved in the sale of furniture, household goods, hardware and ironmongery
 - 51.16: Agents involved in the sale of textiles, clothing, footwear and leather goods

- 51.17 : Agents involved in the sale of food, beverages and tobacco
- 51.18: Agents specializing in the sale of particular products or ranges of products n.e.c.
- . 51.19 : Agents involved in the sale of a variety of goods
- 51.2: Wholesale of agricultural raw materials and live animals (These groups include only wholesale on own account)
- · 51.21 : Wholesale of grain, seeds and animal feeds
- 51.22: Wholesale of flowers and plants
- 51.23: Wholesale of live animals
- 51.24: Wholesale of hides, skins and leather
- 51.25: Wholesale of unmanufactured tobacco
- 51.3: Wholesale of food, beverages and tobacco
- 51.31: Wholesale of fruit and vegetables
- 51.32: Wholesale of meat and meat products
- 51.33: Wholesale of dairy produce, eggs and edible oils and fats
- 51.34: Wholesale of alcoholic and other beverages
- 51.35: Wholesale of tobacco products
- 51.36: Wholesale of sugar and chocolate and sugar confectionery
- 51.37: Wholesale of coffee, tea, cocoa and spices
- 51.38: Wholesale of other food, including fish, crustaceans and molluscs
- 51.39: Non-specialized wholesale of food, beverages and tobacco
- 51.4: Wholesale of household goods
- 51.41: Wholesale of textiles
- 51.42: Wholesale of clothing and footwear
- 51.43: Wholesale of electrical household appliances and radio and television goods
- 51.44: Wholesale of china and glassware, wallpaper and cleaning materials
- 51.45: Wholesale of perfume and cosmetics
- 51.46 : Wholesale of pharmaceutical goods
- 51.47: Wholesale of other household goods
- 51.5: Wholesale of non-agricultural intermediate products, waste and scrap
- 51.51: Wholesale of solid, liquid and gaseous fuels and related products
- 51.52: Wholesale of metals and metal ores
- · 51.53: Wholesale of wood, construction materials and sanitary equipment
- 51.54: Wholesale of hardware, plumbing and heating equipment and supplies
- 51.55 : Wholesale of chemical products
- 51.56: Wholesale of other intermediate products
- 51.57: Wholesale of waste and scrap
- 51.6: Wholesale of machinery, equipment and supplies
- 51.61: Wholesale of machine-tools
- 51.62: Wholesale of construction machinery
- 51.63: Wholesale of machinery for the textile industry and of sewing and knitting machines
- 51.64: Wholesale of office machinery and equipment
- 51.65: Wholesale of other machinery for use in industry, trade and navigation
- 51.66: Wholesale of agricultural machinery and accessories and implements, including tractors
- 51.7 : Other wholesale
- 51.70 : Other wholesale
- 52: Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods
 - 52.1 : Retail sale in non-specialized stores
 - 52.11: Retail sale in non-specialized stores with food, beverages or tobacco predominating
 - 52.12 : Other retail sale in non-specialized stores
 - 52.2 : Retail sale of food, beverages and tobacco in specialized stores
 - 52.21: Retail sale of fruit and vegetables
 - 52.22: Retail sale of meat and meat products
 - 52.23: Retail sale of fish, crustaceans and molluscs
 - 52.24: Retail sale of bread, cakes, flour confectionery and sugar confectionery
 - 52.25: Retail sale of alcoholic and other beverages
 - 52.26 : Retail sale of tobacco products
 - 52.27: Other retail sale of food, beverages and tobacco in specialized stores
 - 52.3 : Retail sale of pharmaceutical and medical goods, cosmetic and toilet articles

- 52.31: Dispensing chemists
- · 52.32 : Retail sale of medical and orthopaedic goods
- 52.33: Retail sale of cosmetic and toilet articles
- 52.4 : Other retail sale of new goods in specialized stores
- 52.41 : Retail sale of textiles
- 52.42 : Retail sale of clothing
- 52.43: Retail sale of footwear and leather goods
- 52.44: Retail sale of furniture, lighting equipment and household articles n.e.c.
- 52.45: Retail sale of electrical household appliances and radio and television goods
- 52.46: Retail sale of hardware, paints and glass
- 52.47: Retail sale of books, newspapers and stationery
- 52.48: Other retail sale in specialized stores
- 52.5 : Retail sale of second-hand goods in stores
- 52.50: Retail sale of second-hand goods in stores
- 52.6 : Retail sale not in stores
- 52.61: Retail sale via mail order houses
- 52.62: Retail sale via stalls and markets
- 52.63 : Other non-store retail sale
- 52.7: Repair of personal and household goods
- 52.71: Repair of boots, shoes and other articles of leather
- 52.72: Repair of electrical household goods
- 52.73: Repair of watches, clocks and jewellery
- 52.74 : Repair n.e.c.

ection H: Hotels and restaurants

- 55: Hotels and restaurants
 - 55.1 : Hotels
 - · 55.11: Hotels and motels, with restaurant
 - 55.12: Hotels and motels, without restaurant
 - · 55.2 : Camping sites and other provision of short-stay accommodation
 - 55.21: Youth hostels and mountain refuges
 - 55.22: Camping sites, including caravan sites
 - 55.23: Other provision of lodgings n.e.c.
 - 55.3 : Restaurants
 - 55.30: Restaurants
 - 55.4 : Bars
 - 55.40 : Bars
 - 55.5 : Canteens and catering
 - 55.51 : Canteens
 - 55.52 : Catering

section I: Transport, storage and communication

- 60 : Land transport; transport via pipelines
 - 60.1: Transport via railways
 - 60.10 : Transport via railways
 - 60.2 : Other land transport
 - · 60.21: Other scheduled passenger land transport
 - 60.22 : Taxi operation
 - 60.23 : Other land passenger transport
 - 60.24: Freight transport by road
 - 60.3 : Transport via pipelines
 - 60.30: Transport via pipelines
- 61: Water transport
 - 61.1 : Sea and coastal water transport
 - 61.10 : Sea and coastal water transport
 - 61.2 : Inland water transport
 - 61.20 : Inland water transport
- 62 : Air transport
 - 62.1 : Scheduled air transport
 - 62.10 : Scheduled air transport

- · 62.2 : Non-scheduled air transport
- 62.20: Non-scheduled air transport
- 62.3 : Space transport
- 62.30 : Space transport
- 63: Supporting and auxiliary transport activities; activities of travel agencies
 - 63.1 : Cargo handling and storage
 - 63.11 : Cargo handling
 - 63.12: Storage and warehousing
 - 63.2 : Other supporting transport activities
 - 63.21: Other supporting land transport activities
 - 63.22: Other supporting water transport activities
 - · 63.23: Other supporting air transport activities
 - 63.3 : Activities of travel agencies and tour operators; tourist assistance activities n.e.c.
 - 63.30: Activities of travel agencies and tour operators; tourist assistance activities n.e.c.
 - 63.4 : Activities of other transport agencies
 - 63.40 : Activities of other transport agencies
- · 64 : Post and telecommunications
 - 64.1 : Post and courier activities
 - 64.11: National post activities
 - · 64.12: Courier activities other than national post activities
 - 64.2 : Telecommunications
 - 64.20 : Telecommunications

Section J: Financial intermediation

- 65: Financial intermediation, except insurance and pension funding
 - 65.1: Monetary intermediation
 - 65.11 : Central banking
 - 65.12: Other monetary intermediation
 - 65.2 : Other financial intermediation
 - 65.21: Financial leasing
 - 65.22: Other credit granting
 - 65.23: Other financial intermediation n.e.c.
- · 66: Insurance and pension funding, except compulsory social security
 - 66.0: Insurance and pension funding, except compulsory social security
 - 66.01 : Life insurance
 - 66.02 : Pension funding
 - 66.03 : Non-life insurance
- 67: Activities auxiliary to financial intermediation
 - 67.1 : Activities auxiliary to financial intermediation, except insurance and pension funding
 - 67.11: Administration of financial markets
 - · 67.12 : Security broking and fund management
 - 67.13: Activities auxiliary to financial intermediation n.e.c.
 - 67.2 : Activities auxiliary to insurance and pension funding
 - 67.20: Activities auxiliary to insurance and pension funding

Section K: Real estate, renting and business activities

- 70 : Real estate activities
 - 70.1: Real estate activities with own property
 - 70.11: Development and selling of real estate
 - 70.12: Buying and selling of own real estate
 - 70.2 : Letting of own property
 - · 70.20 : Letting of own property
 - 70.3 : Real estate activities on a fee or contract basis
 - 70.31 : Real estate agencies
 - 70.32: Management of real estate on a fee or contract basis
- 71: Renting of machinery and equipment without operator and of personal and household goods
 - 71.1 : Renting of automobiles
 - 71.10 : Renting of automobiles
 - 71.2 : Renting of other transport equipment
 - 71.21 : Renting of other land transport equipment

- 71.22: Renting of water transport equipment
- 71.23: Renting of air transport equipment
- 71.3: Renting of other machinery and equipment
- 71.31: Renting of agricultural machinery and equipment
- 71.32: Renting of construction and civil engineering machinery and equipment
- · 71.33 : Renting of office machinery and equipment, including computers
- 71.34: Renting of other machinery and equipment n.e.c.
- 71.4: Renting of personal and household goods n.e.c.
- 71.40: Renting of personal and household goods n.e.c.
- 72: Computer and related activities
 - 72.1 : Hardware consultancy
 - 72.10: Hardware consultancy
 - 72.2 : Software consultancy and supply
 - 72.20: Software consultancy and supply
 - 72.3 : Data processing
 - 72.30 : Data processing
 - 72.4 : Database activities
 - 72.40 : Database activities
 - 72.5: Maintenance and repair of office, accounting and computing machinery
 - 72.50: Maintenance and repair of office, accounting and computing machinery
 - 72.6: Other computer related activities
 - 72.60: Other computer related activities
- 73: Research and development
 - 73.1: Research and experimental development on natural sciences and engineering
 - 73.10: Research and experimental development on natural sciences and engineering
 - 73.2: Research and experimental development on social sciences and humanities
 - 73.20 : Research and experimental development on social sciences and humanities
- 74: Other business activities
 - 74.1: Legal, accounting, book-keeping and auditing activities; tax consultancy; market research
 and public opinion polling; business and management consultancy; holdings
 - 74.11 : Legal activities
 - 74.12: Accounting, book-keeping and auditing activities; tax consultancy
 - 74.13: Market research and public opinion polling
 - 74.14: Business and management consultancy activities
 - · 74.15: Management activities of holding companies
 - 74.2 : Architectural and engineering activities and related technical consultancy
 - 74.20: Architectural and engineering activities and related technical consultancy
 - 74.3 : Technical testing and analysis
 - 74.30: Technical testing and analysis
 - 74.4 : Advertising
 - 74.40 : Advertising
 - 74.5: Labour recruitment and provision of personnel
 - 74.50: Labour recruitment and provision of personnel
 - 74.6: Investigation and security activities
 - 74.60: Investigation and security activities
 - 74.7 : Industrial cleaning
 - 74.70 : Industrial cleaning
 - 74.8: Miscellaneous business activities n.e.c.
 - 74.81: Photographic activities
 - 74.82 : Packaging activities
 - 74.83: Secretarial and translation activities
 - 74.84: Other business activities n.e.c.
- Section L: Public administration and defence; compulsory social security
 - 75: Public administration and defence; compulsory social security
 - 75.1: Administration of the State and the economic and social policy of the community
 - 75.11: General (overall) public service activities
 - 75.12: Regulation of the activities of agencies that provide health care, education, cultural services and other social services, excluding social security

- · 75.13 : Regulation of and contribution to more efficient operation of business
- 75.14: Supporting service activities for the government as a whole
- 75.2: Provision of services to the community as a whole
- 75.21: Foreign affairs
- 75.22 : Defence activities
- 75.23: Justice and judicial activities
- 75.24: Public security, law and order activities
- 75.25 : Fire service activities
- 75.3 : Compulsory social security activities
- 75.30 : Compulsory social security activities

Section M : Education

- 80 : Education
 - 80.1 : Primary education
 - 80.10 : Primary education
 - 80.2 : Secondary education
 - 80.21: General secondary education
 - 80.22: Technical and vocational secondary education
 - 80.3 : Higher education
 - 80.30 : Higher education
 - 80.4 : Adult and other education
 - 80.41: Driving school activities
 - 80.42: Adult and other education n.e.c.

Section N : Health and social work

- 85 : Health and social work
 - 85.1: Human health activities
 - 85.11: Hospital activities
 - 85.12 : Medical practice activities
 - 85.13 : Dental practice activities
 - 85.14: Other human health activities
 - 85.2 : Veterinary activities
 - 85.20 : Veterinary activities
 - 85.3 : Social work activities
 - 85.31: Social work activities with accommodation
 - 85.32 : Social work activities without accommodation

Section O: Other community, social and personal service activities

- 90 : Sewage and refuse disposal, sanitation and similar activities
 - 90.0 : Sewage and refuse disposal, sanitation and similar activities
 - 90.00: Sewage and refuse disposal, sanitation and similar activities
- 91: Activities of membership organizations n.e.c.
 - · 91.1 : Activities of business, employers' and professional organizations
 - 91.11: Activities of business and employers' organizations
 - 91.12 : Activities of professional organizations
 - 91.2 : Activities of trade unions
 - 91 20 Activities of trade unions
 - 91.3 : Activities of other membership organizations
 - 91.31 : Activities of religious organizations
 - 91.32 : Activities of political organizations
 - 91.33 : Activities of other membership organizations n.e.c.
- 92: Recreational, cultural and sporting activities
 - 92.1: Motion picture and video activities
 - 92.11: Motion picture and video production
 - 92.12: Motion picture and video distribution
 - 92.13: Motion picture projection
 - 92.2 : Radio and television activities
 - 92.20 : Radio and television activities
 - 92.3 : Other entertainment activities
 - 92.31: Artistic and literary creation and interpretation
 - 92.32 : Operation of arts facilities

- 92.33: Fair and amusement park activities
- 92.34: Other entertainment activities n.e.c.
- 92.4 : News agency activities
- 92.40: News agency activities
- 92.5: Library, archives, museums and other cultural activities
- 92.51: Library and archives activities
- 92.52: Museums activities and preservation of historical sites and buildings
- 92.53: Botanical and zoological gardens and nature reserves activities
- 92.6 : Sporting activities
- 92.61: Operation of sports arenas and stadiums
- 92.62: Other sporting activities
- 92.7 : Other recreational activities
- 92.71: Gambling and betting activities
- 92.72 : Other recreational activities n.e.c.
- 93 : Other service activities
 - 93.0 : Other service activities
 - · 93.01 : Washing and dry-cleaning of textile and fur products
 - · 93.02 : Hairdressing and other beauty treatment
 - 93.03: Funeral and related activities
 - 93.04: Physical well-being activities
 - 93.05 : Other service activities n.e.c.

Section P: Private households with employed persons

- 95: Private households with employed persons
 - 95.0: Private households with employed persons
 - 95.00: Private households with employed persons

Section Q: Extra-territorial organizations and bodies

- 99: Extra-territorial organizations and bodies
 - 99.0 : Extra-territorial organizations and bodies
 - 99.00: Extra-territorial organizations and bodies

3.7 Pollution Estimation by IPPS method

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TSS	ton/vear ner	1,000 employees	4.04	167.06	38.91	02:59	49.20	0.02	0.01	391.89	22.0	0.11	72.0	1,725.37	74.1	12.99	0.40	84.9	00.00	0.11	1.64	00.0	0.24	00.0	81.82	21.82	0.03	2.59	23.78	0.21	00.0	00.0	5,088.48	8.87	18.78	0.09	880.43
T	nound/vear ner	1,000 employees	8,906.8	368,217.1	85,749.4	144,803.4	108,436.3	40.7	15.5	863,751.5	1,701.6	238.9	596.4	3,802,819.9	3,247.9	28,632.1	872.2	14,285.3	0.0	247.1	3,622.4		527.1	0.0	180,341.8	48,087.6	72.8	5,718.9	52,412.3	461.8		1.7	11,215,316.3	19,555.4	41,398.8	209.2	1,940,529.1
D_5	ton/vear ner	1,000 employees	3.26	1,159.86	24.66	38.54	43.54	0.00	0.01	273.33	1.61	0.27	0.19	96.656	2.68	5.62	0.32	4.17	0.00	90.0	0.98	0.00	0.00	0.00	43.33	7.14	0.00	2.65	5.04	0.12	0.00	0.00	1,498.21	5.17	19.04	0.17	569.61
BODs	nound/vear ner	1,000 employees	7,182.2	2,556,411.0	54,357.6	84,938.7	95,975.3	3.2	13.8	602,434.9	3,543.7	604.1	409.4	2,115,815.1	5,917.1	12,387.7	714.2	9,198.9	0.0	122.7	2,153.8		0.0	0.0	95,498.5	15,732.8	0.0	5,832.4	11,115.1	257.8		0.2	3,302,137.6	11,389.4	41,969.9	382.2	1,255,448.8
metal	ton/vear ner	1,000 employees	0.74	3.26	1.49	0.00	12.98	00.00	0.00	0.20	00.0	0.35	0.28	8.62	0.00	1.21	0.39	7.60	0.12	0.39	3.89	00.00	0.04	0.00	15.70	0.67	0.00	0.00	0.05	0.00	0.00	0.03	131.75	0.41	0.48	0.00	427.38
Used metal	nound/vear ner	1,000 employees	1,621	7,187	3,284	0	28,611	0	0	437	0	992	611	18,997	0	2,668	098	16,757	268	998	8,574	0	78	0	34,593	1,480	0	3	121	0	8	69	290,395	901	1,059	2	941,970
	ISIC Code ISIC Description		3111 Meat Products	3112 Dairy products	3113 Preserved fruits, vegetables	3114 Fish products	3115 Oils and Fats	3116 Grain mill products	3117 Bakery products	3118 Sugar Factory & Refineries	3119 Confectionery Products	3121 Food Products N.E.C.	3122 Prepared animal foods	3131 Distilled sprits	3132 Wine industries	3133 Malt liquors and malt	3140 Tobacco Manufactures	3211 Spinning, weaving, finishing textiles	3212 Made-up textiles except apparel	3213 Knitting mills	3214 Carpets and rugs	3215 Cordage, rope & twine	3219 Textiles, N.E.C	3220 Wearing apparel	3231 Tanneries and leather finishing	3232 Fur dressing and dyeing	3233 Leather products	3240 Footwear	3311 Sawmills, planting & other wood mills	3312 Wooden & cane containers; small cane ware	3319 Wood &cork products	3320 Furniture & fixtures, nonmetal	3411 Pulp, paper, &paperboard	3412 Paper & paperboard containers & boxes	3419 Pulp, paper, & paperboard articles	3420 Printing & publishing	3511 Industrial chemicals except fertilizer

		[[sed meta]	metal	BC	BOD.		SSL
		naso ''	, ,		6.7	1	
ISIC Code	ISIC Description	pound/year per 1,000 employees	ton/year per 1,000 employees	pound/year per 1,000 employees	ton/year per 1,000 employees	pound/year per 1,000 employees	ton/year per 1,000 employees
3512	3512 Fertilizer & pesticides	38,790	17.60	15,697.9	7.12	3,054,594.1	1,385.89
3513	3513 Synthetic resins, plastics materials, & manmade fibers	109,799	49.82	55,872.2	25.35	180,549.5	81.92
3521	3521 Paints, varnishes, & lacquers	066	0.45	60.1	0.03	252.5	0.11
3522	Drugs and medicines	13,021	5.91	14,183.2	6.44	3,555,879.2	1,613.33
3523	3523 Soap, cleaning preps., perfumes, & toilet papers	1,584	0.72	33,360.2	15.14	47,118.9	21.38
3529	3529 Chemical products, N.E.C.	12,370	5.61	2,635.6	1.20	3,803.7	1.73
3530	3530 Petroleum refiners	72,606	32.94	250,712.4	113.75	1,258,255.8	570.88
3540	3540 MISC. Petroleum & coal products	3,480	1.58	6,558.0	2.98	8,049.9	3.65
3551	3551 Tires and tubes	455	0.21	3.4	00.00	1,506.5	89.0
3559	3559 Rubber products, N.E.C.	38	0.02	57.0	0.03	267,163.7	121.21
3560	3560 Plastics products, N.E.C	687	0.22	54,766.8	24.85	1,183.5	0.54
3610	3610 Pottery, China, & earth ware	69	0.03	2,900.9	1.32	719.4	0.33
3620	3620 Glass and glass products	2,066	0.94	176.7	0.08	1,250.5	0.57
3691	Structural clay products	091	0.07	47.1	0.02	840.3	0.38
3692	3692 Cement, lime and plaster	8,817	4.00	241.0	0.11	528,465.8	239.77
3699	3699 Nonmetallic mineral products, N.E.C.	253	0.11	2,860.3	1.30	4,196.1	1.90
3710	3710 Iron and steel	55,775	25.31	2,105.4	0.96	31,018,255.6	14,073.24
3720	3720 Non-ferrous metals	22,527	10.22	575,085.3	260.92	8,312,905.1	3,771.63
3811	3811 Cutlery, hand tools, & general hardware	225	0.10	0.0	0.00	42.0	0.02
3812	3812 Furniture & fixtures of metal	120	0.05	0.0	0.00	72.0	0.03
3813	Structural metal products	7,203	3.27	123.6	0.00	169.8	0.08
3819	Fabricated metal products	4,661	2.11	3,043.9	1.38	87,616.2	39.75
3821	Engines and turbines	1,073	0.49	266.7	0.12		0.00
3822	3822 Agricultural machinery equipment	1,361	0.62	0.0	0.00	728.5	0.33
3823	3823 Metal & wood working machinery	322	0.15	15.7	0.01	13,809.7	6.27
3824	3824 Special industrial machinery & equipment	337	0.15	835.5	0.38	683.2	0.31
3825	3825 Office computing, & accounting machinery	14	0.01	0.3	0.00	103.3	0.05
3829	3829 Machinery & equipment, N.E.C	1,519	0.69	166.0	0.08	3,909.5	1.77
3831	Electrical industrial machinery	198	0.09	93.1	0.04	516.4	0.23
3832	3832 Radio, TV, & communication equipment	716	0.32	4,477.8	2.03	6,196.2	2.81
3833	3833 Electrical appliances & house wares	5	0.00		0.00		0.00
3839	3839 Electrical apparatus and supplies, N.E.C	1,135	0.51	39.3	0.02	241.1	0.11
3841	3841 Shipbuilding and repairing	22	0.01	12.0	0.01	38.0	0.02
3842	3842 Railroad equipment	27	0.01	0.0	00.00	422.4	0.19
3843	3843 Motor vehicles	543	0.25	57.3	0.03	288.1	0.13

		Osed	Used metal	BC	BOD ₅	T	LSS
ISIC Code	ISIC Description	pound/year per	ton/year per	pound/year per	ton/year per	pound/year per	ton/year per
		1,000 employees	1,000 employees	1,000 employees	1,000 employees	1,000 employees	1,000 employees
3844	3844 Motorcycles and bicycles	14,501	6.58	646.0	0.29	3,836.4	1.74
3845	3845 Aircraft	173	80.0	132.6	90'0	1,153.2	0.52
3851	3851 Professional & scientific equipment	107	0.05	68.3	0.03	75.9	0.03
3852	3852 Photographic and optical goods	9	00.0	49.9	0.02	30.3	0.01
3853	3853 Watches and clocks	0	00.0	0.0	00.0	0.0	0.00
3901	3901 Jewelry and related articles	1,589	0.72	0.0	00.0	2,875,077.4	1,304.45
3902	3902 Musical instruments	0	00.0		00.0		0.00
3903	3903 Sporting and athletic goods	27	0.01	0.0	00.0	2,279,277.3	1,034.13
3909	3909 Manufacturing industries, N.E.C	326	0.15	6.8	00.00	41.5	0.02

3.8 Examples of Industrial Wastewater Quality in Japan

Table 3 15	High	Concentration	Organic	Wastewater
Table 3.13	111211	Concenti ation	Organic	vvasicwaici

ľ		<u>a</u>	4 Table 3.13		centration Organic	· wastewater
	Remarks	Ratio of N and P in biological treatment	Soluble protein, ratio of N and P, order	Soluble organic matter, pH	pH, Cl° in picking process	Oil separator and ratio of N and P
	Treatment (General)	Activated sludge	Activated sludge	Activated sludge	Activated sludge	Floatation Activated sludge
	Quantity (m³/day) & Quality of Wastewater	pH around 7 BOD ₅ 300 – 600 SS 100 – 300 T-N 50 – 80 T-P 10 – 15 Quantity 50 – 100	pH 7-8.5 BOD ₅ 200-2,000 SS 150-1,000 T-N 100-200 T-P 30-80 Quantity 200-400-5,000	pH 1-14 BOD ₅ 300-600 SS 250-600	pH 1-12 BOD ₅ 200-600-2,500 SS 120-200-1,000 T-N 100 T-P 30 CI (picling) 2,500-8,000 Quantity 50-300-600	pH 6-8 BOD ₅ 200-600-1,300 SS 100-150-900 T-N 20-40 T-P 10-20 Quantity 20-50-200
	Sources of Wastewater	ial s	s s	Melting process Sun drying process	Raw material treatment pH (de-salt, drying) Disinfection process Cooling water T-N T-P Cl (qua	Mixer cleaning process biscuit, cracker, dried cleaning process chocolate, sweets,
I. High concentration organic wastewater	Products	Raw mater Boiling proces Sausage, ham, bacon, including canned or Cooling water bottled products	Canned or bottled seafood, sausage and ham, Cooling water other fishery products	Agar for eating and industry	and and Canned and preserved vegetable and fruits, vegetable pickles, jam, marmalade, jelly, peanuts butter, frozen vegetables and fruits	Kinds of bread, cakes, biscuit, cracker, dried confectionery, candy, chocolate, sweets, wafer
ncentration org	Type of Industry	Meat products	Fishery products	Agar products	Canned and preserved vegetable and fruits products	Bakery, confectionery products
1. High con	Industry classification			Food Processing		

Industry classification	Type of Industry	Products	Sources of Wastewater	Quantity (m³/day) & Quality of Wastewater	Treatment (General)	Remarks
		Bear	ility nachinery	pH 8-11 BOD ₅ 500 – 2,000		Cleaning wastewater: 0.9 m ³ /m ³ -barley
	Bear product		cleaning process Bottle cleaning process	SS 250 -1,000 T-N 30 - 50	Activated sludge	9 – 13 m²/m²-bear after brewing
				T-P 5-15 Ouantity 5.000-10.000		hd
			Distilled residue	8-9 Hd		Concentrated wastewater
				~~		$5-7 \text{ m}^3$ -wastewater/m ³ -
	Sprits, mixed	Whiskey, brandy, mixed liquor, sweet sake,			Activated sludo	grain
	liquor products	fruit wine, medical wine		T-N 20		
				1-P 10 Quantity 500–1,500		
			Syrup fermentation wastewater	6-9 Hd	Activated sludge	Ratio of N and P in
			Cleaning wastewater	BOD ₅ 300 – 1,200- 7,000		biological treatment
	Baking powder,	Yeasts synthetic compounds	Other wastewater			
	Yeasts production					
Food				T-P 20 - 50		
Processing)	Quantity 600-80,000		
	Edible Oil and fat	to the second se	Raw material cleaning facility	pH 1-7	Floatation	
	=	а оп, тагванпе,		130 - 1,100	Activated studge	Emulsified oil separation
	classified into others	into edible oil and fat	Cooling water	SS 100 – 300 Quantity 50 – 20		4
			Raw material treatment process		Sedimentation	pH change due to
			Chopping process	$0_5 500 - 3,000$	Lagoon	decomposition
	Starch production	Starch, sweet potato starch, potato starch, corn				Wastewater: 8 -10 m ³ /ton-
	4	starch				raw material
				T-P 30 - 40		
				Quantity 100-200-1,000		
			atment process	8-9 Hd		
			Soaking process	~		
	D-glucose, malt	D-glucose, glucose sweet syrup, maltos		1,000-2,250	Activated sludge	
	syrup production					
				T-P 30 - 40		
				Quantity 50–100		

Industry classification	Type of Industry	Products	Sources of Wastewater	Quantity (m³/day) & Quality of Wastewater	Treatment (General)	Remarks
	Noodle production	Noodles, macaroni	Raw material treatment process Boiling process	pH 6-8 BOD ₅ 250-600 SS 200-500 Quantity 50-200	Coagulation- sedimentation Activated sludge	
Food Processing	Crudely made bean jam production	Raw bean jam	Raw material treatment process PH 6-8 Sedimentation process BOD ₅ 500 Compression process SS 250 – T-N 60 T-P 15 Quantity 30	500 500 -300	Activated sludge	N and P change Wastewater: 30 – 35 m³/ton-bean
	Frozen food processing	Raw material trea Boiling process Frozen food such as deep fried fish and meat, Cleaning process croquette, cutlet, stick, hamburger steak, meat dumpling, meat ball	Raw material treatment process Boiling process Cleaning process	pH 6 -8 BOD ₅ 200 -1,000-4,000 SS 100 - 500-1,000 Oil and fat 30 - 200 T-N 30 T-P 6 Quantity 100-1,000	Oil separation Activated sludge	
Chemical	Animal and vegetable oil and fat production	Animal and vegetable oil and fat	Extraction process Cleaning process De-acid process	4 - 9 100 - 2,000 400 - 600 - 1,000 20 - 30 40 - 80 ity 100 - 500 - 2,000	Flotation Activated sludge	Emulsified oil separation Odor
industry	Medical supplies production	Blood serum, vaccine, medical grass, synthetic Reaction facility medical supplies, vitamin, hormone, alkaloid, Synthetic facility penicillin, antibiotic, organic and inorganic Distillation facility medical medicines, regents		pH 2-11 BOD ₅ 40-2,500 SS 200-600 T-N 80-100 T-P 10-20 Quantity 1,000-3,000	Neutralization Activated sludge	pH, color, odor

Remarks	Odor	Strong odor Pulp recover: around 50 % Wastewater: 150 – 300 m³/ton-pulp Pulp recover: around 50 % Wastewater: 150 – 500 m³/ton-pulp	Pulp recover : around 75 % % Wastewater: 100 – 150 m³/ton-pulp
Treatment (General)	Activated sludge	Coagulation- sedimentation Activated sludge Coagulation- sedimentation Activated sludge	Coagulation- sedimentation Activated sludge
Quantity (m³/day) & Quality of Wastewater	pH 1-9 BOD ₅ 1,000–5,000 SS 500–700 T-N 30 T-P 5 Quantity 20–50-150	pH 7-9 BOD ₅ 300-700 SS 40-80 T-N 110 T-P 2 pH 3.5-4.5 BOD ₅ 300-500 SS 50-300 T-N 100 T-P 3	pH 3-7 BOD ₅ 500-2,000 SS 200-600 T-N 70 T-P 2
Sources of Wastewater	Extraction process Reaction process	Decomposition process with steam Cleaning process Bleaching process Decomposition process with steam Cleaning process Bleaching process	Decomposition process with steam Cleaning process Bleaching process
Products	glue Glue, soybean glue, mix casein glue	Kraft pulp	SCP pulp
Type of Industry	Gelatin, glue production	Pulp production	Pulp production
Industry classification	Chemical industry	Pulp, paper, paper processing	

Table 3.16 Low Concentration Organic Wastewater

	MICCILLI ALIOH OF	LOW COINCING AND OF BAILT WAS COMMEN				
Industry assification	Industry Type of Industry assification	Products	Sources of Wastewater	Quantity (m ³ /day) & Quality of Wastewater	Treatment (General)	Remarks
ood	Dairy products	Butter, cheese, casein, powdered yogurt, cleaning process condensed milk, milk, ice cream, other diary Cooling water	cess	pH 6.5 – 11 BOD ₅ 50 – 350 SS 70 – 150 T-N 30 - 40 T-P 5 - 8 Quantity 1,000 – 6,000	Activated sludge	pH, N and P, residual chlorine

Type of Industry	Products	Sources of Wastewater	Quantity (m³/day) & Quality of Wastewater	Treatment (General)	Remarks
produc	Fermented soybean paste, edible amino acid, glutamine soda, sauce, tomato ketchup, Seasoning product vegetable sauce, mayonnaise, edible vinegar, spices, curry powder, red pepper, Japanese horseradish, pepper	Raw material treatment process pH Bottle cleaning process BOI Cleaning process SS T-N T-P	6-8 $20 - 300 - 2,000$ $200 - 300$ $100 - 150$ $15 - 60$ antity $50 - 200$	Activated sludge	Oil
Grain polishing, flour milling	Grain, rice and barley polishing; flour mill; Raw material treatment powdered buckwheat, corn, bean, soybean, Dust collection facility starch, feed; fertilizer of seafood, bone, fish, wastewater soybean waste	process	6 - 8 $5 20 - 400$ $400 - 600$ $410 50 - 200 - 400$	Sedimentation Flotation Activated sludge	Odor
roduction	Sugar production Sugar, cube sugar, granulated sugar, molasses	Filtration facility Cooling water S T	6 - 8 $5 - 80 - 500$ $70 - 100$ $20 - 30$ $3 - 8$ $113 - 300 - 1,500$	Sedimentation	Flow-out of activated carbon in cleaning filter cloth
Refined sake	Refined sake	Bottle cleaning process Equipment and machinery I cleaning process T	pH 8-11 BOD ₅ 500-2,000 SS 250-1,000 T-N 15-25 T-P 3-10 Quantity 7,000	Activated sludge	
Soft drinks production	Soft drinks, favorite drinks, cider, lemonade, carbonated drinks, juice, syrup, honey (except fruit wines)	Bottle cleaning process E	pH 9-12 BOD ₅ 250-350 SS 100-150 Quantity 300-1,000-3,000	Activated sludge	Ratio of N and P
Bean curd production	Bean curd, fried bean curd, frozen bean curd	Raw material treatment process pH Boiling process BOD; Soaking process n-hex T-N T-P Quant	5.1-7.3 ; 200-1,400 80-460 ane 6-80 10-50 1.3-7.4 ity 2-600	Oil separation Activated sludge	Wastewater: 50 – 160 m³/ton-soybean

Industry classification	Type of Industry	Products	Sources of Wastewater	Quantity (m³/day) & Quality of Wastewater	Treatment (General)	Remarks
Food Processing	Lunch production	Rice lunch, sushi lunch, sandwich, boiled noodle, rice ball	Kitchen facility (Raw material cleaning; dishes BOD ₅ 40–1,700 and container cleaning facility) SS 20–500 n-hexane 10–1,20 T-N 4.5-44 T-P 1-13 Quantity 4–450	0	Activated sludge	Including similar facilities to lunch caterer, group and school lunch facilities
Tobacco Production	Tobacco production	Cigarette, cigar, pipe tobacco	Wet de-odor facility Cleaning process	00	Activated sludge	Addition of N and P
Textile Industry except textile products			facility	pH 6-8 BOD ₅ 150-300 SS 50-100 T-N 20-30 T-P 3-8 Quantity 80-200 pH 3.5-9 BOD ₅ 150-200-400 SS 60-800 T-N 20-140 T-N 20-140 T-N 20-140 T-N 20-140 T-N 20-140 SS 50-80	Activated sludge Activated sludge Coagulation-Sedimentation Activated sludge	Wastewater: 0.03 – 0.06 m³/m²-cotton cloth
	Knitting industry	Socks, gloves	Dyeing facility	·=)	

Industry classification	Type of Industry	Products	Sources of Wastewater	Quantity (m ³ /day) & Quality of Wastewater	Treatment (General)	Remarks
Textile Industry except textile	Dyeing finishing indus	dyeing and finishing thread, cloth,	Refining facility Dyeing facility Bleaching facility		Coagulation- Sedimentation Activated sludge	
products	Textile sanitary production	Absorbent cotton, gauze, bandage, fibrous Cleaning facility sanitary products	,	0	Coagulation- Sedimentation Activated sludge	
Lumber, wooden production	Lumber, wooden production	wooden Sawed lumber, tip, particle board, plywood n	Wet parker pH 4.5 - 6.4 Adhesive machine cleaning facil BODs 20 - 240 SS 40 - 300 T-N 0.5 - 2.0 T-P 1 - 7 Quantity 3,000 - 1	30,000	Coagulation- Sedimentation Floatation	
Pulp, paper, paper processing	Paper production	Paper production Kinds of paper, cardboard	Papermaking facility Tip soaking facility Grinder facility		Coagulation-Sedimentation Floatation	Pulp recovery rate: around 90%
Chemical Industry	Organic industrial	Coal tar product; dyeing and medical intermittent product; synthetic dyeing material, organic paint, fermentation industry, ethylene derivative, synthetic resin, methanol and its derivative, organic industrial products not classified into plasticity products.	Cleaning facility Reaction facility Cleaning facility	SS 200 – 300 Quantity 500 – 2,000 pH 1 - 13 BOD ₅ 100 – 1,000 SS 20 – 150 T-N 10- 200 T-P 10- 200 Quantity 50 – 200 - 500	Neutralization Activated sludge Coagulation- sedimentation	Wastewater: average 65m³/ton-pulp pH, odor, color

Industry classification	Type of Industry	Products	Sources of Wastewater	Quantity (m³/day) & Quality of Wastewater	Treatment (General)	Remarks
Chemical Industry	Oil and fat processing, paint production including surfactan	Oil and fat acid, hardened oil, glycerin, soap, surfactant, paint, printing ink, cleaning agent, brushing agent	Raw oil cleaning facility Cooling water		Floatation Activated sludge	
100	Waste oil recycle	Refining waste oil, recycled oil, mud oil recycle	Cleaning facility Distill facility	-50	Floatation	pH, oil
products	Oil refinery	Oil products, gasoline, paraffin	Cleaning wastewater (including BOD ₅ 20 – 200 emulsion, acid and alkali SS 20 – 100 wastewater) T-N 20-30 T-P 5		Floatation Activated sludge Coagulation- sedime	Floatation 50,000 m³-wastewater/ Activated sludge 15,900,000 barrel Coagulation- sedime 1m³-white water/m³- product
Rubber industry	Tire, tube	Tire, tube, rubber hose, rubber plate, industrial rubber products	Direct vulcanization process	PpH 6-9 COD _{Min} 50 – 70 SS 30	Coagulation- sedimentation Oil separation	Zn Possible biological treatmen
	Medical, sanitary rubber production	Medical, sanitary Medical, sanitary rubber products, fiber rubber production rubber, rubber glove	r Latex mold cleaning process	n-hexane 10 T-N 1 T-P 0.5 Quantity 2,000–9,000 – 100,000		
Wholesale market	Local whole sale market	Fresh, frozen, salt dried fishery products, Marine products processing	Cleaning wastewater	pH 6-7 BOD ₅ 100 – 300 SS 90 - 300 T-N 10 - 25 T-P 8 - 10 Quantity 10 – 500	Activated sludge	

Industry classification	Type of Industry	Products	Sources of Wastewater	Quantity (m³/day) & Quality of Wastewater	Treatment (General)	Remarks
Wholesale	Empty bottle wholesale	bottle Bottle cleaning, reuse and wholesale for wine, whisky, brandy, milk, edible vinegar	for Automatic bottle cleaning	pH 8-12 BOD ₅ 30 – 500 n-hexane 0-30 SS 10-200 T-N 2-8 T-P 1-4 Quantity 20-500-3,000	Activated sludge	
Vehicle repair shop	Automobile repair shop	Automobile repair shop	Car washing facility		Grid chamber Oil separation Coagulation - sedimentation	
	Home laundry	Y-shirt	Cleaning facility	pH 8.7 -11.5 BOD ₅ 90 - 410 SS 140 (ave.) n-hexane 95 (ave) T-N 10 - 30 T-P 15 - 40	Coagulation – Use rotary bi sedimentation heavy foamin Floatation Chloride sol Biological treatment dry cleaning	Use rotary bio-disk due to heavy foaming Chloride solvent is used in dry cleaning
Cleaning industry	Linen supply	Sheet, pillow cover	Cleaning facility	pH 9.0-10.6 BOD ₅ 87 – 647 SS 160 (ave.) n-hexane 110 (ave) T-N 10-30 T-P 15-40	Coagulation – sedimentation Floatation Biological treatment heavy foaming	Use rotary bio-disk due to heavy foaming
	Baby laundry	Diaper	Cleaning facility	pH 8.5-9.4 BOD ₅ 200 – 1,450 SS 150 (ave.) n-hexane 150 (ave) T-N 10 - 40 T-P 15 - 30	Coagulation – sedimentation Floatation Use rotary bio- Biological treatment heavy foaming	Use rotary bio-disk due to heavy foaming

Industry classification	Type of Industry	Products	Sources of Wastewater	Quantity (m³/day) & Quality of Wastewater	Treatment (General)	Remarks
	Restaurant	Restaurant serving staple food such as bread, rice, cooked cuisine	Kitchen facility		Oil separator Activated sludge	Western and Chinese restaurant wastewater includes high BOD and oil
Restaurant	Restaurant	Sushi, noodle, drinking (coffee, tea, milk, Kitchen facility alcohol)		pH 6-8 BOD ₅ 210-1,200 SS 40-90 n-hexane 10-250 T-N 3-40 T-P 1-13 Quantity 1-25	Activated sludge	High BOD ₅ and oil in wastewater from coffee shop serving light meal Big difference in quality depends on serving alcohol
	Restaurant	Cuisine, staple, alcohol	Kitchen facility	000	Activated sludge	Big difference in scale Big daily and hourly fluctuation
Hospital	General hospital	Kitchen facility Laundry facility Medical service such as out and in-patient, Bathing facility medication, operation Picture developmen	nt facility	pH 6.9 – 7.4 BOD ₅ 80 – 280 SS 20 – 50 Phenol 0.02 – 48 T-N 4 - 7 T-P 0.5 - 1 Quantity 50 – 1,000	Coagulation- sedimentation Activated sludge	Big difference in scale and examination courses
Livestock industry	Pig raising	Living pig	Raising facility	500 00 50	Activated sludge Methane fermentatio	Activated sludge Methane fermentatio Big difference in scale, feeding, raising and facility management

Table 3.17 Orga	anic Wastev	vater with T	Toxic Substaı	ıces
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Remarks	Chrome, sulfide						Same as gas production,	coke production industry		Liquid: 10 % of	carbonized coal										38 1	Wastewater: 1.5 - 5m /ton-	carbonized coal						
Treatment (General)	Coagulation-	sedimentation	Activated sludge	Oxidation ditch			Chemical treatment	Activated sludge	Ammonia stripping																				
Quantity (m ³ /day) & Quality of Wastewater	pH 7-12	2	SS $50-3,000$	T-N 250-350	T-P 10 - 20	Quantity 3 0- 100 - 600	(Gas liquid)	pH 9-9.5	BOD_5 3,000 – 4,000	SS 50	T-N $800 - 1,000$	T-P $20-50$	Phenol 1,000 – 5,000	Thio-cyanide acid	200 - 800	Cyanide 40	Sulfide 200 – 400	Free ammonia	3,000-7,000	(Gas cleaning wastewater)	pH 9-9.5	$BOD_5 150 - 800$	Phenol 50 – 500	Thio-cyanide acid	200 - 800	Cyanide 0-300	Sulfide 200 – 400	Free ammonia	500 - 2,000
Sources of Wastewater	Raw material treatment process pH		acility	Dyeing facility														Coke furnace											
Products			Leather, tanned leather, chrome leather, Fish	skin, leather dyeing														Blast lulliace 11g Pig iron by blast furnace											
Type of Industry			Leather industry														Dloct frames Die	Diast iniliace rig	IIOII										
Industry classification			Leather	processing														Steel industry											

Industry classification	Type of Industry	Products	Sources of Wastewater	Quantity (m³/day) & Quality of Wastewater	Treatment (General)	Remarks
Chemical Industry	Insecticide production	Insecticide, disinfectant, mosquito killer, pesticide	Reaction facility Cleaning facility	pH 4-9 BOD ₅ 20-100 SS 50-70 Quantity 50-200-300		Need design of each treatment with each product
Publishing business	Newspaper, publishing, print, bookbinder	Newspaper, publishing, print, Newspaper, magazine, books, advertisement bookbinder	Cleaning facility of automatic foreelopment and fixing solution) Eleaning facility of print by H 44.5; 9.5-10.5 Cleaning facility of print BOD ₅ 3,000-20,000 development with automatic SS 100-200 T-N 100-200 T-P 10-200 Chantity 400-120,000		Neutralization Coagulation - sedimentation	CN, Cd, Cr, Mn, Cu, Zn included

 Table 3.18
 Inorganic Wastewater

		Iai	710 3.10 1
Remarks		pH, color	Abrading, oil
Treatment (General)	Neutralization- sedimentation	Neutralization- sedimentation	Coagulation- sedimentation
Quantity (m³/day) & Quality of Wastewater	pH 1-4 BOD ₅ 800-1,200 SS 50-350 T-N 250-350 T-P 220-280 Quantity 100-1,000	pH 1-9 BOD ₅ 20 SS 1,000-2,000 T-N 60-100 T-P 2-5-50 Quantity 500-2,000	$\begin{array}{lllll} pH & 7-9 \\ BOD_5 & 20-70 \\ SS & 150-300 \\ Quantity & 50-100-5,000 \end{array}$
Sources of Wastewater	Reaction facility Gas cleaning facility	Grinder facility Calcium-carbide, Cooling facility te acid, inorganic dustrial products	Grinding facility Cleaning facility Cooling facility
Products	Ammonia fertilizer, lime nitrogen, phosphate fertilizer, combined fertilizer	Soda industrial product, Calcium-carbide, man-made carbon, Phosphate acid, inorganic paint, salt, other inorganic industrial products	Ceramic industry, soil Glass production processed goods production
Type of Industry	Chemical fertilizer production	Inorganic industrial products	Glass production
Industry classification	Chemical	Industry	Ceramic industry, soil and stone production

Industry classification	Type of Industry	Products	Sources of Wastewater	Quantity (m³/day) & Quality of Wastewater	Treatment (General)	Remarks
Ceramic industry, soil and stone production	Concrete product	Concrete tube, cement tile, cement plate, slate, concrete electricity poll, concrete tank, block	ý	pH 9 – 14 SS 150 – 500 Quantity 100- 300	Neutralization- sedimentation	
	Not by blast furnace	Electric furnace steel, charcoal furnace steel, small-sized blast furnace steel, recycled furnace steel, raw iron, sponge steel, granule steel, steel bar, pure iron, ferroalloy, base metal, titan slug	Cooling facility Dust collecting facility 9	PH 4-8 BOD ₅ 50-100 SS 500-3,000 T-N 5-15 T-P 10-20 Quantity 200-1,000	Neutralization- sedimentation	
	g m	Steel and rolling mill products, special steel, steel pipe	Rolling mill facility Acid cleaning facility Dust collecting facility Oust	pH 3-8 SS 500-1,000 Quantity 100-1,500	Neutralization- Coagulation- sedimentation	Acid washing wastewater: 1 – 4m³/ton-steel 200 – 400 mg/L oil in cool rolling wastewater Wastewater in rolling mill: 7 -12 m³/ton-steel
Steel industry Steel produstry steel steel manu	ma ıction facturir	Heated and cooled rolling plate, expanded steel	Acid cleaning facility Cooling facility	pH 3-4 SS 70-200 Quantity 100-400	Neutralization- Coagulation- sedimentation	Hundreds of scale and 10 – 20 mg/L oil in heated rolling wastewater
	Plating steel materials production	Tin plate, zinc steel plate, lead steel plate, zinc Acid cleaning facility plating steel pipe, plating steel wire, tinning Cooling water steel pipe		pH 2-6 SS 30-150 Quantity 50-150	Neutralization- Coagulation- sedimentation	Wastewater: 30 -40 m³/ton-steel plate
	Steel industry by blast furnace	Steel industry by Steel rolling products, regular steel, steel pipe blast furnace	Blast furnace (steel manufacturing	rnace dust wastewater) $7 - 8$ $500 - 3,000$ aperature $40 - 50$ °C nitiy $10 - 15$ m ³ per ton-	Coagulation- sedimentation Sedimentation	Rolling wastewater and acid cleaning wastewater: same as the rolling wastewater above

Industry classification	Type of Industry	Products	Sources of Wastewater	Quantity (m³/day) & Quality of Wastewater	Treatment (General)	Remarks
Steel Industry	Steel industry by blast furnace	Steel Industry by Steel rolling products, regular steel, steel pipe	Revolving fumace (steel manufacturing)	(Revolving furnace gas cleaning wastewater) pH $_3$ -6 SS $_2$,000 - 6,000 Temperature $_4$ 0 - 60 $_{\odot}$ C Quantity $_1$ - 3 $_{\odot}$ 3 per toningot	Coagulation- sedimentation Sedimentation	Wastewater consumption: $100 - 150$ m ³ /crude steel Among it fresh water: $50 - 80$ m ³ /crude steel, among it $70 - 90$ % is reused.
Metal Metal surfa processing processing	Metal surface processing	Electrolysis polishing, Alumite, Polishing, Chemical film facility metal corrosion protection Acid or alkali cleaning	g wastewat	$ \begin{array}{c} 2 - 10 \\ 70 - 150 \\ \text{untity} 20 - 60 \end{array} $	Neutralization- sedimentation	Fluctuation of wastewater

Table 3.19 Inorganic Wastewater with Toxic Substances

		Table .	3.19 Inorga	ine w
Remarks	Heavy metals	Heavy metals	Chemical treatment Fluctuation of wastewater Heavy metals	
Treatment (General)	Coagulation- sedimentation Chemical treatment	Neutralization- sedimentation	Chemical treatment	Ion-exchange Chemical treatment
Quantity (m³/day) & Quality of Wastewater	pH 6 – 8 SS 500 – 3,000 Quantity 1,000 – 3,000	pH $2-7$ SS $70-200$ Quantity $200-600-10,000$	pH 1-2 CN 20-200 Cr 40-150 Cu, Cd, Zn included Quantity 10-30-100	Hg including
Sources of Wastewater	Gas cleaning facility	Acid cleaning facility	Electricity plating facility Acid, alkali cleaning facility	Mercury electrode Electrolysis facility
Products	Cupper metallurgy, Cupper production, Nonferrous metals electricity cupper metallurgy, metallurgy of first metallurgy, lead, zinc, aluminum, gold, titan, nickel, silver, Gas cleaning facility antimony, mercury, magnesium, tungsten, germanium	Nonferrous metal rolling, expanded Expanded cupper, pipe, rolling and expanded pipe, alloy lead, aluminum, precious metals compounds	Electricity plating industry	Soda industrial product
Type of Industry	Nonferrous metals first metallurgy, refiner	Nonferrous metal rolling, expanded pipe, alloy compounds	Electricity plating industry	industrial
Industry classification	Nonferrous metals	processing	Metal products processing	Chemical industry

Industry Telessification	n Type of Industry	Products	Sources of Wastewater	Quantity (m³/day) & Quality of Wastewater	Treatment (General)	Remarks
Ceramic industry, soil an stone products manufacturing	Glass production	Optical glass, special glass(with heavy metals like Cd)	Grinder, Cleaning facility	Heavy metal like Cd	Coagulation- sedimentation Filtration	

3.9 Estimation of Industrial Wastewater Quality

Table 3.20 Estimation of Industrial Wastewater Quality

	Industria					Woten	Wootcomoton		Estin	ration by 1	PPS (The 1	Estimation by IPPS (The Industrial Pollution Projection System) Method	llution Pro	jection Syste	m) Method			Example in Japan	lapan	H	Anal	Analysis Result	=	Estimated	ated
No. Company/Factory Name		Classification Industry Number of A or B code employees	Industry	Number of employees	Products	consumption	generation	Estimate	L ĝ	Unit Load (ton/year/1,000	9	Load (ton/year)	n/year)		g/m³	_	Estimated	- F	g/m³			g/m³		(g/m³)	ر ر
	- IPPC					(m ⁻ /year)	(m ⁻ /year)	ISIC Code	Use	BODs	s	Used BOD ₅		SS Used	al BODs	s s		y BOD _s	ss	BODs	D ₅ COD(Mn)	Mn) SS	Remarks	s BODs	S
1 Ading AD	4.1,4.2	V	24.66	100	powder cement products, water solution additives, epoxide systems, mineral oils, construction facilities	18,600	90009	3529	5.61	1.2	1.73	9.0	0.1	0.2	94	20	29 Organic industrial production	100-1,000	20-150	-11	150 1,	1,930 264	4	200	300
2 TGS Tehnicki gasovi	4.2 a	4	24.11	9/	acetylen	18,500	16,000	3529	5.61	1.2	1.73	0.4	0.1	0.1	27	5.7	8.2 In-organic noducts	.i	20 1,000-2,000	- 00	'	'		30	1,000
31 ARCELORMITTAL STEEL	2.3	٧	27.10	970	hot rolling mill, cold rolling mill	2,375,600	2,085,600	3710	25.31	0.96	14,074	24.6	0.9	13,651.8	12	0.4 6,5	6,546 Steel industry	stry,	500-1,000	0 ignore	J.	190 315	15 Fe: 177	09	200
	2.2 & 2.3	٧	27.10	096	sheet metal	4,492,853	1,523,449	3710	25.31	1 96.0	14,074	24.3	0.9	13,511.0	16	9.8	Plating steel 8,869 materials production	s sel	30-150	· ·	5.6 15(CODer)		12 Fe: 1.9	09	150
5 Rz. Usługi	,	_	40.3,	207	services, water supply	50,370	50,370	3851	0.05	0.03	0.03	0:0	0.0	0.0	0.21 0.	0.12 0.	(Steam and hot water supply, collection, purification and	on to				8:	94	09	150
6 Replek Farm	4.5	В	24.41	330	pharmaceutical products	2,580	2,064	3511	427	570	088	140.9	188.1	290.4 68,7	68,270 91,134	134 140,698	0 1 8	100-1,000	20-150	4	413	9 829	29	200	7.5
7 Zito Luks - Suto Orizari	6.4	ш	18.81	394	bread, pastries made of flour and icebound dought	57,024	48,840	3121	0.35	0.27	0.11	0.1	0.1	0.0	2.8	2.2	Bakery, 0.9 confrctionery products	ery 200-600-2,500	,500 120-600-2500	2500 -	'	'	'	009	009
8 Fitofarm	4.5	٧	24.41	31	cosmetic products solutions, medicine creams and greases syrups	5,531	5,531	3523	0.72	15.14	21	0.0	0.5	0.7	4.0	85 1	Organic 120 industrial production	100-1,000	20-150	'	'	'		250	200
9 Klinicki centar	1	1	85.11	4200	services, hospital	527,588	475,000	3512	17.6	7.12	1,386	73.9	29.9 5,1	5,821.2	156	63 12,255		80-280	20-50	'		'		170	350
10 Gradska bolnica	1	/	85.11	340	services, hospital	39,630	36,000	3512	17.6	7.12	1,386	0.9	2.4	471.2	166	67 13,090	Oenral hospital	80-280	20-50			•		80	150
11 Voena bolnica	1	1	85.11	604	services, hospital	240,000	220,000	3512	17.6	7.12	1,386	10.6	4.3	837.1	48	20 3,8	3,805 Genral	80-280	20-50			•		80	350
12 Alkaloid AD-Lafoma	4.1,4.2,4.	¥	24.51	194	chemicals, cosmetics products, pharmaceuticals, chemodialysis solution	310,000	210,000	3523	0.72	15.14	21	0.1	2.9	4.1	0.7	14	Organic 20 industrial productior	100-1,000	20-150		1,	1,430 315	15 Fe;31	700	350
Alkaloid AD- pharmaceutical	4.5	٧	24.41	758	analgin,paracetamol,kofein,pentoksifelin	138,900	137,900	3511	427	570	088	323.7 4	432.1	667.0 2,;	2,347 3,1	3,133 4,8	4,837 industrial	100-1,000	20-150			343		250	75
14 Alkaloid AD-Herbs	1	/	15.86	50	tea,spices,parapharmaceuticals,herbs	70,000	68,000	3121	0.35	0.27	0.11	0.0	0.0	0.0	0.3	0.2	0.1 Seasoning product	40-300-2,000	000 200-300			182		150	250
15 DOOEL	4.1	Y	24.3	63	materials, dispersions,coatings,synthetic materials	40,820	23,681	3521	0.45	0.03	0.11	0.0	0.0	0.0	1.2	0.1	Organic 0.3 industrial production	100-1,000	20-150			420		200	100
16 Kanar 92	2.6	V	28.11	50	welded metal structures	2,000	4,000	3813	3.27	0.06	80:0	0.2	0.0	0.0	41	8.0	1.0 Plating steel materials production	s su	30-150	•		•		30	70
17 MZT energetika	,	_	40.3,	43	Production and distribution of compressed air, gases and water	800	800	3851	0.05	0.03	0.03	0.0	0.0	0.0	2.7	9.1	(Steam and hot water supply, collection, purification and	B + 4 K						30	9
18 MZT Hepos	2.3	٧	28.11	493	machines and parts	174,149	132,248	3813	3.27	90'0	80.0	1.6	0.0	0.0	12 (0.2	0.3 materials production	s s	30-150		30	50 5	55	30	09
19 MZT Learnica	2.4	<	27.52	367	foundries of nodular foundry,foundries of grey foundry	92,400	48,600	3710	25.31	0.96	14073	9.3	0.4 5,	5,164.8	. 161	7.2 106,271	<u>_</u>	ls se	30-150			18	881	70	190
20 Sanos Bus	1	,	34.1	59	pnses	12,950	11,650	3842	0.25	0.03	0.13	0.0	0.0	0.0	1.3	0.2	0.7 Automobile	ile 20-120	10-700	'		'		40	70
21 Evropa A.D.	6.4	В	15.84	431	confectionary products	102,000	90,000	3119	1971	72.0	0.13	0.7	0.3	0.1	7.7	3.7	0.6 confrctionery products	ery 200-600-2,500	,500 120-600-2500		17	115 5	99	300	009
22 JSP - Gjorce Petrov	1	,	60.21	1294	services, public transporatation	39,201	37,240	3851	0.05	0.03	0.03	0.1	0.0	0.0	1.7	1.0	1.0 Automobile repair shop	ile 20-120	10-700	<u> </u>	'	<u> </u>	n-hexane	80	200
23 JSP - Avtokomonda	1	1	60.21	1294	services, public transporatation	966'06	87,834	3851	0.05	0.03	0.03	0.1	0.0	0.0	0.7	0.4	0.4 Automobile repair shop	ile 20-120	10-700				n-hexane	80	200

	Industria					Woton	Wortenstein		Estin	ration by h	IPPS (The	Estimation by IPPS (The Industrial Pollution Projection System) Method	ollution Pr	ojection Sys	tem) Meth	poi		Exam	Example in Japan			Analysis Result	Result		Estimated
No. Company/Factory	Category	Classification Industry	Industry	Number of	f Products	consumption	generation	Estimate	֓֞֞֞֞֞֞֞֩֓֓֓֞֩֞֩֞֩֓֓֓֓֞֩֞֩֓֓֓֡֓֡	Unit Load	_	Load (Load (ton/year)		••	g/m³	Esti	Estimated	g/m³			g/m³	۳_	_	water quanty (g/m³)
	- IPPC	1				(m³/year)	(m³/year)	٠.	Used		s	Used Bo	BODs	SS	Used B	BODs	SS FE DE	Type of Industry	BOD ₅	s	BOD,	BOD ₅ COD(Mn)	SS Rer	Remarks BC	BOD ₅ SS
24 Energetika - ELEM	1	٧	40.3	138	technological steam, hot water, DM water	255,211	62,611	3851	0.05	0.03	0.03	0:0	0.0	0:0	0.1	0.1	(Stea hot 1 0.1 sup colle	(Steam and hot water supply, collection,					1	1	20 50
25 Skopski Leguri	2.5	٧	27.1	969	Si-Mn, Planning Fe-Mn	4,483,200	2,031,600	3720	10.22	261	3772	7.1	181.7	2,625.3	3.5	68	Platin 1,292 mats	Plating steel materials production	36	30-150					20 70
26 Komuna	6.1	A	21.21	75	paper,confection,bags	496,392	473,620	3412	0.41	5.17	8.87	0.0	0.4	0.7	0.1	8.0	1.4 Pa	_	150-200 25	250-600		220	498		150 500
27 Pivara	6.4	٧	15.96	394	beer,bah,vinigar	000*099	520,827	3133	1.21	5.62	12.99	0.5	2.2	5.1	6.0	4.3	9.8 Beer I	- 5	500-2,000 25	250-1,000	808	296	130		850 130
28 Rade Koncar-Kontaktori i relei	2.4	В	31.2	270	contactors	31,400	31,400	3831	0.09	0.04	0.23	0.0	0.0	0.1	8.0	0.3	2.0 Elec	Electricity	20	70-150			59		50 70
29 Ohis AD	4	A	24.1	1500	detergents, acrylic fibre, mat fibre, roving, yarn, PVA emulsions and processing (not production), PVC moulding into duct, compounds, pipes and foils, cosmetics	2,014,430	891,361	3513	49.82	25.35	81.92	74.7	38.0	122.9	84	43	Org 138 indu prod		100-1,000 20	20-150		220			100 80
30 Cementamica Usje	3.1	A	26.51	514	cement	395,000	368,000	3692	4	0.11	240	2.1	0.1	123.4	5.6	0.2	335 Cor	Concrete	15	150-500	30 12	128 (CODc	100		30 200
31 Mlekarnica Masko	6.4	В	15.51	6	yogurt,milk,cheese	72,720	72,720	3112	3.26	1160	167	0.0	10.4	1.5	0.4	144	21 Di		50-350 70	70-150	11 35	37 (CODcr	2,200		350 2,200
32 Skovin	1	1	15.98	99	vine production	18,000	18,000	3132	0	2.68	1.47	0.0	0.2	0.1		10	5.4 Sprits	pex	600-92,000 60	600-2,000					009 009
33 M&A beveridzis	1	1	15.98	130	soft drinks	10,200	4,200	3132	0	2.68	1.47	0.0	0.3	0.2	•	83	46 Soft prod	Soft drinks production 250.	250-350 10	100-150	132 (D	25	8		350 150
34 Beton AD Skopje	/	,	26.61	1316	concrete	8,024	5,400	3691	0.07	0.02	0.38	0.1	0.0	0.5	17	4.9	93 Cor	Concrete	113	150-500					20 200
35 Globus	6.4	В	15.11	51	delicatess products	14,000	13,110	3111	0.74	3.26	4.04	0.0	0.2	0.2	2.9	13	16 Meatp	Meat products 300	300-600	100-300	2.5	620	570		009 009
36 Klanica "Vilan"	6.4	В	15.11	9	loading/unloading of meat	1,320	1,254	3111	0.74	3.26	4.04	0.0	0.0	0.0	3.5	16	19 Meatp	Meat products 300	300-600	100-300					300 100
37 "Rimes"	6.4	В	15.11	45	sausages, smoked pig meat, pareni products	7,836	7,150	3111	0.74	3.26	4.04	0.0	0.1	0.2	4.7	21	25 Meat p		009-008	100-300	73 26	26 (CODer)	217		300 100
38 Lek Skopje	4.5	В	24.41	33	medicaments	3,240	3,240	3529	5.61	1.2	1.73	0.2	0.0	0.1	57	12	18 Empt	Empty bottel 30-;	30-500 10	10-200					350 100
39 Drisla	5.3	A	90.00	102	landfill	9,025	34,254	3529	5.61	1.2	1.73	9:0	0.1	0.2	17	3.6	5.2				15				60 120
40 AD Toplifikacija - Zapad	1.1	A	40.30	220	heat energy	155,700	5,100	3529	5.61	1.2	1.73	1.2	0.3	0.4	242	52	75				560	235	2,600 Fe: 1,400		600 2,600
41 AD Toplifikacija - Istok	1.1	A	40.30	70	heat energy	239,950	30,350	3529	5.61	1.2	1.73	0.4	0.1	0.1	13	2.8	4.0							-	60 70
42 AD Toplifikacija - 11 Oktomvri	1.1	В	40.30	6	heat energy	9,520	1,520	3529	5.61	1.2	1.73 #V.	#VALUE! #VA	#VALUE! #V/	#VALUE! #VA	#VALUE! #V.	#VALUE! #V/	#VALUE!								09
43 MIDA	1	,	1	120	services, car wash	22,200	18,000	3843	0.25	0.03	0.13	0.0	0.0	0.0	1.7	0.2	0.9 Auto	Automobile 20-1	20-120	10-700					920
44 Rade Koncar TEP	1	1	31.10	21	cupboard,transformators	308	230	3831	0.09	0.04	0.23	0.0	0:0	0.0	8.2	3.7	Platir 21 mate prode	Plating steel materials production	30	30-150					001 09
45 "Promes"	6.4	В	15.11	150	meat products (dry)	44,400	42,180	3111	0.74	3.26	4.04	0.1	0.5	9:0	2.6	12	14 Meatp	cts	300-600	100-300		48	114		300 150
46 Carwash TONI	,	,	,	3	services, car wash	1,095	1,095	3843	0.25	0.03	4.04	0.0	0.0	0.0	0.7	0.1	11 Home	Home laundry 90-4	90-410	10-700	•		,		120 150
47 Carwash Brane	,	,	/	3	services, car wash	730	730	3843	0.25	0.03	4.04	0.0	0.0	0.0	1.0	0.1	17 Home	Home laundry 90-2	90-410	10-700		-			120 150
48 Carwash Medzik Kisel	/	,	1	4	services, car wash	2,880	2,880	3843	0.25	0.03	4.04	0.0	0.0	0.0	0.3	0.0	5.6 Home	Home laundry 90-2	90-410	10-700	-				120 150
49 AD Toplifikacija - Sever	1.1	В	40.30	7	heat energy	5,110	1,260	3529	5.61	1.2	4.04	0:0	0.0	0.0	31	7	22								09
50 Swiss-lion	,	В	15.81	114	softy biscuette, salt proggramme	11,125	11,120	3119	0	1.61	0.77	0.0	0.2	0.1		17	7.9 confro	Bakery, confrctionery 200 products	200-600-1,300 100-150-900	00-150-900	1500	1500	550	1,	1,500 600
Total				19,365		17,878,505	9,974,019																		

3.10 Pollution Load by Type of Industry

Table 3.21 Pollution Load by Type of Industry

ر ق				1:	ΞI	1			•	Table	-	-				_		1	D.	y Typ		10	111	uus	ti y			Г		Т	_
Estimated Pre- traetment	^		Oil	lio ;	Fe,Mn, Oil	Oil			Heavy metals, Oil BOD ₅	Heavy metals, Oil, BOD ₅	Heavy metal Oil	Oil	Heavy metals, Oil	Oil	CN, heavy metals, phenol. oil					Oil	SS			Fe	Fe	Phenol				Heavy	metals
Discharge in Future					Sewer				238 Vardar River	174 Vardar River	Sewer	Sewer	Sewer	Sewer	Sewer			Sewer		Sewer	Ш	Sewer	Sewer	Sewer	Sewer	Sewer	102 Vardar River	Sewer			Sewer
Wastewate r/hour			7.1	0.5	1.9	0.6	21		238	174	6.0	30	232	5.5	7.4	889		42	42	2.9	7.7	0.0	1.4	35	34	12	102		196		3.9
Operation hours/day	•		24	15	15	15			24	24	16	16	24	24	16		i	24		∞	8	16	15	24	16	∞	24			7	4 7
Operation days/year			365	183	183	183			365	365	280	276	365	365	264			365		260	260	220	261	250	250	250	365			200	365
d load ay)	SS		8.6	0.5	72.5	0.0	94		2,857.0	626.1	1.0	28.7	389.6	25.3	8.3	3,936		202	202	7	62	Т	4	294	41	6	195		614	-	-
Estimated load (kg/day)	BODs		3.4	0.4	10.0	0.5	31		342.8	250.4	0.4	14.4	111.3	9.3	5.9	735		30.2	30	4.6	1.8	4.7	5.3	588.0	137.9	18.9	244.2		1,006	· ·	0.0
water mg/L)	SS		50	70	2,600	70		l	200	150	70	09	70	190	70		9	200		300	1,000	75	200	350	75	100	08			9	170
Estimated water quality (mg/L)	BODs		20	09	009	09		l	09	09	30	30	20	70	50		4	30		200	30	500	250	700	250	200	100			Q	00
neration	m³/day		172	6.9	27.9	8.3	380		5,714	4,174	14.3	479	5,566	133	119	16,199		1,008	1,008	23	62	9.4	21	840	552	95	2,442		4,044	ā	46
Wastewater generation	m³/year		62,611	1,260	30,350	1,520	100.841		2,085,600	1,523,449	4,000	132,248	2,031,600	48,600	31,400	5,856,897		368,000	368,000	6,000	16,000	2,064	5,531	210,000	137,900	23,681	891,361	3,240	1,295,777	6	34,234
Products			technological steam, hot water, DM water	heat energy	heat energy	heat energy	3		hot rolling mill,cold rolling mill	sheet metal	welded metal structures	machines and parts	Si-Mn, Planning Fe-Mn	foundries of nodular foundry,foundries of grey foundry	contactors			cement		powder cement products, water solution additives, epoxide systems, mineral oils, construction facilities	acetylene	pharmaceutical products	cosmetic products, solutions, medicine creams and greases, syrups	chemicals, cosmetics products, pharmaceuticals, chemodial ysis solution	analgin,paracetamol,kofein,pentoksifelin	materials, dispersions, coatings, synthetic materials	detergents, acrylic fibre, mat fibre, roving, yarn, PVA emulsions and processing (not production), PVC moulding into duct, commounds mines and foils cosmetics.	medicaments		1001	landfill
Number of employees			138		220				026	096	50	493	969	367	270			514		100	92	330	31	194	758	63	1500	33		6	701
			40.3	40.30	40.30	40.30			27.10	27.10	28.11	28.11	27.1	27.52	31.2		\blacksquare	26.51		24.66	24.11	24.41	24.41	24.51	24.41	24.3	24.1	24.41		00	90:00
Classificat Industry ion A or B code			Α	В	∢ <	В		(4	Ą	Ą	Ą	Α	Α	A	В	of metals		V		∢	Y	В	Α	A	A	A	∢	В		,	٧
Industrial Category - IPPC			1.1		1.1	1.1		ng of metals	2.3	2.2 & 2.3	2.6	2.3	2.5	2.4	2.4	processing		3.1		4.1,4.2	4.2 a	4.5	4.5	4.1,4.2,4.5	4.5	4.1	4	4.5	ŗy	,	5.3
Company/Factory Name		Energy industries		49 AD Toplifikacija - Sever	40 AD Toplifikacija - Zapad		Total energy industries	_	31 STEEL	4' Makstil	16 Kanar 92	18 MZT Hepos	25 Skopski Leguri	19 MZT Learnica	Rade Koncar-Kontaktori i relei	Total production and processing of metals		30 Cementamica Usje	4 Chemical industry	1 Ading AD	2 TGS Tehnicki gasovi	6 Replek Farm	8 Fitofarm	12 Alkaloid AD-Lafoma	Alkaloid AD- pharmaceutical	ALKALOID PREMAZI DOOEL	29 Ohis AD	38 Lek Skopje		Waste management	39 Drisia
Š		1	``	1	Π,			7					, ,		'		3	1	4		Ш						, ,	Ľ		n i	

		Industrial	9:	1					Totom fortune	June to un	Total long	lood lood					Estimated
Š.	. Name	Category - IPPC	ion A or B code	code	employees	Products	Wastewater generation	eneration	quality (mg/L)	mg/L)	(kg/day)		Operation Operation days/year hours/day	Operation hours/day	Operation Operation Wastewate days/year hours/day r/hour	Discharge in Future	Pre- traetment ¹
							m³/year	m³/day	BODs	SS	BOD5	SS		•			•
9	Other activities under IPPC	PC															
, ,	7 Zito Luks - Suto Orizari	6.4	В	15.81	394	bread, pastries made of flour and icebound dought	48,840	134	009	009	80	08	365	24	5.6	Sewer	Oil
37	7 "Rimes"	6.4	В	15.11	45	sausages, smoked pig meat, pareni products	7,150	27	300	100	8	3	261	16	1.7	Sewer	Oil
2	26 Komuna	6.1	A	21.21	75	paper, confection, bags	473,620	1,377	150	200	207	889	344	24	57	Sewer	
27	7 Pivara	6.4	A	15.96	394	beer,bah,vinigar	520,827	1,427	850	130	1,213	186	365	24	59	Vardar River	
2	21 Evropa A.D.	6.4	В	15.84	431	confectionary products	90,000	346	300	009	104	208	260	8	43	Sewer	Oil
3	31 Mlekarnica Masko	6.4	В	15.51	6	yogurt,milk,cheese	72,720	199	350	2,200	20	438	365	24	8.3	Sewer	SS
3,	35 Globus	6.4	В	15.11	51	delicatess products	13,110	46	009	009	27	27	288	8	5.7	Sewer	
36	36 Klanica "Vilan"	6.4	В	15.11	9	loading/unloading of meat	1,254	4.5	300	100	1	0	280	8	9.0	Sewer	
4;	45 "Promes"	6.4	В	15.11	150	meat products (dry)	42,180	146	300	150	44	22	288	24	6.1	Sewer	Oil
56	50 Swiss-lion	6.4	В	15.81	114	softy biscuette, salt proggramme	11,120	44	1,500	009	29	27	250	24	1.9	Sewer	Oil
	Total other activities u	activities under IPPC	C)				1,280,821	3,751			1,821	1,679			190		
7	Other																
,,	5 Rz Uslugi	/	,	40.3, 41.10	207	services, water supply	50,370	138	09	150	8	21	365	24	5.8	Sewer	Oil
,	9 Klinicki centar	,	,	85.11	4200	services, hospital	475,000	1,301	170	350	221	455	365	24	54	Sewer	Toxic substances
Ξ	10 Gradska bolnica	/	/	85.11	340	services, hospital	36,000	66	80	150	8	15	365	24	4.1	Sewer	Toxic substances
=	11 Voena bolnica	/	,	85.11	604	services, hospital	220,000	603	80	350	48	211	365	24	25	Sewer	Toxic substances
14	4 Alkaloid AD-Herbs	,	_	15.86	90	tea, spices, parapharmaceuticals, herbs	68,000	272	150	250	41	89	250	8	34	Sewer	
I.	17 MZT energetika	/	/	40.3,	43	Production and distribution of compressed air, gases and water	800	2.2	30	09	0	0	365	24	0.1	Sewer	
2,	22 JSP - Gjorce Petrov	/	/	60.21	1294	services, public transporatation	37,240	102	80	200	8	20	365	24	4.3	Sewer	Oil
2.	23 JSP - Avtokomonda	_		60.21	1294	services, public transporatation	87,834	241	80	200	19	48	365	24	10	Sewer	Oil
4	46 Carwash TONI	\	_	\	3	services, carwash	1,095	3.0	120	150	0	0	365	8	0.4	Sewer	Oil
4 4	47 Carwash Brane 48 Carwash Medzik Kisel			_	ю 4	services, carwash	730	2.0	120	150	0 -	0 -	365	∞ ×	0.3	Sewer	ië ië
7	20 Sanos Bus			34.1	69	buses	11,650	47	40	70	2	3	250	0	5.8	Sewer	Oil
3,	32 Skovin	/	_	15.98	99	vine production	18,000	69	009	009	41	41	261	16	4.3	Sewer	
3.	33 M&A beveridzis	/	/	15.98	130	soft drinks	4,200	13	350	150	5	2	313	24	9.0	Sewer	
4	43 MIDA	_		\	120	services, carwash	18,000	53	09	350	3	19	340	8	9.9	Sewer	Oil
4	44 Rade Koncar TEP		_	31.10	21	cupboard,transformators	230	0.0	09	100	0	0	260	8	0.1	Sewer	
ř	34 Beton AD Skopje		_	26.61	1316	concrete	5,400	22	20	200	0	4	250	8	2.7	Sewer	
	Total Other						1,037,429	2,975			407	910			159		
				Grand Total	tol		0 074 010	28 464			4 030	7 447			1 301		
				Janu 10	ıaı		7,714,017	1-0+,07			4,007				TACT		

3.11 Estimation of Pollution Load to Sewer and Environment-1: Future Load by All Enterprises to Environment

Table 3.22 Estimation of Pollution Load to Sewer and Environment: Current Situation

(1) Whole 50 Factories

$\overline{}$	<u>) Whole 50 Factor</u>	168											
No.	Company/Factory Name		ewater ration		ed Water (mg/l)	Remarks, Pre-treatment	ı	ted Load /day)	Treatment	Preferable Discharge	Operation	Operation	Wastewate r
	1 ,	(m³/year)	(m ³ /day)	BOD	SS		BOD	SS	Plant	Sewer	(days/year)	(hrs/day)	(m³/hour)
1	Ading AD	6,000	23	200	300		4.6	6.9	No	Sewer	260	8	3
2	TGS Tehnicki gasovi	16,000	62	30	1.000	TSS	1.8	61.5	No	Sewer	260	8	8
3		2,085,600	5,714	60	500	Fe, oil, heavy metals	342.8		Yes	Direct	365	24	238
4	Makstil	1,523,449	4,174	60	150	Oil, heavy metal	250.4	626.1	No	Direct	365	24	174
5	Rz Uslugi	50,370	138	60	150	oil	8.3	20.7	No	Sewer	365	24	6
6	Replek Farm	2,064	9	500	75		4.7	0.7	No	Sewer	220	16	1
7	Zito Luks - Suto Orizari	48,840	134	600	600	n-hexane	80.3	80.3	No	Sewer	365	24	6
8	Fitofarm	5,531	21	250	200		5.3	4.2	No	Sewer	261	15	1
9	Klinicki centar	475,000	1,301	170	350	Check Toxic substances	221.2	455.5	No	Sewer	365	24	54
10	Gradska bolnica	36,000	99	80	150	Check Toxic substances	7.9	14.8	No	Sewer	365	24	4
11	Voena bolnica	220,000	603	80	350	Check Toxic substances	48.2	211.0	No	Sewer	365	24	25
12	Alkaloid AD-Lafoma	210,000	840	700	350	Fe	588.0	294.0	Yes	Sewer	250	24	35
13	Alkaloid AD-pharmaceutical	137,900	552	250	75	Fe	137.9	41.4	No	Sewer	250	16	34
14	Alkaloid AD-Herbs	68,000	272	150	250		40.8	68.0	No	Sewer	250	8	34
15	ALKALOID PREMAZI DOOEL	23,681	95	200	100	Phenol	18.9	9.5	No	Sewer	250	8	12
	Kanar 92	4,000	14	30	70	(Fe, n-hexane)	0.4	1.0	No	Sewer	280	16	1
	MZT energetika	800	2	30	60	(n-hexane)	0.1	0.1	No	Sewer	365	24	0
18	MZT Hepos	132,248	479	30	60		14.4	28.7	Yes	Sewer	276	16	30
19	MZT Leamica	48,600	133	70	190	Heavy metal, n-hexane	9.3	25.3	No	Sewer	365	24	6
20	Sanos Bus	11,650	47	40	70	(n-hexane)	1.9	3.3	No	Sewer	250	8	6
	Evropa A.D.	90,000	346	300 80	600	n-hexane	103.8	207.7	No	Sewer	260	8	43
22	JSP - Gjorce Petrov	37,240	102		200	n-hexane	8.2	20.4	No	Sewer	365	24	4
	JSP - Avtokomonda	87,834	241 172	80 20	200	n-hexane	19.3 3.4	48.1 8.6	No	Sewer	365 365	24 24	10 7
24 25	En ergetika - ELEM Skopski Leguri	62,611 2,031,600	5,566	20	50 70	n-hexane Heavy metal, n-hexane	111.3	389.6	No No	Direct	365		232
26	Komuna	473,620	1,377	150	500	Heavy metal, n-nexane	206.5	688.4	No No	Direct Sewer	344	24 24	57
27	Pivara	520,827	1,427	850	130		1,212.9	185.5	No	Direct	365	24	59
	Rade Koncar-Kontaktori i relei	31,400	119	50		CN, neavy metals, pnenol, n-hexane, anti-corrosion	5.9	8.3	Yes	Sewer	264	16	7
29	Ohis AD	891,361	2,442	100	80	agent	244.2	195.4	Yes	Direct	365	24	102
_	Ce mentarnica Usje	368,000	1.008	30	200	n-hexane	30.2	201.6	No	Sewer	365	24	42
31	Mlekarnica Masko	72,720	199	350	2,200	n-hexane, SS	69.7	438.3	No	Sewer	365	24	8
32	Skovin	18,000	69	600	600	ii iiexaiie, 55	41.4	41.4	No	Sewer	261	16	4
33	M&A beveridzis	4,200	13	350	150		4.7	2.0	No	Sewer	313	24	1
34	Beton AD Skopje	5,400	22	20	200	(n-hexane, SS)	0.4	4.3	-	Sewer	250	8	3
35	Globus	13,110	46	600	600		27.3	27.3	No	Sewer	288	8	6
36	Klanica "Vilan"	1,254	4	300	100		1.3	0.4	No	Sewer	280	8	1
37	"Rimes"	7,150	27	300	100	(n-hexane)	8.2	2.7	Y es-oil	Sewer	261	16	2
38	Lek Skopje	3,240	12	350	100		4.3	1.2	No	Sewer	261	8	2
39	Drisla	34,254	94	60	120	T-P. T-N	5.6	11.3	No	Sewer	365	24	4
40	AD Toplifikacija - Zapad	5,100	28	600	2,600	Fe,Mn, n-hexane	16.7	72.5	No	Sewer	183	15	2
41	AD Toplifikacija - Istok	30,350	166	60	70	n-hexane	10.0	11.6	No	Sewer	183	15	11
42	AD Toplifikacija - 11 Oktomvri	1,520	8	60	70	n-hexane, Cr	0.5	0.6	-	Sewer	183	15	1
43	MIDA	18,000	53	60	350	n-hexane, heavy metal	3.2	18.5	No	Sewer	340	8	7
44	Rade Koncar TEP	230	146	60	100	. 1	0.1	0.1	Yes-other	Sewer	260	8	0
45	"Promes"	42,180	146	300	150	n-hexane	43.9	22.0	Y es-oil	Sewer	288	24	6
46	Carwash TONI	1,095	3	120	150	(n-hexane)	0.4	0.5	No	Sewer	365	8	0
47 48	Carwash Brane	730 2,880	2 8	120 120	150 150	(n-hexane) (n-hexane)	0.2	0.3	No No	Sewer Sewer	365 365	8	0
_	Carwash Medzik Kisel AD Toplifikacija - Sever	1,260	7	60	70	(n-nexane) (n-hexane)	0.9	0.5	No No		183	15	0
50	Swiss-lion	11,120	44	1,500		(n-nexane) (n-hexane, BOD)	66.7	26.7	No No	Sewer Sewer	250	24	2
20	Sub Total (65%)	11,120	28,464	1,300	000	m-nevane, bod)	4,039		110	J SCWCI	15,124	859	1,301
						1	1 4.039	/,44/			1 13.124		1,301
\dashv	Others (35%)		15,327				,				- 7	000	701

Average BOD (mg/l) 142 -Average SS (mg/l) -- 262

(2) Large Six Factories

No.	Company/Factory Name		ewater ration	Estimate Quality	d Water (mg/l)	Remarks, Pre-treatment	Estimate (kg/	ed Load day)	Treatment Plant	Discharge	Operation		r
		m³/year	m³/day	BOD	SS		BOD	SS	riant	Sewer	(days/year)	(IIIs/day)	(m³/hour)
3	ARCELORMITTAL STEEL	2,085,600	5,714	60	500	Fe, oil, heavy metals	343	2,857	Yes	Direct	365	24	238
4	Makstil	1,523,449	4,174	60	150	Oil, heavy metal	250	626	No	Direct	365	24	174
24	Energetika - ELEM	62,611	172	20	50	n-hexane	3	9	No	Direct	365	24	7
25	Skopski Leguri	2,031,600	5,566	20	70	Heavy metal, n-hexane	111	390	No	Direct	365	24	232
27	Pivara	520,827	1,427	850	130		1,213	186	No	Direct	365	24	59
29	Ohis AD	891,361	2,442	100	80		244	195	Yes	Direct	365	24	102
	Large Six Factories Total		19,494				2,165	4,262					

(3) Other 44 Factories

	Other 44 Factorie		ewater	Fetimate	ed Water		Estimat	ed I oad		D C 1.3			Wests
т.	C		ration	ı	(mg/l)	D D A	l	day)	Treatment	Preferable	Operation	Operation	Wastewa
lo.	Company/Factory Name					Remarks, Pre-treatment	BOD	SS	Plant	Discharge Sewer	(days/year)	(hrs/day)	(m ³ /hou
_		m³/year	m³/day	BOD	SS								(III /IIOU
1	Ading AD	6,000	23	200	300		4.6	6.9	No	Sewer	260	8	
2	TGS Tehnicki gasovi	16,000	62	30	1,000	TSS	1.8	61.5	No	Sewer	260	8	
5	Rz Uslugi	50,370	138	60	150	oil	8.3	20.7	No	Sewer	365	24	⊢—
6	Replek Farm	2,064	9	500	75		4.7	0.7	No	Sewer	220	16	
7	Zito Luks - Suto Orizari	48,840	134 21	600 250	600	n-hexane	80.3	80.3	No	Sewer	365	24	—
8	Fitofarm	5,531			200	Charle Tarris and stances	5.3	4.2	No	Sewer	261	15	—
_	Klinicki centar	475,000	1,301	170	350	Check Toxic substances	221.2	455.5	No	Sewer	365	24	
10	Gradska bolnica	36,000	99	80	150	Check Toxic substances	7.9	14.8	No	Sewer	365	24	—
11 12	Voena bolnica	220,000	603 840	80 700	350 350	Check Toxic substances Fe	48.2	211.0	No	Sewer	365	24	2
	Alkaloid AD-Lafoma						588.0	294.0	Yes	Sewer	250	24	
13	Alkaloid AD-pharmaceutical	137,900	552	250	75	Fe	137.9	41.4	No	Sewer	250	16	
14	Alkaloid AD-Herbs	68,000	272	150	250		40.8	68.0	NO	Sewer	250	8	
15	ALKALOID PREMAZI DOOEL	23,681	95	200		Phenol	18.9	9.5	No	Sewer	250	8	
_	Kanar 92	4,000	14	30	70	(Fe, n-hexane)	0.4	1.0	NO	Sewer	280	16	
	MZT energetika	800	2	30	60	(n-hexane)	0.1	0.1	No	Sewer	365	24	
_	MZT Hepos	132,248	479	30	60		14.4	28.7	Yes	Sewer	276	16	
19	MZT Leamica	48,600	133	70	190	Heavy metal, n-hexane	9.3	25.3	No	Sewer	365	24	
0.	Sanos Bus	11,650	47	40	70	(n-hexane)	1.9	3.3	No	Sewer	250	8	
! 1	Evropa A.D.	90,000	346	300	600	n-hexane	103.8	207.7	No	Sewer	260	8	
22	JSP - Gjorce Petrov	37,240	102	80	200	n-hexane	8.2	20.4	No	Sewer	365	24	
23	JSP - Avtokomonda	87,834	241	80	200	n-hexane	19.3	48.1	No	Sewer	365	24	
26	Komuna	473,620	1,377	150	500		206.5	688.4	No	Sewer	344	24	
28	Ra de Koncar-Kontaktori i relei	31,400	119	50	70	n-hexane, anti-corrosion	5.9	8.3	Yes	Sewer	264	16	
30	Cementarnica Usje	368,000	1,008	30	200	n-hexane	30.2	201.6	No	Sewer	365	24	
31	Mlekarnica Masko	72,720	199	350	2,200	n-hexane, SS	69.7	438.3	No	Sewer	365	24	
32	Skovin	18,000	69	600	600		41.4	41.4	No	Sewer	261	16	
33	M&A beveridzis	4,200	13	350	150		4.7	2.0	No	Sewer	313	24	
34	Beton AD Skopje	5,400	22	20	200	(n-hexane, SS)	0.4	4.3	-	Sewer	250	8	
35	Globus	13,110	46	600	600		27.3	27.3	No	Sewer	288	8	
36	Klanica "Vilan"	1,254	4	300	100		1.3	0.4	No	Sewer	280	8	
37	"Rimes"	7,150	27	300	100	(n-hexane)	8.2	2.7	Y es-oil	Sewer	261	16	
38	Lek Skopje	3,240	12	350	100		4.3	1.2	No	Sewer	261	8	
39	Drisla	34,254	94	60	120	T-P. T-N	5.6	11.3	No	Sewer	365	24	
10	AD Toplifikacija - Zapad	5,100	28	600	2,600	Fe,Mn, n-hexane	16.7	72.5	No	Sewer	183	15	
11	AD Toplifikacija - Istok	30,350	166	60	70	n-hexane	10.0	11.6	No	Sewer	183	15	
12	AD Toplifikacija - 11 Oktomvri	1,520	8	60	70	n-hexane, Cr	0.5	0.6	-	Sewer	183	15	
13	MIDA	18,000	53	60	350	n-hexane, heavy metal	3.2	18.5	No	Sewer	340	8	
14	Rade Koncar TEP	230	1	60	100		0.1	0.1	Yes-other	Sewer	260	8	
15	"Promes"	42,180	146	300	150	n-hexane	43.9	22.0	Yes-oil	Sewer	288	24	
16	Carwash TONI	1,095	3	120	150	(n-hexane)	0.4	0.5	No	Sewer	365	8	
17	Carwash Brane	730	2	120	150	(n-hexane)	0.2	0.3	No	Sewer	365	8	
18	Carwash Medzik Kisel	2,880	8	120	150	(n-hexane)	0.9	1.2	No	Sewer	365	8	
19	AD Toplifikacija - Sever	1,260	7	60	70	(n-hexane)	0.4	0.5	No	Sewer	183	15	
50	Swiss-lion	11,120	44	1,500	600	(n-hexane, BOD)	66.7	26.7	No	Sewer	250	24	
	Sub Total		8,970				1,874	3,185			12,934	715	4
	-					Average BOD (mg/l)	209						
						Average SS (mg/l)		355	t				

The industrial wastewater generation amount by 3, 4, 24, 25, 27 and 29 BOD load by 3,4, 24, 25,27 and 29 Total BOD load BOD load BOD load by other installations to sewer in the future	19,494 m ³ /day 2,165 kg/day 4,039 kg/day 1,874 kg/day
Wastewater generation within the survey, except 3, 4, 24, 25, 27 and 29 (to sewer) BOD concentraion to sewer in the future	$8,970 \text{ m}^3/\text{day}$ 209 g/m^3
SS load by 3, 4, 24, 25, 27 and 29 Total SS load SS load by other installations to sewer in the future SS concentraion to sewer in the future	4,262 kg/day 7,447 kg/day 3,185 kg/day 355 g/m ³
The industrial wastewater generation amount by 3, 4, 24 and 25 The total BOD load by 3,4, 24 and 25 Average BOD of 3,4, 24 and 25	15,625 m ³ /day 708 kg/day 45 g/m ³
The industrial wastewater generation amount by 3, 4, 24 and 25 The total SS load by 3,4, 24 and 25 Average SS of 3,4, 24 and 25	15,625 m ³ /day 3,881 kg/day 248 g/m ³
The industrial wastewater generation amount by 27 and 29 The total BOD load by 27 and 29 Average BOD of 27 and 29 The industrial wastewater generation amount by 27 and 29	3,869 m ³ /day 1,457 kg/day 377 g/m ³
The total SS load by 27 and 29 Average SS of 27 and 29	3,869 m ³ /day 381 kg/day 98 g/m ³
Average operation days per year of the 50 enterprises Average operation hours per day of the 50 enterprises	302 days/year 17 hours/day

3.12 Estimation of Pollution Load to Sewer and Environment-2: Future Load to Sewer

The following calculations are to estimate the total load without treatment to sewer line The current calculations are to estimate the total load without Treatment plant

1 Current Wastewater Quality	
Estimated Wastewater generation by interview survey	$43,791 \text{ m}^3/\text{day}$
future (Arcelormittal Steel, Maskstill, Skopski Leguri and Energetika Elem, Pivara and Ohis AD)	19,494 m³/day
Wastewater generation except six factories above	24,296 m ³ /day
2 Current Wastewater Quality	
BOD load within the interview survey	4,039 kg/day
BOD load of the 6 factories above within interview the survey	2,165 kg/day
BOD load except 6 factories above within the interview survey	1,874 kg/day
Wastewater generation except 6 factories above within the interview survey	$8,970 \text{ m}^3/\text{day}$
BOD concentration except 6 factories above within the interview survey	209 g/m^3
SS load within the interview survey	7,447 kg/day
SS load of the 6 factories above within interview the survey	4,262 kg/day
SS load except 6 factories above within the interview survey	3,185 kg/day
Wastewater generation except 6 factories above within the interview survey	$8,970 \text{ m}^3/\text{day}$
SS concentration except 6 factories above within the interview survey	355 g/m^3
Assuming BOD and SS concentration is the same as above, except 6 factories above	
BOD load except 6 companies	5,077 kg/day
BOD load by Pivera and Ohis AD	1,457 kg/day
Industrail wastewater generation by Arcelormittal Steel, Maskstill, Skopski Leguri and Energeti	$0.935 \text{ m}^3/\text{sec}$
(Use actual measurement)	$80,784 \text{ m}^3/\text{day}$
Average BOD ₅ concentration of the 4 steel realted companies	45 g/m^3
BOD load by 4 steel compnaies	3,660 kg/day
Total current BOD load	10,194 kg/day
SS load except 6 companies	8,627 kg/day
SS load by Pivera and Ohis AD	381 kg/day
Industrail wastewater generation by Arcelormittal Steel, Maskstill, Skopski Leguri and Energeti	$0.935 \text{ m}^3/\text{sec}$
(Use actual measuremant)	$80,784 \text{ m}^3/\text{day}$
Average SS concentration of the 4 steel realted companies	248 g/m^3
SS by 4 steel compnaies	20,066 kg/day
Total current SS load	29,074 kg/day

3 Estimation of future in Year 2020 in sewer

Excluding the Privala and Ohis AD that have their own treatment plants and ARCELORMITTAL STEEL, Makstill, Skopski Leguri and Energetika Elem that should have their own treatment plants, (by using current condition)

Current total wastewater generation, excluding 6 factories	24,296 m ³ /day
Average BOD concentration, excluding 6 factories Average SS concentration, excluding 6 factories	209 g/m^3 355 g/m^3
Assuming the annual genrationgrowth until Year 2020 total growth from year 2007	3.5 % 156 %
Assuming wastewater generation increase in proportion to this rate Wastewater generation in Year 2020	$37,999 \text{ m}^3/\text{day}$
Assuming water saving by introduction of cleaner production Wastewater generation by cleaner production	15 % 32,299 m³/day
Assuming reduction of pollutants by introduction of cleaner production BOD by introduction of cleaner production SS by introduction of cleaner production	20 % 167 g/m ³ 284 g/m ³
Pollution load to sewer in Year 2020 BOD SS	5,399 kg/day 9,175 kg/day
Effluent After treatment by Sewage Treatment Plant Effluent BOD Effluent SS	25 g/m ³ 807 kg/day 35 g/m ³
4 Estimation of future in Year 2030 to sewer Excluding the Privala and Ohis AD that have their own treatment plants and ARCELORMITTAL STEEL, Makstill, Skopski Leguri and Energetika Elem that should have their own treatment plants, (by using current condition)	1,130 kg/day
Current total wastewater generation, excluding 6 factories	24,296 m³/day
Average BOD concentration, excluding 6 factories Average SS concentration, excluding 6 factories	209 g/m^3 355 g/m^3
Assuming the annual generaton growth until Year 2030 total growth from year 2007	3.5 % 221 %
Assuming wastewater generation increase in proportion to this rate Wastewater generation in Year 2020	53,601 m ³ /day
Assuming water saving by introduction of cleaner production Wastewater generation by cleaner production	35 % 34,840 m ³ /day

Assuming reduction of pollutants by introduction of cleaner production BOD by introduction of cleaner production SS by introduction of cleaner production	35 % 136 g/m ³ 231 g/m ³
Pollution load to sewer in Year 2020	
BOD	4,732 kg/day
SS	8,041 kg/day
Effluent After treatment by Sewage Treatment Plant	
Effluent BOD	25 g/m^3
	871 kg/day
Effluent SS	35 g/m^3
	1,219 kg/day

3.13 Estimation of Pollution Load to Sewer and Environment-3: Future Load to Sewer by the 4 Factories to Environment

5 In 2020 industrial wastewater estimation

5.a ARCELORMITTAL STEEL, Makstill, Skopski Leguri and Energetika Elem

Current Actual industrial wastewater generation of 4 steel related factories	$80,784 \text{ m}^3/\text{day}$
Current Average BOD ₅ concentration, from 4 steel related factories	45 g/m^3
Current SS concentration, from 4 steel related factories	248 g/m^3
Assuming the annual generation growth	0 %
until Year 2020 total growth from year 2007	100 %
Assuming wastewater generation increase in proportion to this rate	
Wastewater generation in Year 2020	$80,784 \text{ m}^3/\text{day}$
Assuming water saving by introduction of cleaner production	5 %
Wastewater generation by cleaner production	$76,745 \text{ m}^3/\text{day}$
Assuming reduction of pollutants by introduction of cleaner production	10 %
BOD ₅ by introduction of cleaner production	41 g/m^3
SS by introduction of cleaner production	224 g/m^3
Polution load in 2020	
BOD load	3,130 kg/day
SS by introduction of cleaner production	17,157 kg/day
After treatment by Own Treatment Plant	
effluent BOD	25 g/m^3
	1,919 kg/day
effluent SS	35 g/m^3
	2,686 kg/day
5.b Privala and Ohis AD	
Current total wastewater generation of 2 factories	$3,869 \text{ m}^3/\text{day}$
Current average BOD concentration, from 2 factories	377 g/m^3
Current average SS concentration, from 2 steel related factories	98 g/m³
Assuming the annual generation growth	3.5 %
until Year 2020 total growth from year 2007	156 %

	Assuming wastewater generation increase in proportion to this rate	
	Wastewater generation in Year 2020	$6,051 \text{ m}^3/\text{day}$
	Assuming water saving by introduction of cleaner production	15 %
	Wastewater generation by cleaner production	$5,143 \text{ m}^3/\text{day}$
		20
	Assuming reduction of pollutants by introduction of cleaner production	20 %
	BOD ₅ by introduction of cleaner production	301 g/m ³
		1,550 kg/day
	SS by introduction of cleaner production	79 g/m ³
	33 by introduction of cleaner production	405 kg/day
	After treatment by Own Treatment Plant	105 kg/da/y
	effluent BOD	25 g/m^3
	VII.W 4110 20 2	129 kg/day
	effluent SS	35 g/m^3
	VII. W 410 55	180 kg/day
5.c	Total load by 6 factories	
	BOD	4,679 kg/day
	SS	17,562 kg/day
	After treatment	
	BOD	2,047 kg/day
	SS	2.066 kg/dov
	55	2,866 kg/day
		2,866 kg/day
6	In 2030 industrial wastewater estimation	2,866 kg/day
	In 2030 industrial wastewater estimation	2,866 kg/day
		2,866 kg/uay
	In 2030 industrial wastewater estimation ARCELORMITTAL STEEL, Makstill, Skopski Leguri and Energetika Elem	
	In 2030 industrial wastewater estimation	2,866 kg/day 80,784 m ³ /day
	In 2030 industrial wastewater estimation ARCELORMITTAL STEEL, Makstill, Skopski Leguri and Energetika Elem Current Actual industrial wastewater generation of 4 steel related factories	80,784 m ³ /day
	In 2030 industrial wastewater estimation ARCELORMITTAL STEEL, Makstill, Skopski Leguri and Energetika Elem	
	In 2030 industrial wastewater estimation ARCELORMITTAL STEEL, Makstill, Skopski Leguri and Energetika Elem Current Actual industrial wastewater generation of 4 steel related factories Current Average BOD concentration, from 4 steel related factories	80,784 m ³ /day 45 g/m ³
	In 2030 industrial wastewater estimation ARCELORMITTAL STEEL, Makstill, Skopski Leguri and Energetika Elem Current Actual industrial wastewater generation of 4 steel related factories	80,784 m ³ /day
	In 2030 industrial wastewater estimation ARCELORMITTAL STEEL, Makstill, Skopski Leguri and Energetika Elem Current Actual industrial wastewater generation of 4 steel related factories Current Average BOD concentration, from 4 steel related factories Current SS concentration, from 4 steel related factories	80,784 m ³ /day 45 g/m ³
	In 2030 industrial wastewater estimation ARCELORMITTAL STEEL, Makstill, Skopski Leguri and Energetika Elem Current Actual industrial wastewater generation of 4 steel related factories Current Average BOD concentration, from 4 steel related factories	80,784 m ³ /day 45 g/m ³ 248 g/m ³
	In 2030 industrial wastewater estimation ARCELORMITTAL STEEL, Makstill, Skopski Leguri and Energetika Elem Current Actual industrial wastewater generation of 4 steel related factories Current Average BOD concentration, from 4 steel related factories Current SS concentration, from 4 steel related factories Assuming the annual generation growth	80,784 m ³ /day 45 g/m ³ 248 g/m ³ 0 %
	In 2030 industrial wastewater estimation ARCELORMITTAL STEEL, Makstill, Skopski Leguri and Energetika Elem Current Actual industrial wastewater generation of 4 steel related factories Current Average BOD concentration, from 4 steel related factories Current SS concentration, from 4 steel related factories Assuming the annual generation growth	80,784 m ³ /day 45 g/m ³ 248 g/m ³ 0 %
	In 2030 industrial wastewater estimation ARCELORMITTAL STEEL, Makstill, Skopski Leguri and Energetika Elem Current Actual industrial wastewater generation of 4 steel related factories Current Average BOD concentration, from 4 steel related factories Current SS concentration, from 4 steel related factories Assuming the annual generation growth until Year 2030 total growth from year 2007	80,784 m ³ /day 45 g/m ³ 248 g/m ³ 0 %
	In 2030 industrial wastewater estimation ARCELORMITTAL STEEL, Makstill, Skopski Leguri and Energetika Elem Current Actual industrial wastewater generation of 4 steel related factories Current Average BOD concentration, from 4 steel related factories Current SS concentration, from 4 steel related factories Assuming the annual generation growth until Year 2030 total growth from year 2007 Assuming wastewater generation increase in proportion to this rate	80,784 m ³ /day 45 g/m ³ 248 g/m ³ 0 % 100 %
	In 2030 industrial wastewater estimation ARCELORMITTAL STEEL, Makstill, Skopski Leguri and Energetika Elem Current Actual industrial wastewater generation of 4 steel related factories Current Average BOD concentration, from 4 steel related factories Current SS concentration, from 4 steel related factories Assuming the annual generation growth until Year 2030 total growth from year 2007 Assuming wastewater generation increase in proportion to this rate	80,784 m ³ /day 45 g/m ³ 248 g/m ³ 0 % 100 %
	In 2030 industrial wastewater estimation ARCELORMITTAL STEEL, Makstill, Skopski Leguri and Energetika Elem Current Actual industrial wastewater generation of 4 steel related factories Current Average BOD concentration, from 4 steel related factories Current SS concentration, from 4 steel related factories Assuming the annual generation growth until Year 2030 total growth from year 2007 Assuming wastewater generation increase in proportion to this rate Wastewater generation in Year 2030	80,784 m ³ /day 45 g/m ³ 248 g/m ³ 0 % 100 %
	In 2030 industrial wastewater estimation ARCELORMITTAL STEEL, Makstill, Skopski Leguri and Energetika Elem Current Actual industrial wastewater generation of 4 steel related factories Current Average BOD concentration, from 4 steel related factories Current SS concentration, from 4 steel related factories Assuming the annual generation growth until Year 2030 total growth from year 2007 Assuming wastewater generation increase in proportion to this rate Wastewater generation in Year 2030 Assuming water saving by introduction of cleaner production Wastewater generation by cleaner production	80,784 m ³ /day 45 g/m ³ 248 g/m ³ 0 % 100 % 80,784 m ³ /day 10 % 72,706 m ³ /day
	In 2030 industrial wastewater estimation ARCELORMITTAL STEEL, Makstill, Skopski Leguri and Energetika Elem Current Actual industrial wastewater generation of 4 steel related factories Current Average BOD concentration, from 4 steel related factories Current SS concentration, from 4 steel related factories Assuming the annual generation growth until Year 2030 total growth from year 2007 Assuming wastewater generation increase in proportion to this rate Wastewater generation in Year 2030 Assuming water saving by introduction of cleaner production Wastewater generation by cleaner production Assuming reduction of pollutants by introduction of cleaner production	80,784 m ³ /day 45 g/m ³ 248 g/m ³ 0 % 100 % 80,784 m ³ /day 10 % 72,706 m ³ /day 15 %
	In 2030 industrial wastewater estimation ARCELORMITTAL STEEL, Makstill, Skopski Leguri and Energetika Elem Current Actual industrial wastewater generation of 4 steel related factories Current Average BOD concentration, from 4 steel related factories Current SS concentration, from 4 steel related factories Assuming the annual generation growth until Year 2030 total growth from year 2007 Assuming wastewater generation increase in proportion to this rate Wastewater generation in Year 2030 Assuming water saving by introduction of cleaner production Wastewater generation by cleaner production	80,784 m ³ /day 45 g/m ³ 248 g/m ³ 0 % 100 % 80,784 m ³ /day 10 % 72,706 m ³ /day

	Polution load in 2030	
	BOD load	2,800 kg/day
	SS by introduction of cleaner production	15,351 kg/day
	After treatment by Own Treatment Plant	
	effluent BOD	25 g/m^3
		1,818 kg/day
	effluent SS	35 g/m^3
		2,545 kg/day
6.b	Privala and Ohis AD	
	Current total wastewater generation of 2 factories	$3,869 \text{ m}^3/\text{day}$
	Current average BOD concentration, from 2 factories	377 g/m^3
	Current average SS concentration, from 2 steel related factories	98 g/m^3
	Assuming the annual generation growth	3.5 %
	until Year 2030 total growth from year 2007	221 %
		,,
	Assuming wastewater generation increase in proportion to this rate	
	Wastewater generation in Year 2020	8,535 m ³ /day
	wastewater generation in 1 car 2020	0,555 m /day
	Assuming water saving by introduction of cleaner production	35 %
	Wastewater generation by cleaner production	$5,548 \text{ m}^3/\text{day}$
	Assuming reduction of pollutants by introduction of cleaner production	35 %
	BOD by introduction of cleaner production	245 g/m ³
		1,358 kg/day
	SS by introduction of cleaner production	64 g/m ³
	,	355 kg/day
	After treatment by Own Treatment Plant	
	effluent BOD	25 g/m^3
		139 kg/day
	effluent SS	35 g/m^3
		194 kg/day
6.c	Total load by 6 factories	<i>5</i>)
	BOD	4,158 kg/day
	SS	15,706 kg/day
		, v
	After treatment by Own Treatment Plant	
	effluent BOD	1,956 kg/day
	effluent SS	2,739 kg/day
		-,> 115, 441

3.14 Estimation of Pollution Load to Sewer and Environment-4: Future Load by all Enterprises to Environment

Load to the river

		Wastewater generation		Load (kg/day)			
		~	Without		With Trea	atment	
		(m³/day)	BOD_5	SS	BOD_5	SS	
	ARCELORMITTAL STEEL, Makstill, Skopski Leguri and Energetika Elem	80,784	3,660	20,066	-	-	
	Privala and Ohis AD	3,869	1,457	381	-	-	
Current	Others	24,296	5,077	8,627	-	-	
	Municipal wastewater						
	Total current Case-2	108,949	10,194	29,074	-	-	
	ARCELORMITTAL STEEL, Makstill, Skopski Leguri and Energetika Elem	76,745	3,130	17,157	1,919	2,686	
	Privala and Ohis AD	5,143	1,550	405	129	180	
in 2020	Others (Load to Sewer)	32,299	5,399	9,175	807	1,130	
	Municipal wastewater						
	Total in 2020 Case-2	114,187	10,078	26,736	2,855	3,997	
	ARCELORMITTAL STEEL, Makstill, Skopski Leguri and Energetika Elem	72,706	2,800	15,351	1,818	2,545	
	Privala and Ohis AD	5,548	1,358	355	139	194	
in 2030	Others (Load to Sewer)	34,840	4,732	8,041	871	1,219	
	Municipal wastewater						
	Total in 2030 Case-2	113,094	8,890	23,747	2,827	3,958	

3.15 Current Situation of BREF Note Preparation

Table 3.23 Current Situation of BREF Note Preparation

= BREF formally adopted;	= BREF finalise	d; = Final Draf	= W	orking Draft	= work started.
TWG & Members list (click on TWG name to see the list of members)	Documents available (see key below table)	Documents available for the revisions (see key below table)	Revisions (see key below table)	Background material	Additional Information
Pulp and Paper manufacture	BREF (12.01)		<u>MR</u> (01.07)	<u>List</u>	<u>Yes</u>
Iron and Steel production	BREF (12.01)		<u>MR</u> (09.06)	<u>List</u>	Yes
Cement and Lime production	BREF (12.01)	<u>D1</u> (09.07)	<u>MR</u> (09.05)	<u>List</u>	Yes
Cooling Systems	<u>BREF</u> (12.01)			<u>List</u>	<u>Yes</u>
Chlor-Alkali manufacture	BREF (12.01)		2008	<u>List</u>	<u>Yes</u>
Ferrous Metal processing	BREF (12.01)		2007	<u>List</u>	<u>Yes</u>
Non-Ferrous Metal processes	BREF (12.01)		2007	<u>List</u>	<u>Yes</u>
Glass manufacture	<u>BREF</u> (12.01)		<u>MR</u> (05.07)	<u>List</u>	<u>Yes</u>
Tanning of hides and skins	BREF (02.03)		<u>MR</u> (10.07)	<u>List</u>	<u>Yes</u>
Textile processing	BREF (07.03)			<u>List</u>	<u>Yes</u>
Monitoring systems	<u>BREF</u> (07.03)			<u>List</u>	<u>Yes</u>
Refineries	BREF (02.03)		2008	<u>List</u>	<u>Yes</u>
Large Volume Organic Chemicals	BREF (02.03)		2008	<u>List</u>	<u>Yes</u>
Smitheries and Foundries	BREF (05.05)			<u>List</u>	
Intensive Livestock Farming	BREF (07.03)		2008	<u>List</u>	<u>Yes</u>
TWG & Members list (click on TWG name to see the list of members)	Documents available (see key below table)	Documents available for the revisions (see key below table)	Revisions (see key below table)	Background material	Additional Information

Emissions from storage of bulk or dangerous materials	<u>BREF</u> (07.06)			<u>List</u>	
Common waste water and waste gas treatment and management systems in the chemical sector	<u>BREF</u> (02.03)		2007	<u>List</u>	<u>Yes</u>
Economic and cross media issues under IPPC	BREF (07.06)			<u>List</u>	
Large Combustion Plant	<u>BREF</u> (07.06)			<u>List</u>	
Large Volume Inorganic Chemicals - Ammonia, Acids & Fertilisers	BREF (08.07)			<u>List</u>	
Large Volume Inorganic Chemicals - Solid & Others	BREF (08.07)			<u>List</u>	<u>Yes</u>
Slaughterhouses and Animal By-products	BREF (05.05)			<u>List</u>	
Food, Drink and Milk processes	BREF (08.06)			<u>List</u>	<u>Yes</u>
Ceramics	<u>BREF</u> (08.07)			<u>List</u>	
Management of Tailings and Waste-Rock in Mining Activities	MR BREF (07.04)			<u>List</u>	
Surface treatment of metals	BREF (08.06)			<u>List</u>	
Surface treatments using solvents	BREF (08.07)			<u>List</u>	<u>Yes</u>
Waste Incineration	BREF (08.06)			<u>List</u>	
TWG & Members list (click on TWG name to see the list of members)	Documents available (see key below table)	Documents available for the revisions (see key below table)	Revisions (see key below table)	Background material	Additional Information
Waste Treatments [Previously Waste Recovery/Disposal	<u>BREF</u> (08.06)			<u>List</u>	Yes_

activities]				
Speciality inorganic chemicals	BREF (08.07)		<u>List</u>	<u>Yes</u>
Organic fine chemicals	BREF (08.06)		<u>List</u>	
Polymers	<u>BREF</u> (08.07)		<u>List</u>	
Energy Efficiency	MR D2 (07.07)		<u>List</u>	

Key to "Documents available":

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BREF (mm.yy)	indicates that a document has been formally adopted by the Commission and can be downloaded by following the link which leads to the list of mirrors available and selecting the site nearer to you.
BREF (mm.yy)	indicates that a document has been finalised after submission to DG Environment and the final version dated as shown can be downloaded by following the link which leads to the list of mirrors available and selecting the site nearer to you.
FD (mm.yy)	indicates that a Final Draft document dated as shown has been put up for discussion with DG Environment and the Information Exchange Forum and the draft can be downloaded by following the link.
D1/2/3 (mm.yy)	indicates that a 1st / 2nd / 3rd working Draft reference document dated as shown has been put to consultation in the TWG and the draft can be downloaded by following the link.
MR (mm.yy)	indicates work has started, the TWG has met for the first time on date shown and a Meeting Report of that first meeting can be downloaded by following the link where shown.

indicates work is planned to commence in the year shown and has not yet started.

Source: European Integrated Pollution Prevention and Control Bureau by Internet

= BREF formally adopted;	= BREF finalised;	= Final Dra BREF;	eft = W	/orking Draft EF;	= work started.
TWG & Members list	Documents available	Documents available for the revisions	Revisions	Background material	Additional Information
Pulp and Paper manufacture	BREF (12.01)		MR (01.07)	List	Yes
Iron and Steel production	BREF (12.01)		MR (09.06)	List	Yes
Cement and Lime production	BREF (12.01)	D1 (09.07)	MR (09.05)	List	Yes
Cooling Systems	BREF (12.01)			List	Yes
Chlor-Alkali manufacture	BREF (12.01)		2008	List	Yes
Ferrous Metal processing	BREF (12.01)		2007	List	Yes
Non-Ferrous Metal processes	BREF (12.01)		2007	List	Yes
Glass manufacture	BREF (12.01)		MR (05.07)	List	Yes
Tanning of hides and skins	BREF (02.03)		MR (10.07)	List	Yes
Textile processing	BREF (07.03)			List	Yes
Monitoring systems	BREF (07.03)			List	Yes
Refineries	BREF (02.03)		2008	List	Yes
Large Volume Organic Chemicals	BREF (02.03)		2008	List	Yes
Smitheries and Foundries	BREF (05.05)			List	
Intensive Livestock Farming	BREF (07.03)		2008	List	Yes
Emissions from storage of bulk or dangerous materials	BREF (07.06)			List	
Common waste water and waste gas treatment and management systems in the chemical sector	BREF (02.03)		2007	List	Yes
Economic and cross	BREF (07.06)			List	

media issues under IPPC					
Large Combustion Plant	BREF (07.06)			List	
TWG & Members list	Documents available	Documents available for the revisions	Revisions	Background material	Additional Information
Large Volume Inorganic Chemicals - Ammonia, Acids & Fertilisers	BREF (08.07)			List	
Large Volume Inorganic Chemicals - Solid & Others	BREF (08.07)			List	Yes
Slaughterhouses and Animal By-products	BREF (05.05)			List	
Food, Drink and Milk processes	BREF (08.06)			List	Yes
Ceramics	BREF (08.07)			List	
Management of Tailings and Waste-Rock in Mining Activities	MR BREF (07.04)			List	
Surface treatment of metals	BREF (08.06)			List	
Surface treatments using solvents	BREF (08.07)			List	Yes
Waste Incineration	BREF (08.06)			List	
Waste Treatments [Previously Waste Recovery/Disposal activities]	BREF (08.06)			List	Yes
Speciality inorganic chemicals	BREF (08.07)			List	Yes
Organic fine chemicals	BREF (08.06)			List	
Polymers	BREF (08.07)			List	
Energy Efficiency	MR D2 (07.07)			List	

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FD (mm.yy)	indicates that a Final Draft document dated as shown has been put up for discussion with DG Environment and the Information Exchange Forum and the draft can be downloaded by following the link.
D1/2/3 (mm.yy)	indicates that a 1st / 2nd / 3rd working Draft reference document dated as shown has been put to consultation in the TWG and the draft can be downloaded by following the link.
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yyyy indicates work is planned to commence in the year shown and has not yet started.

Source: European Integrated Pollution Prevention and Control Bureau by Internet

3.16 Uniformed Discharge Criteria to Sewer System in Japan

 Table 3.24
 Uniformed Discharge Criteria to Sewer System in Japan

	Table 3.24 Uniformed Discharge Criteria to Sewer System in Japan							
		Paramete	r	Unit	Special Enterprise More than 50 m ³ /day Less than 50 m ³ /day			
		m	T	°C				
-	ers	Temperature		$^{\circ}$	45	45		
000 1000	net	pH		/1	5 to 9	5 to 12		
by]	araı	Biological oxygen demand (BOD ₅)		mg/l	600	1,200		
ria	General parameters	Suspended solid (SS)	M: 1 '1	mg/l	600	1,200		
Criteria by local ordinance	nera	n-hexane extract	Mineral oil	mg/l	5	5		
	Ge	I. din di	Animal and vegetable oil	mg/l	30	150		
		Iodine(I ₂₎ consumption		mg/l	220	220		
	_ la	Phenol		mg/l	5 3	5 3		
	Uniformed environmental parameter	Cupper (Cu)		mg/l				
	Jniformed vironmen parameter	Zinc (Zn)		mg/l	5	5		
	Unit	Iron (Fe)		mg/l	10 (soluble)	10 (soluble)		
	l en	Manganese (Mn)		mg/l	10 (soluble)	10 (soluble)		
		Total chromium (Cr)		mg/l	2	2		
		Cadmium (Cd)		mg/l	0.1	0.1		
		Cyanide (CN)		mg/l	1	1		
		Organic phosphorus		mg/l	1	1		
		Lead (Pb)		mg/l	0.1	0.1		
		Hexavelent chromium (Cr ⁶⁺)		mg/l	0.5	0.5		
		Arsenic (As)		mg/l	0.1	0.1		
>		Total mercury (T-Hg)		mg/l	0.005	0.005		
Criteria by governmental law		Alkyl-Hg		mg/l	ND	ND		
ntal		Poly Biphenyl Chloride (PCB)		mg/l	0.003	0.003		
me		Tri-chloroethylene		mg/l	0.3	0.3		
ern		Tetrachloroethylene		mg/l	0.1	0.1		
yog	se	Di-chloromethane		mg/l	0.2	0.2		
by	ınce	Butyl chloride carbon (CCl ₄)		mg/l	0.02	0.02		
ria	Foxic substances	1.2-dichloroethane		mg/l	0.04	0.04		
rite	ns	1.1-dichloroethylene		mg/l	0.2	0.2		
	oxic	cis-1.2-dichloroethylene		mg/l	0.4	0.4		
	Ţ	1.1.1-trichroroethane		mg/l	3	3		
		1.1.2-trichroroethane		mg/l	0.06	0.06		
		1.3-dichloropropene		mg/l	0.02	0.02		
		Thriuram		mg/l	0.06	0.06		
		Simazine		mg/l	0.03	0.03		
		Thiobencarb		mg/l	0.2	0.2		
		Benzene		mg/l	0.1	0.1		
		Selenium (Se)	1	mg/l	0.1	0.1		
		Boric acid (B)		mg/l	10 (230)	10 (230)		
		Fluorine (F)		mg/l	8 (15)	8 (15)		
		NH ₄ -N, NO ₂ -N and NO ₃ -N		mg/l	380	380		
		Dioxin			10	10		
(Note)		DIUXIII	I	pg-TEQ/l	10	10		

(Note)

- 1, Columns in yellow is the criteria of direct punishment in case of violation
- 2, Colums in white is the criteria for the obligation of installation of facility to sewer.
- 3,Discharge volume is the one divided by operation days per year,
- 4, Criteria for dioxin depends on the enterprise or location.
- 5, Criteria in parentheses for boronic acid, fluorine is used in case municipal wastewater discharges its effluent to the sea.
- 6, Criteria of boronic acid, NH₄-N, NO₂-N and NO₃-N have the transition criteria depending on type of industry.
- 7. The criteria of each parameter is possible to change more stricter or add parameters by local government.

3.17 Rainfall Data from 2003 to 2007

Table 3.25 Rainfall Data from 2003 to 2007

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Survey on Amount of Rainfall in Skopje 06.2003

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Survey on Amount of Rainfall in Skopje 11.2004

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Survey on Amount of Rainfall in Skopje 06.2005

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3.18 Current situation of Industrial Wastewater Management

				Tab	le 3.26		Sit	ua	tio	n	of	In	du	stria	l V	Vaste	w	ate	er Man	ag	em	ien	t			
Sampling	No.	2	0	4	4	1	4	0	0	0	0	0	7	7	6	7	0	0	5	1	0	1	5	2	0	0
Measurement	Wastewater	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Measu	Water supply	Meter	Meter	Meter	Meter	Meter	Meter	Meter	Meter	Meter	Meter	Meter	Meter	Meter	Meter	Meter	Meter	Meter	Meter	Meter	Bill	Meter	Meter	Meter	Meter	Meter
Recirculation	of water	No	No	Yes	Yes	Yes	No	No	No	No	No	No	No	No	Yes	No	oN	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes
ISO9000 or	14000	Yes	Yes	$_{ m Aex}$	Yes	No	No	λ es	No	No	No	No	Yes	No	Yes	oN	-	oN	$_{ m Aex}$	Yes	-	1	oN	oN	Yes	No
Own	laboratory	Other	-	Other	Other	Other	Yes	-	-	-	-	-	Yes	Yes	Yes	Yes	-	-	Yes	-	1	Other	Other	Other	Yes	Yes
Pollution	controller	Yes only monitoring	-	Yes	Yes	-	No	No	No	No	No	-	No	No	No	No	Yes	Yes	Yes	Yes	ı	-	No	No	Yes	Yes
Willing to	pay	oN	Yes	$_{ m Aes}$	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	No	No	-	Yes	-	Yes	-	i	Yes	Yes	Yes	ı
Discharge	hope	Sewer	Sewer	Sewer	Sewer	Sewer	Sewer	Sewer	Sewer	Sewer	Sewer	Sewer	Sewer	Sewer	Sewer	Sewer	-	Sewer	Sewer	Sewer	-	Sewer	Sewer	Sewer	Sewer	Sewer
Treatment	plant	No	-	Sedimentation, Neutralization, oil separator	Sedimentation, Filtration, Oil separator,	No (Pond)	No	No	No	No	No	No	Yes	No	-	-	No	No	Sedimentation, Filtration, Oil separator,	No	1	No	No	No	No (only pool for neutralization)	No (Sedimentation only for recirculation)
Commony/Footony Nome	o. Company/ractory manie	1 Ading AD	2 TGS Tehnicki gasovi	31 ARCELORMITTAL STEEL	4¹ Maksti1	5 Rz Usługi	6 Replek Farm	7 Zito Luks - Suto Orizari	8 Fitofarm	9 Klinicki centar	10 Gradska bolnica	1 Voena bolnica	12 Ainaioin AD-Laioina	Alkaloid AD-pharmaceutical	14 Alkaloid AD-Herbs	ALKALOID PREMAZI DOOEL	16 Kanar 92	17 MZT energetika	18 MZT Hepos	19 MZT Learnica	20 Sanos Bus	Evropa A.D.	22 JSP - Gjorce Petrov	23 JSP - Avtokomonda	24 Energetika - ELEM	25 Skopski Leguri
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7	Ę	Treatment	Discharge	Willing to	Pollution	Own	ISO9000 or	Recirculation	Measurement	rement	Sampling
No.	No. Company/Factory Name	plant	hope	pay	controller	laboratory		of water	Water supply	Wastewater	No.
26	Komuna	No	Sewer	No	No	Other	No	Yes	Meter	No	3
27	27 Pivara	No	Water body	No	No	Yes	No	No	Meter	No	
28	Rade Koncar-Kontaktori i relei	Sedimentation, Filtration, Oxidation- decomposition, Neutralization, Reduction- sedimentation with metal coagulant (Fe, Al)	Sewer	No	Yes	Yes	Yes	No	Meter	No	1
29	29 Ohis AD	Biological treatment, coagulation-sedimentation, Neutralization,	Vardar River	°Z	Yes	Yes	Yes	°Z	Meter	°Z	æ
30	Cementamica Usje	No	Sewer	Yes	No	Other	Yes	Yes	Meter	No	2
31		No	Sewer	Yes	No	Other	Yes	No	Meter	No	1
32	Skovin	No	Sewer	Yes	-	ı	Yes	No	Meter	No	0
33	M&A beveridzis	No	Sewer	Yes	No	Other	No	No	Meter	No	0
34	Beton AD Skopje	-	'	-		1	'	No	-		1
35		No	Sewer	Yes	ı	Other	HASSP	oN :	Meter	No	2
36	Klanica "Vilan" "Pimec"	No	Sewer	- N	۱ ک <u>۲</u>	- Other	% S	2 2	Meter	No No	0 -
38		SNO	Sewer	Yes	2 Z	- care	Yes	S N	Meter	S S	0
39		No	Sewer	Yes	No	Other	No	No	Reservoir level	Weir	1
40	40 AD Toplifikacija - Zapad	No	ı	-	No	Yes	Yes	No	Meter	No	1
41		No	Sewer	Yes	No	Yes	Yes	No	Meter	1	1
42	AD Toplifikacija - 11 Oktomvri		Sewer	Yes	-	ı	Yes	No	Meter	No	0
43		No	Sewer	No	No	-	Yes	No	Meter	No	0
44	Rade Koncar TEP	Sedimentation	Sewer	No	No	1	Yes	No	Meter	No	0
45	"Promes"	Oil separator	Sewer	'	ı	Other	HASSP	No	Meter	No	1
46	Carwash TONI	No	Sewer	Yes	No	1	No	No	No	No	0
47	Carwash Brane	No	Sewer	Yes	No	ı	No	No	Water works	No	0
48	Carwash Medzik Kisel	No	Sewer	Yes	No		oN	No	Lump-sum	No	0
49	AD Toplifikacija - Sever	No	Sewer	No	No	Yes	No	No	Meter	No	
50	50 Swiss-lion	No	Sewer	Yes	No	Other	ISO 22000	No	Meter	No	2