CHAPTER 9 ENVIRONMENTAL IMPACT ASSESSMENT

9.1 Environmental Regulations

9.1.1 Environmental Protection Act

(1) The Environmental Protection Act, which should be called a principal law pertaining to protection of environment, was enacted in 1991. This act makes clear the basic principles for management of environment and provides basic guidelines for other regulations pertaining to environment.

(2) Consisting of six chapters, this act sets forth the provisions regarding obtaining and furnishing information concerning the state of environment, control of the state of environment, assessment of the impact on environment, planning and implementation of environmental protection activities, rights and duties of central and local authorities, bodies corporate and physical persons relating to environmental protection.

(3) As is clear from the above, the Environmental Protection Act makes clear the basic principles constituting the prerequisite conditions for promoting various measures for environmental protection including management of environmental conditions, clarification of responsibility of persons causing pollutant emissions, and the responsibility of the government and local administrative authorities, in order to promote schematic overall environmental administration.

9.1.2 Air Pollution

(1) Environmental Standards of Bulgaria

(a) The environmental and emission control standards pertaining to air pollution in Bulgaria is presented in Tables 9-1-2-1 and 9-1-2-2.

(b) The emission control standards are regulated separately for the existing thermal power plants(commissioned by 1992)and new power plants(commissioned thereafter).

(c) Should an existing power plant not comply with the standard value, the power plant is allowed to continue its operation by paying a penalty imposed by the Ministry of Environment.

(d) The Maritza East No.1 Themal Power Plant is imposed upon with a penalty due to emission of SO_2(boiler equipment) and dust(coal drying equipment), while the No.2 and No.3 Thermal Power Plants are imposed upon with penalties due to emission of SO_2.

(e) Out of the sums deposited as fees for polluting the environment, thirty per cent(30%)and seventy(70%) are distributed to the local environmental protection fund and national environmental protection fund, respectively. No penalty is imposed upon any new thermal power plant commissioned since 1992.

It means that thermal power plants where the standard is not observed shall not be allowed to operate.

(2) EU Standards

(a) In preparation for joining the European Union (EU), the Government of Bulgaria expressed its intention to comply with the Guideline of the EU, and as a result of negotiations between EU and the Government of Bulgaria regarding the countermeasures for reducing air pollution due to sulfur oxides(SOx), the Government set a target for reducing the total amount (2,050 kt) of SOx emission throughout the country in 1980 to those presented in table 9-1-2-3 by 2000, 2005 and 2010, respectively.

(b) The environmental protection policy of the EU is presented in the form of 「directive」 in many cases, and the same form is presented to Bulgaria.

According to such a 「directive」, the EU member countries are absolutely forced to be responsible for establishing a legal system in their domestic laws. Given in the most intensive form is the 「regulation」, which binds the member countries directly with a binding force equivalent to any domestic law of every member country. In addition, there are 「decision」 binding only those who were involved in decision making and 「recommendation」 without any binding force.

(c) The emission control standards in the EU are presented in Tables 9-1-2-4~9-1-2-7 and Figures 9-1-2-1~9-1-2-3.

(3) Emission Standard to Replacing Plant

As a result of discussions with the NEK, either of the following conditions is specified to be satisfied: Namely, the amount of SO_2 emission should be not higher than 650mg/m^3 N

according to the Bulgarian Standards, or the desulfurization efficiency be not less than 90% in case of using the fuel with a high sulfur content according to the EU Standards.

As fot NO_x, dust and CO, the Bulgarian Standards should also be satisfied; NO_x (600mg/m^3N), Dust (100mg/m^3N) and CO (250 mg/m^3N).

9.1.3 Water Pollution

(1) Environmental Standards of Bulgaria

(a) The standards pertaining to water pollution are set forth in "Indicators and Standards Applied in Assessment of Running Surface Water Quality" published by the Environmental Protection Committee, the Ministry of Health and the Committee of Municipal Planning in State Gazette Issue No. 96/12,12,1986.

(b) According to these indicators and standards, samples for determining the rate and nature of water flow pollution due to sewage, industrial and agricultural effluents are desingnated to be taken at the points downstream of their practical mixing where the water quality is set and regulated regarding water discharged from specified facilities.

(c) In other words, the public service water areas (river, lake, swamp, etc.) are classified into three categories (I :Tap water , II Irrigation and fish farming water, III: Other than the above two categories of water), and enterprises are regulated by measuring the water quality downstream of the enterprises(after mixing of effluents)and comparing the quality with standard values according to the above categories. Therefore, there arises a contradiction that the enterprise who is located the more downstream is regulated the more strictly.

(d) The water quality sampling sites at river network in Bulgaria are presented in Figure 9-1-3-1. The rivers around the proposed project site are set to belong to the standard values of categorie III.

(e) At present, the relevant laws and regulations are being reviewed to execute direct regulation of water quality at the discharge outlet.

(f) The water quality standards of Bulgaria are presented in Table 9-1-3-1.

(2) Waste Water Standards for Replacing Plant

Although there is no waste water standard for power plant, the standard values of Categorie III above have been determined to be adopted for preservation of environment.

These standard values are roughly equivalent to those of other countries experienced in execution of countermeasures for protection of environment and deemed to be sufficient for preservation of environment in the area under study. Howere, it should be taken into consideration that the regulations would be reviewed in the future.

9.1.4 Noise

Bulgarian Standards No. 14478-82 stipulate the restriction of noise in the workplace not at the boundary of premises. Further, Ministry of Health Hygienic Norms No. 0-64 (Official Gazette, Issue No.87/1972) set up highest admissible noise levels in different residential areas and zones. Permitted noise levels are set by specific work positions and/or location, an outline of which is shown in Table 9-1-4-1 and Hygienic Norms are shown in Table 9-1-4-2.

9.1.5 Environmental Impact Assessment

(1) The environmental impact assessment in Bulgaria is regulated in 「On the Environmental Impact Assessment」 (Regulation No.1 of 28 December 1992).

(2) The environmental impact assessment is defined to mean "the procedures for studying and analyzing the conclusions related to the protection of the air, waters, land, mineral resources, flora, fauna, protected territories, landscape, population, settlements and cultural heritage with respect to their permissibility with a view of the existing statutory requirements and their environmental and socio-economic viability."

(3) The environmental impact assessment is applicable to the following;

① National and provincial development programs, including district development plans;

② Landscape development plans and urban development plans as well as their amendments;

③ Project for green field construction, expansion, reconstruction and facility refurbishment set forth in Annexes 1 and 2 of the Environmental Protection Act;

④ Operating facilities, equipment ,activities and others which are considered by the Ministry of Environment to exert substantial impact on the environment in the process of their operation, restructuring, privatization or restitution.

(4) The results of environmental impact assessment should be submitted in the form of a report, and the cost therefor be borne by the relevant enterprise.

(5) Prior to executing any project for constructing power plant and so forth important for the country or local community, it is mandatory to carry out the environmental impact assessment.

Table 9-1-2-1 Air Quality Standard in Bulgaria

(Unit:mg/m^{3}N)

Pollutant	30 Minutes Average	24 Hours Average	Annual Average
SO_2	0.50	0.15	0.05
NO_2	0.60	0.10	0.10
NO_x	0.60	0.06	—
Dust	0.50	0.25	0.15
H_2S	0.008	0.008	0.008

Table 9-1-2-2 Emission Standard in Bulgaria

(Unit:mg/m^{3}N)

Fuel type	The existing Power Plants commissioned up to 1992				New Power Plants			
	Dust	SO_2	NO_x	CO	Dust	SO_2	NOx	CO
Domestic coal	200	3,500	1,000	250	100	650	600	250
Imported coal	150	2,500	1,300	250	80	650	600	250
Liquid fuel	50	2,500	700	170	50	650	450	170
Gaseous fuel	10	—	500	100	10	—	300	100

Table 9-1-2-3 SO_2 Emission Level and Its Reduction Percentages in Bulgaria

	SO_2 Emission Level per year	SO_2 Target Emission Level per year	Emission Reduction Percentage (base year 1980)
1980	2,050kt	—	—
2000	—	1,374kt	33%
2005	—	1,230kt	40%
2010	—	1,127kt	45%

Table 9-1-2-4 SO_2 Emission Limit from New Plant in the EC(Solid fuels)

MWth	Emission Limit Value (mg/m_3N)	Desulphurization rate(%)
50~100	[2,000]	—
100~500	2,000~400 (liner decrease)	40%:100~167MWth 40-90%:liner increase 167~500MWth
>500	400	90

Note:Should the emission limit not be met with high sulphur coal/solid fuels fire, the percentage reduction rates or maximum limit of 650mg/m_3N shall be applied.

Table9-1-2-5 SO_2 Emission Level from New Plant in the EC in mg/m³N(Gaseous fuels)

Type of Fuel	Limit Values
Gaseous fuels in general	35
Liquefied gas	5
Low calorific gases from gasification of refinery residues, coke oven gas, blast-furnace gas	800

Table 9-1-2-6 NOx Emission Level from New Plant in the EC in mg/m³N

Type of Fuel	Limit Value
Solid in general	650
Solid with a less than 10% of volatile compounds	1,300
Liquid	450
Gaseous	350

Table 9-1-2-7 Dust Emission Level from New Plant in the EC

Type of Fuel	MWth	Limit Values(mg/m³N)
Solid	≧500	50
	<500	100
Liquid *	All plant	50
Gaseous	All plant	5 as a rule but 10 for blast furnace gas and 50 for gases produced by the steel industry which can be used elswhere

Note:A limit value of 100mg/m³N may be applied to plants with a thermal capacity of less than 500MW burning liquid fuel with an ash content of more than 0.06%.

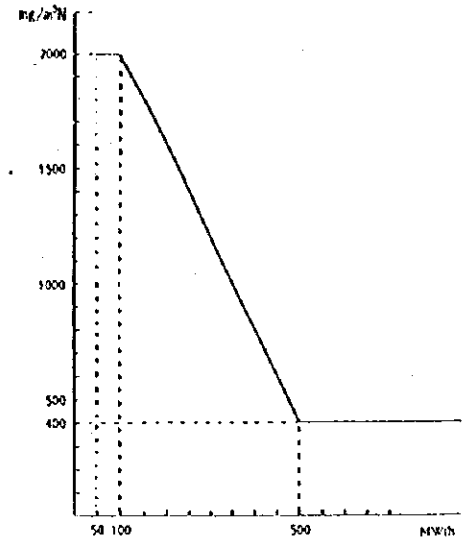


Figure 9-1-2-1 New Plant Emission Limit Values for SO_2 In the EU in mg/m3N(Solid fuels)

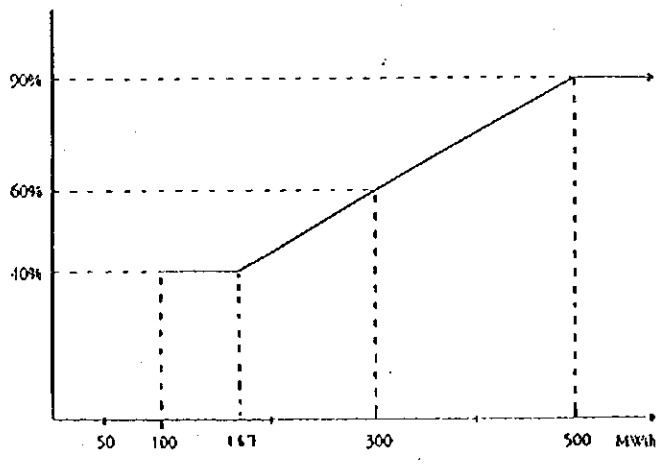


Figure 9-1-2-2 Rates of Desulfurization in the EU

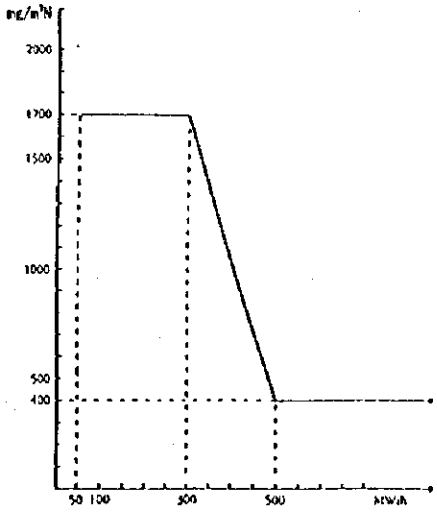


Figure 9-1-2-3 New Plant Emission Limit Values for SO_2 In the EU in mg/m3N(Liquid fuels)

Figure 9-1-3-1 Water Quality Sampling Sites at River Network in Bulgaria

Table 9-1-3-1 The Water Quality Standard of Bulgaria

Indicators and Standards for Assessment of the Admissible Pollution Rates of Various Categories of Running Surface Waters

Item No.	Indicators	Measure Unit	Category: I	II	III
1	2	3	4	5	6
Group A. General Physics and Inorganic Chemistry Indicators					
1. Temperature		°C	Not exceeding the average seasonal temperature by more than 3°C.		
2. Colour			No visible additional colouring at 20°C.		
3. Smell		Force	2	3	3
4. Active reaction		pH	6,5-8,5	6,0-8,5	6-9
5. Oxygen saturation		%	75	40	20
6. Electric conductivity		mkC	700	1300	1600
7. Dissolved oxygen		mg/dm^3	6	4	2
8. Dissolved substance		"	700	1000	1500
9. Suspended matter		"	30	50	100
10. Total hardness		mgekv/dm^3	7	10	14
11. Chlorine ion		mg/ dm^3	200	300	400
12. Sulphate ion		"	200	300	400
13. Hydrogen sulphide (free)		"	n.a.		
14. Iron (total)		"	0,5	1,5	5
15. Manganese (total)		"	0,1	0,3	0,8
16. Nitrogen (ammonia)		"	0,1	2	5
17. Sodium nitrogen		"	0,002	0,04	0,06
18. Nitrate nitrogen		"	5	10	20
19. Phosphate (PO4)		"	0,2	1	2
20. Phosphorus (total content as PO4)		"	0,4	2	3
21. Selenium		"	0,01	0,01	0,01
22. Beryllium		"	0,0002	0,0002	0,002
23. Vanadium		"	0,1	0,01	1
24. Molybdenum		"	0,5	0,5	3
25. Barium		"	1	1	4
26. Boron		"		n.a.	
27. Silver		"	0,001	0,01	0,01
28. Uranium		"	0,6	0,6	0,6
29. Radium 226		mBk/ dm^3	150	150	150

Group B. General Indicators of Organic Pollutants				
30. Organic non-dissolved matter	mg/dm^3	5	15	25
31. Oxdizability (permanganatic)	"	10	30	40
32. HPK (bichromate)	"	25	70	100
33. BPK5	"	5	15	25
34. Dissolved organic carbon	"	5	12	20
35. Extractable species (with tetrachloromethane)	"	0,5	3	5
36. Organic Nitrogen	"	1	5	10
Group C. Indicators of Inorganic Industrial Pollutants				
37. Mercury	mg/dm^3	0,0002	0,001	0,003
38. Cadmium	"	0,005	0,01	0,02
39. Lead	"	0,02	0,05	0,2
40. Arsenic	"	0,02	0,05	0,2
41. Copper	"	0,05	0,1	0,5
42. Chromium (trivalent)	"	0,1	0,5	1
43. Chromium (hexavalent)	"	0,02	0,05	0,1
44. Cobalt	"	0,02	0,05	0,1
45. Nickel	"	0,02	0,05	0,1
46. Zinc	"	1	5	10
47. General beta-activity	mBk/ dm^3	750	750	750
48. Cyanide (highly degradable)	mg/dm^3	n.a.	0,05	0,1
49. Cyanide (total)	"	n.a.	0,5	1
50. Fluoride (total)	"	0,5	1,5	3
51. Free active Chlorine	"	n.a.	0,05	0,1
Group D. Indicators of Industrial Organic Pollutants				
52. Anionoactive detergent	mg/dm^3	0,5	1	3
53. Phenoles (volatile)	"	0,01	0,05	0,1
54. Oil product	"	n.a.	0,3	0,5
55. Aldrine	"	0,0002	0,0002	0,0002
56. Pyridine	"	0,2	0,2	0,5
57. Xanthogenate	"	0,001	0,01	0,1
58. Saponine	"	0,2	0,2	1
59. Styrene	"	0,1	0,2	0,5
60. Benzene	"	0,5	0,5	1

61. Formaldehyde	mg/dm^3	0,5	0,5	1
62. Caprolactam	"	1	1	1
63. Phthalic acid	"	0,1	1	5
64. Phenitrotione (Agria 1050)	"	0,0001	0,0001	0,3
65. Zolone (Agria 1060)	"	0,0001	0,0001	0,002
66. Saturnine	"	0,1	0,1	1
67. Atrazine (Ceazine)	"	0,25	0,25	2,5
68. Lasso	"	0,3	0,3	0,5
69. 2,4 D	"	1	1	5
70. Sevine (Decarban)	"	0,002	0,002	0,1
71. Vinyl chloride	"	0,01	0,01	0,01
72. Dichloroethane	"	1,5	1,5	1,5
73. Aphalone	"	0,5	1	1
74. Pathorane	"	0,2	2	2
75. Dimyde	"	1	1	5
76. Ramrod	"	0,5	0,5	1
77. Treflane	"	1	1	5
78. Propanide	"	0,1	1	2
79. Diphenzoquate	"	0,2	1	5
Group E. Biological Indicators				
80. Saprobacity		olygo	beta-mezo	alfa-mezo
Pantle-Book Index		< 1,5	< 2,5	< 3,2
Zelenika-Marvan-Rotstein Index		> 60	> 40	> 25
81. Species variety of the macro-zoobentos (by Shannon)		> 3	> 2	> 1
82. Macrozoobentos equalization degree		> 0,7	> 0,6	> 0,5
83. Macrozoobentos domination degree		< 0,2	< 0,3	< 0,5
84. Micro-organism total (direct) count		6	6	6
85. Total coli-titre	cm^3	< 0,1	< 0,1	< 0,001
86. Escherichia-coli-titre-thermoresistant	"	< 1,0	< 1,0	< 0,01
87. Patogenic micro-organisms		- Not admissible -		

Table 9-1-4-1 Permission Noise Level (BSS 14478-82)

Working place	Equivalent should level	Level of sound pressure octave frequency lane - Hz							
	dB(A)	63	125	250	500	1000	2000	4000	8000
Production rooms at enterprise site	85	99	92	86	83	80	78	76	74
Penalize and cabins for survey and remote control: laboratories without phone extension	80	95	87	82	78	75	73	71	69
In control rooms, typist offices and direct telephone contact	65	83	74	68	63	60	57	55	54
Management office (administration)	60	79	70	63	58	55	52	50	49
Designer offices, programmers, theoretical work	50	71	61	54	49	45	42	40	38
Drivers and service personnel of agricultural transport and load vehicles	85	99	92	86	83	80	78	76	74

Table 9-1-4-2 Highest admissible noise levels in different residential areas and zones

Residential areas and zones	Noise level -dB(A)	
	Day-time	Night
1. Residential areas and zones		
a) existing urban districts	55	45
existing urban districts next to major communication facilities	60	50
b) new districts	50	40
new districts next to major communication facilities	55	45
2. Central urban regions	60	50
3. Industrial districts and zones	70	60
4. Public and individual recreation area	45	35
5. Hospital, sanatorium and other medical establishments' estate	45	35
6. R&D and educational zones	45	35

9.2 Present Situations of Environment

9.2.1 Conditions in the Surrounding Area

(1) The proposed project site is located on the Thracia Plain 100 m above the sea level and surrounded by a moderately sloped hill area where the land is used as farmland (wheat /barley, potato, fruits and other crops). Therefore , the area is less forested.

(2) In the Galabovo district with a population of about 17,000 where the proposed project site is located , there are residences , schools , hospitals and other facilities.

(3) There are twenty-two(22) towns and villages within a radius range of about 30 km from the power plant site (Refer to Figure 9-2-1-1). Theoretically , the arrival distance of air pollutants emitted from a stack with a height of about 200 m is said to be about 30 km. The number of houses and that of livestock within this range are presented in Table 9-2-1-1, and the area of arable land, etc. in Table 9-2-1-2. These numbers and area really occupy about 3～5% of Bulgaria.

(4) The Sazliika River flows north of the Maritza East No.1 Power Plant. As a tributary of the Sazliika River, the Ovcharitza River runs out of the Ovcharitza Lake adjacent to the Maritza East No.2 Power Plant. From the direction of the Maritza No.3 Power Plant, the Sokolitza River flows into the Sazliika River.

(5) Speaking of the utilization conditions of these rivers, the people living in the surrounding area are enjoying fishing on week end, and any full scale fishing operation has not been practiced.

(6) The Rozovkladenetz Lake located south of the Maritza East No.1 Power Plant was constructed artificially by damming up the Sokolitza River to obtain cooling water for the power plant.

(7) About twenty species of fishes are inhabiting in this lake. Fish culturing is carried out by making use of warm waste water from the power plant with an annual catch of about 150 ton since 1989.

(8) Although underground water is used for irrigation of farmland, it is not used as drinking water . The drinking water in the Galabovo District is taken in from the Sazliika River.

(9) Within the proposed site there is no specified nature preservation zone or other particular area one spat the Thracia remains during the second through third century before Christ are located and have been preserved carefully. A list of historical assets on the towns and villages around the proposed project site are presented in Table 9-2-1-3.

(10) As indicated in the geological map around the proposed project site is presented in Figure 9-2-1-2, the ground around the project site comprises alluvium deposit.

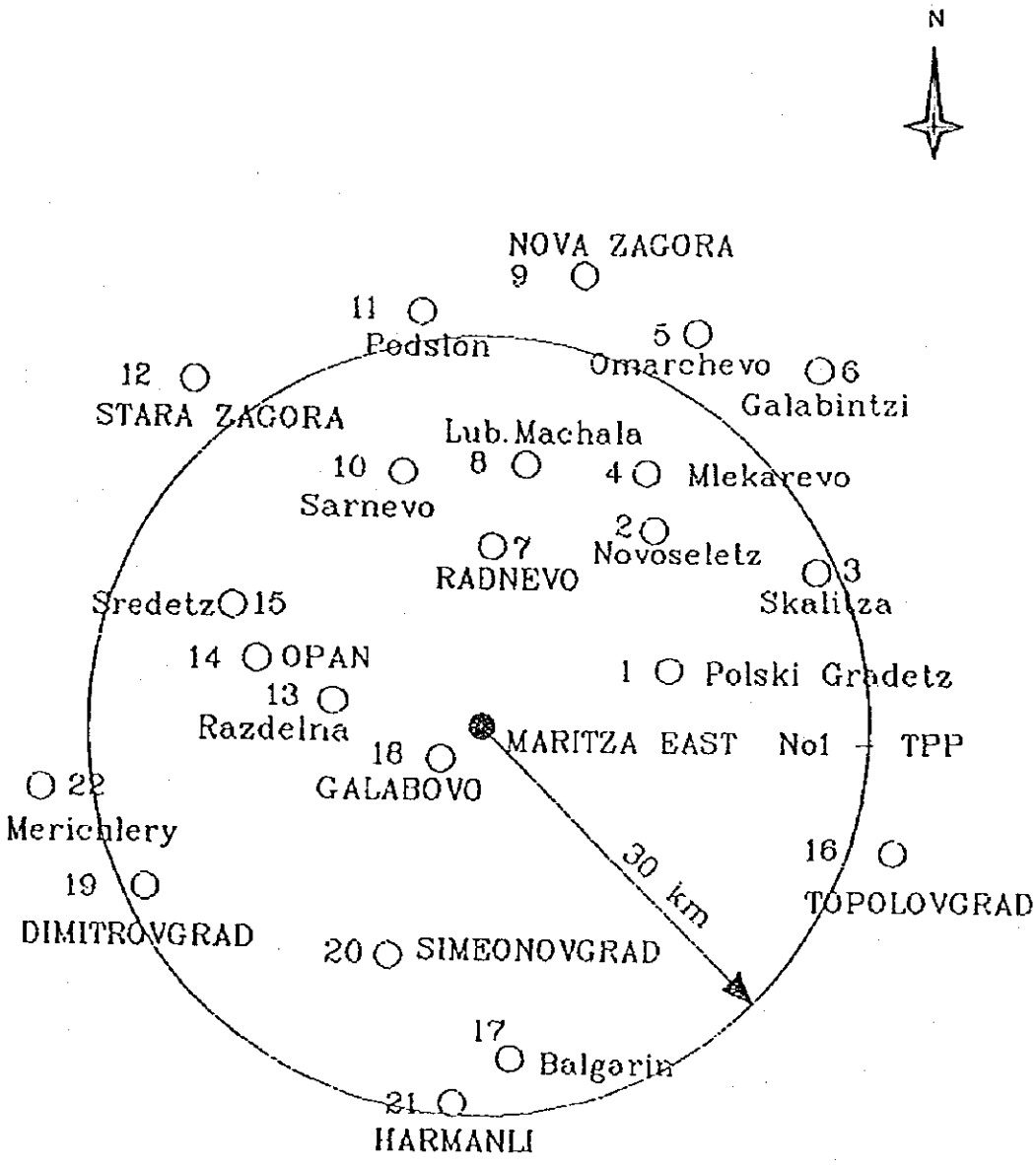


Figure9-2-1-1 Demogarphic Structure within the Area 30km from Maritza East 1 TPP

Table 9-2-1-1 Demographic Structure and Domestic Animals within the Area 30km from Maritza East 1

No.	Settlements	Settlement Population	Region Population	Domestic Animals		
				Cattle	Sheep & Goats	Pigs
1	2	3	4	5	6	7
	North-East Direction					
1	Polski Gradetz	1,013				
2	Novoseletz	772				
3	Skalitza	1,070				
4	Mlekarevo	1,142				
5	Omarchevo	1,079				
6	Galabintzi	647				
7	Radnevo	16,617	27,773	5,586	21,966	19,515
8	Lub. Machala	1,273				
9	NOVA ZAGORA	26,234	49,524	14,173	54,814	28,769
	(Sub-total)	49,847	77,297	19,759	76,780	48,284
	North-West Direction					
10	Samevo	1,783				
11	Podslon	203				
12	STARA ZAGORA	180,482	195,383	14,025	61,392	70,003
13	Razdelna	196				
14	Opan	567	4,850	13,676	13,876	2,510
15	Sredetz	443				
	(Sub-total)	183,674	200,233	27,701	75,268	72,513
	East & South-East Direction					
16	TOPOLOVGRAD	7,388	19,093	2,233	40,516	3,403
17	Balgarin	568				
	(Sub-total)	7,956	19,093	2,233	40,516	3,403
	West & South-West Direction					
18	GALABOVO	9,518	17,747	2,869	19,322	3,850
19	DIMITROVGRAD	50,938	72,756	16,018	33,604	8,913
20	SIMEONOVGRAD	8,289	11,939	2,068	8,227	1,535
21	HARMANLI	21,126	39,733	4,608	31,458	31,390
22	Merichlery	2,600				
	(Sub-total)	92,471	142,175	25,563	92,611	45,688
	TOTAL	333,948	438,798	75,256	285,175	169,888
	ALL BULGARIA	8,472,724	8,472,724	1,335,618	7,256,108	2,978,260
	TOTAL/ALLBULGARIA, [%]	3.94	5.18	5.63	3.93	5.70

Table 9-2-1-2 The distribution of Land in Use and Arable Land

No.	Villages	Area	Land in Use	Arable land						
				Total	Field	Natural Meadow	Artificial Meadow	Wildlife Field	Trees & Vineyard	Forest's Breeder
	For Bulgaria	111.000.000	6.1537.591	46.401.718	40.467.948	2.908.631		192.259	2.789.801	43.079
1	2	3	4	5	6	7	8	9	10	11
1	Polski Gradetz									
2	Novoseletz									
3	Skalitza									
4	Mlekarevo									
5	Omarchevo									
6	Galabintzi									
7	Radnevo	638.79	370.368	300.394	284.4	8.522	1.631	0	5.841	0
8	Lub. Machala									
9	Nova Zagora	984.86	671.67	572.392	521.029	3.066	1.928	0	46.266	0.103
10	Sarnevo									
11	Podslon									
12	Stara Zagora	1.006.22	615.397	502.027	428.871	4.193	6.654	0	61.872	0.437
13	Razdelna									
14	Opan	281.36	217.127	185.97	179.884	2.858	0.496	0	2.732	0
15	Sredetz									
16	Topolovgrad	709.805	485.293	248.999	209.32	4.927	17.97	1.4	15.17	0.212
17	Balgarin									
18	Galabovo	342.314	216.648	161.094	151.088	3.348	0.817	0	5.841	0
19	Dimitrovgrad	563.612	412.493	332.444	319.51	4.417	0	0	8.297	0.22
20	Simeonovgrad	222.222	140.754	108.615	100.763	2.013	0	0	5.826	0.013
21	Harmanli	698.877	491.203	255.067	219.268	10.16	0	0	25.479	0.16
22	Merichlery									
	TOTAL	5.448.06	3.620.953	2.667.002	2.414.133	43.504	29.496	1.4	177.324	1.145
	%	4.908	5.884	5.748	5.966	1.496		0.728	6.356	2.658

Table 9-2-1-3 The distribution of Monuments by Settlements

Settlements	Monument	Location	Category	Type
1	2	3	4	5
Galabovo	1. Church "St. Dimitar"	In the town	Local	Architectural
	2. House of Kalina Toneva Gecheva	In the town	Local	Architectural
Madretz	1. Church "St. Archangel Mikhail"	In the village	Local	Artistic
Obruchiste	1. Ground bank "Erkesiata"	1.5 km north of the village	National	Historical
Razdelna	1. Home of Tenju Kratunkov	In the village	Local	Historical
Opan	1. Home of Stoju Tilev	In the village	Local	Historical
Sredetz	1. Leko Malamova mound		National	Archaeological
	2. Kondova mound		National	Archaeological
Stara Zagora	1. Museum "Geo Milev"	In the town	National	Historical
	2. House of Georgi Bakalov	In the town	National	Historical and architectural
	3. House of Nikolaj Liliev	In the town	National	Historical
	4. Village mound	In the west of the town	National	Archaeological
	5. Shopova mound	In the east of the town	National	Archaeological
	6. Bereketska mound	Residential district "Koliu Ganchev"	National	Archaeological
	7. Hill necropolis of five mounds	3 km east of the town	National	Archaeological
	8. The south gate of Augusta Trajana	In the town	National	Aarchaeological
	9. Relics from Roman wall with mosaic floor	In the town	National	Archaeological

1	2	3	4	5
Gledachevo	1. Grave mound	Place "Mogilata"	National	Archaeological
Radnevo	1. House of Geo Milev	In the town	Local	Historical
	2. Church "St. Ivan Rilski"	In the town	Local	Artistic
	3. Home of Drago Koev	In the town	Local	Historical
	4. Home of Ivan Grozev	In the town	Local	Historical
Trojanovo	1. Ground bank "Erkesiata"	4km south-east of the town	National	Archaeological
Podslon	1. Home of Stojanka and Bojcho Stojanovi	In the village	Local	Historical
Dimitrovgrad	1. Church "St. Dimitar"	In the town	Local	Artistic
	2. Church "St. George"	In the town	Local	Artistic
Merichleri	1. Factory for bottling of mineral water and pavillion for drinking of mineral water	In the village	Local	Architectural
	2. Church "St. Nikolaj"	In the village	Local	Artistic
Simeonovgrad	1. Prehistoric village	In the town	National	Archaeological
	2. Prehistoric village	Place "Chavdarova" mound	National	Archaeological
	3. Village mound Deve bargan	5km east of the town	National	Archaeological
	4. Mound necropolis	1.5km south-east of residential district "Zlati dol"	National	Archaeological
	5. Village from Iron epoch	2km east of residential district "Zlati dol"	Naional	Archaeological
	6. Village from Roman epoch	0,5km north-east of residential district "Zlati dol"	National	Archaeological

1	2	3	4	5
	7. Mound necropolis	3km north-west of the town	National	Archaeological
	8. Mound	2.8km north-west of the town	National	Archaeological
	9. Middle Ages necropolis	Place "Belana", 2km east of the town	National	Archaeological
Balgarin	1. Antique Middle Ages fort	On the left side of "Maritza" river 3km south of the town	Local	Archaeological
	2. Church "Rogdestvo Bogorodichno"	In the village	Local	Artistic
Harmanli	1. Relics from caravanserai	In the town	Local	Architectural
	2. Church "St. Atanasij"	In the town	Local	Artistic
Topolovgrad	1. Relics from fort Paleokastro	3km west of the town	National	Archaeological
	2. Relics from fort Vishegrad	6.7km south of the town	National	Archaeological
Lub. Machala	1. Temple-monument "St. George"	In the village	Local	Historical
	2. Necropolis of three mounds	Place "Kara gjol"	National	Historical
	3. Mounds	Place "Suvata", "Suvatkite"	National	Archaeological
Nova Zagora	1. Communist party house	In the town	National	Historical
	2. The house where Petko Enev lived	In the town	National	Historical
	3. Prehistoric gypsy mound	In the west of residential district "Tracia"	National	Archaeological
	4. Prehistoric mound	Place "Bokluk tarla"	National	Archaeological

1	2	3	4	5
	5. Mound	In the south of the town, in residential district "Chaira"	National	Archaeological
	6. Necropolis of three mounds	In the town	National	Archaeological
Novoseletz	1. Church "St. Troitza"	In the village	Local	Artistic
	2. Antique inscriptions in the church "St. Troitza"	In the village	Local	Archaeological
Omarchevo	1. Church "St. Ilia"	In the village	Local	Artistic
	2. Prehistoric mound	In the town	National	Archaeological
	3. Mound	In the west end of the village	National	Archaeological
	4. Kokanova mound	To the east of the village	National	Archaeological

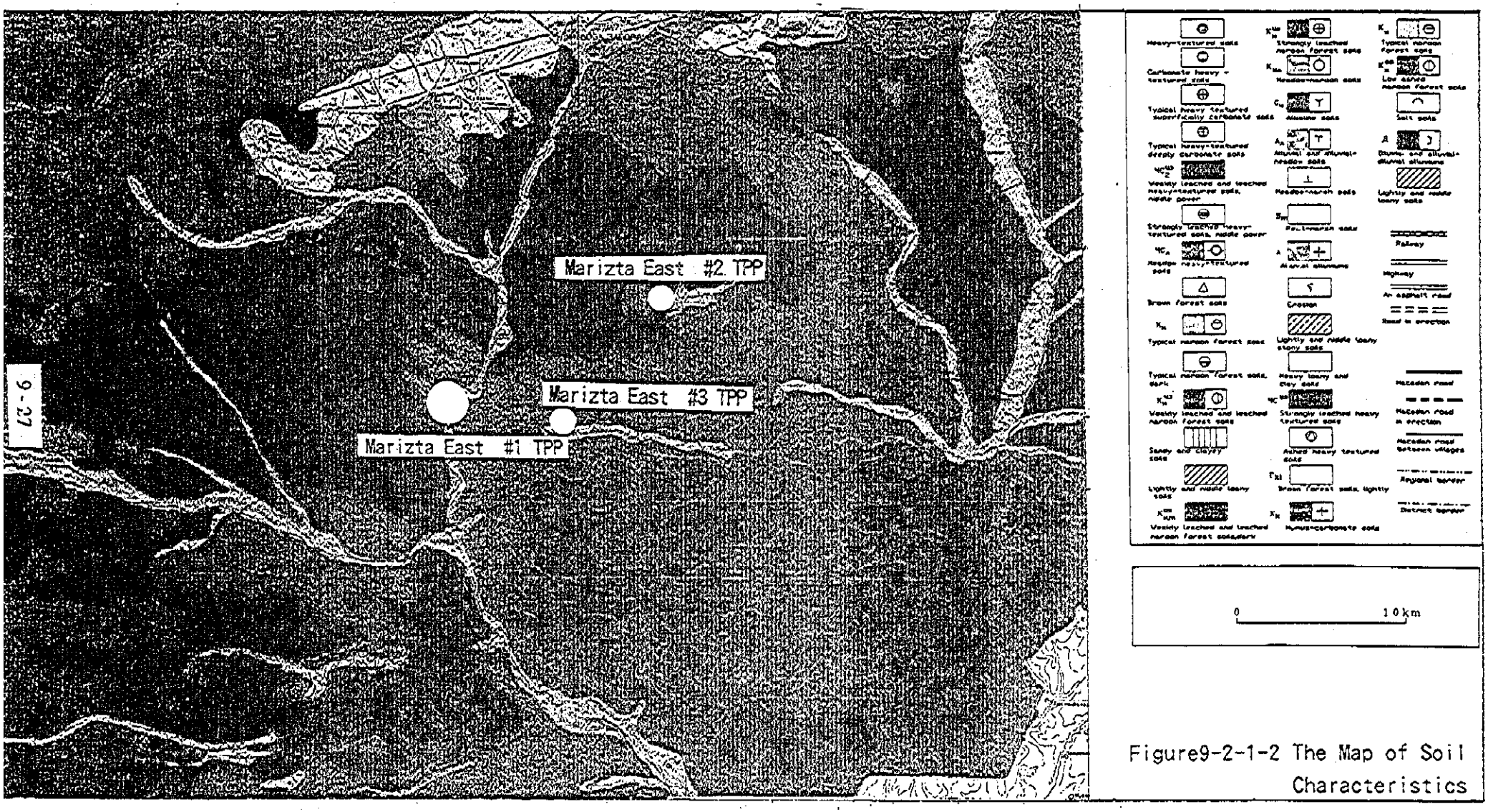


Figure9-2-1-2 The Map of Soil Characteristics

9.2.2 Meteorology

(1) Meteorological Condition

Bulgaria has a rather mild climate and regular changes of season. It is warm and humid so called the Mediterranean climate in the peripheral area of Maritsa East No.1 Thermal Power Plant. The following are averages of what measured at the climate observation center located at the lake side of Rozovkladenetz 1km south west of Maritza East No.1 Thermal Power Plant, during ten years for a period of 1983 to 1992.

(2) Ambient Average Temperature (Refer to Table 9-2-2-1)

With the yearly mean ambient temperature being 12.5°C, the monthly mean ambient temperature is highest (23.8°C) in July and lowest (1.8°C) in January and December.

(3) Atomospheric Pressure (Refer to Table 9-2-2-2)

With the yearly mean atomospheric pressure being 1003.5hPa, the monthly mean atomospheric pressure highest (1007.9hPa) in December and lowest (998.9hPa) in June.

(4) Number of Days with Precipitation (Refer to Table 9-2-2-3)

On a yearly basis, the number of days with precipitation is 42 days, the monthly mean number of days with precipitation highest (8 days) in January, November and December.

(5) Number of Days with Snowfall (Refer to Table 9-2-2-4)

On a yearly basis, the number of days with snowfall is 14days, the monthly mean number of days with snowfall highest (4 days) in January and February.

(6) Annual Average Humidity (Refer to Table 9-2-2-5)

With the annual average humidity being 73%. the monthly mean average humidity highest (84%) in December and lowest (63 %) in June.

(7) Wind Direction and Wind Velocity

On a yearly basis, the prevailing wind direction is NE, the yearly mean wind velocity is 2.5m/sec. Frequency in percent of the wind by direction and velocity is presented in Table 9-2-2-6 and Wind rose in velocity are presented in Figure 9-2-2-1.

Table 9-2-2-1 Ambient Average Temperature (Galabovo 1983-1992)

Month	Monthly Average Maximum	Monthly Average Minimum	Monthly Average
Jan.	6.1 °C	-2.4 °C	1.8 °C
Feb.	7.8 °C	-1.9 °C	3.0 °C
Mar.	12.3 °C	1.3 °C	7.1 °C
Apr.	18.7 °C	6.1 °C	12.6 °C
May	23.4 °C	9.9 °C	17.2 °C
Jun.	27.1 °C	14.0 °C	21.1 °C
Jul.	30.2 °C	15.9 °C	23.8 °C
Aug.	29.8 °C	15.5 °C	23.3 °C
Sept.	26.3 °C	11.9 °C	19.5 °C
Oct.	19.2 °C	6.8 °C	13.1 °C
Nov.	11.4 °C	2.5 °C	6.9 °C
Dec.	5.6 °C	-1.6 °C	1.8 °C
Annual	-	-	12.5 °C

Table 9-2-2-2 Atmospheric Pressure(1983-1992)

Month	Average(hPa)
Jan.	1007.6
Feb.	1006.2
Mar.	1003.9
Apr.	1000.1
May.	1000.7
Jun.	998.9
Jul.	1000.0
Aug.	1000.2
Sep.	1003.6
Oct.	1006.3
Nov.	1006.6
Dec.	1007.9
Annual average	1003.5

Table 9-2-2-3 Number of Days with Precipitation(1983-1992)

Month	Days
Jan.	8
Feb.	4
Mar.	4
Apr.	2
May.	1
Jun.	1
Jul.	0
Aug.	0
Sep.	1
Oct.	5
Nov.	8
Dec.	8
Annual total	42

Table 9-2-2-4 Number of Days with Snowfall(1983-1992)

Month	Days
Jan.	4
Feb.	4
Mar.	2
Apr.	0
May.	0
Jun.	0
Jul.	0
Aug.	0
Sep.	0
Oct.	0
Nov.	1
Dec.	3
Annual total	14

Table 9-2-2-5 Annual Average Humidity(1983-1992)

Month	%
Jan.	83
Feb.	79
Mar.	75
Apr.	72
May.	71
Jun.	63
Jul.	65
Aug.	65
Sep.	67
Oct.	74
Nov.	82
Dec.	84
Annual average	73

Table9-2-2-6 Frequency in Percent of the Wind by Direction and Velocity

January

Velocity	Wind Direction								Calm
m/s	N	NE	E	SE	S	SW	W	NW	
1-3	15.2	4.5	5.2	2.2	8.8	6.8	12.4	7.2	40%
4-6	6.4	5.4	3.4	0.7	2.5	1.8	4.3	0.9	
7-10	1.9	3.4	3.2	0.4	1.2		0.4	0.2	
11-16	0.2	0.5	0.5						
16-		0.4							
Total	23.7	14.2	12.3	3.3	12.5	8.6	17.1	8.3	

February

Velocity	Wind Direction								Calm
m/s	N	NE	E	SE	S	SW	W	NW	
1-3	15.1	9.6	6.1	3.8	7	3.3	5.8	4.5	29.1%
4-6	5	8.1	6.1	1.3	2.3	0.8	3.6	0.7	
7-10	2	3.2	2.3	0.8	1.8	0.2	1.2	0.8	
11-16	0.3	0.8	0.8	0.3	0.8		0.5		
16-		0.2	0.2		0.5			0.2	
Total	22.4	21.9	15.5	6.2	12.4	4.3	11.1	6.2	

March

Velocity	Wind Direction								Calm
m/s	N	NE	E	SE	S	SW	W	NW	
1-3	13.8	10.2	7.1	2.4	6.4	2.1	4.6	3.5	23%
4-6	5.7	10.6	8	1.7	3.9	1.1	1.2	0.8	
7-10	1.8	3.5	2	0.4	2	0.1	1.4	0.6	
11-16	0.4	1	2	0.1	0.6	0.1	0.3		
16-		0.1	0.3		0.1		0.1		
Total	21.7	25.4	19.4	4.6	13	3.4	7.6	4.9	

April

Velocity	Wind Direction								Calm
m/s	N	NE	E	SE	S	SW	W	NW	
1-3	11.8	9.5	9.3	4.1	7.9	3.7	5.8	5	22%
4-6	4.3	7.8	5.8	2.8	4.3	0.3	1.1	1.7	
7-10	1.3	2.4	3.1	1	2.6	0.3	1.6	0.1	
11-16	0.1	0.6	0.8		0.3			0.1	
16-		0.3			0.1	0.1			
Total	17.5	20.6	19	7.9	15.2	4.4	8.5	6.9	

May

Velocity	Wind Direction								Calm
m/s	N	NE	E	SE	S	SW	W	NW	
1-3	13.5	9.3	8.2	5	9.2	3	7.2	4.8	25.5%
4-6	3	5.9	7.8	3.5	2.6	0.3	1.7	1.6	
7-10	1.6	2.6	2.6	0.4	1	0.3	0.9	0.1	
11-16	0.3	0.7	1.6	0.1			0.4		
16-	0.1	0.3	0.1				0.3		
Total	18.5	18.8	20.3	9	12.8	3.6	10.5	6.5	

June

Velocity	Wind Direction								Calm
m/s	N	NE	E	SE	S	SW	W	NW	
1-3	14	7.4	13.4	2.8	7	4.2	10.3	7.7	32%
4-6	5.4	3.9	4.9	1.5	1.3	0.7	3.4	1.3	
7-10	1.6	1.3	2.6	0.5	0.8	0.2	1.1	0.7	
11-16		0.6	0.7				0.2	0.3	
16-		0.2							
Total	21	13.4	21.6	4.8	9.1	5.1	15	10	

July

Velocity	Wind Direction								Calm
m/s	N	NE	E	SE	S	SW	W	NW	
1-3	19.9	14.9	11.7	2.3	3.7	3.7	4.7	6.6	29.7%
4-6	6.3	6.9	6	0.6	0.2	0.3	1.2	1.1	
7-10	2.9	1.2	3.2	0.2			0.8	0.4	
11-16	0.3	0.3	0.3					0.3	
16-									
Total	29.4	23.3	21.2	3.1	3.9	4	6.7	8.4	

August

Velocity	Wind Direction								Calm
m/s	N	NE	E	SE	S	SW	W	NW	
1-3	17.2	13.3	11	1.2	3.6	2.2	4.3	4.8	30.5%
4-6	5.4	8.4	8.5	0.6	1.1	0.5	1.2	1.2	
7-10	2.3	5	5	0.2	0.2	0.2	0.5	0.3	
11-16		0.2	0.9						
16-		0.2	0.3					0.2	
Total	24.9	27.1	25.7	2	4.9	2.9	6	6.5	

September

Velocity	Wind Direction								Calm
m/s	N	NE	E	SE	S	SW	W	NW	
1-3	18.1	13.9	13.9	2.4	4.8	2.9	4.9	3.2	34.6%
4-6	5.9	7.1	7.5	1.2	0.7	0.3	1.2	0.8	
7-10	2.4	2.5	3.9		0.3		0.3	0.2	
11-16	0.3	0.3	0.3				0.7		
16-									
Total	26.7	23.8	25.6	3.6	5.8	3.2	7.1	4.2	

October

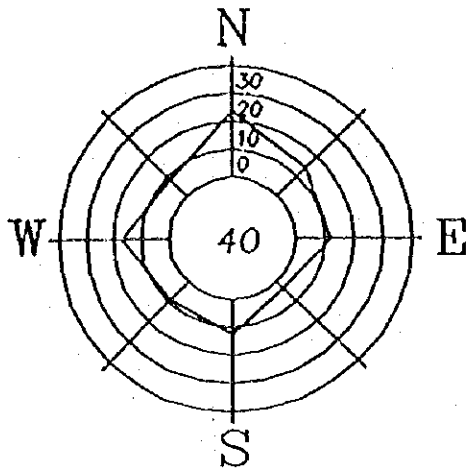
Velocity	Wind Direction								Calm
m/s	N	NE	E	SE	S	SW	W	NW	
1-3	19.9	12.7	12.5	3	5.9	3.1	4.6	4.9	34.7%
4-6	5.3	8.6	4.1	1	1.2	0.2	1.3	1.5	
7-10	1.8	2.8	1.6	0.2	1	0.2	0.2	0.6	
11-16	0.3	0.3	1						
16-		0.2							
Total	27.3	24.6	19.2	4.2	8.1	3.5	6.1	7	

November

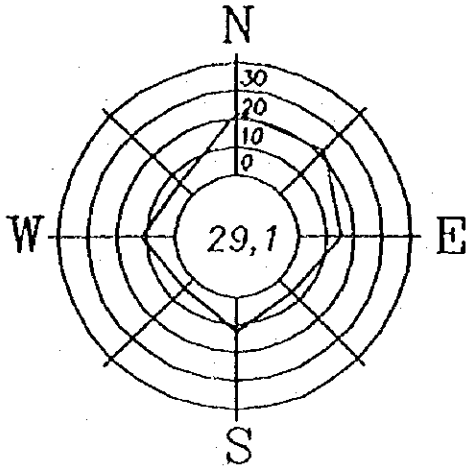
Velocity	Wind Direction								Calm
m/s	N	NE	E	SE	S	SW	W	NW	
1-3	19.8	11.1	6.6	1.8	5	3.4	11.1	5.9	38.1%
4-6	5.7	6.3	3.8	1.8	2.2	0.9	1.6	1.1	
7-10	1.8	3.4	2.5		0.7		1.1	0.5	
11-16	0.2	0.4	0.5	0.2	0.4			0.2	
16-									
Total	27.5	21.2	13.4	3.8	8.3	4.3	13.8	7.7	

December

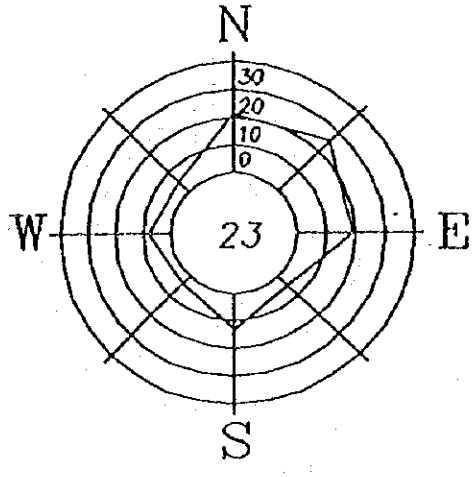
Velocity	Wind Direction								Calm
m/s	N	NE	E	SE	S	SW	W	NW	
1-3	17	9.8	5.4	2.2	8.5	5	10	4.3	38.1%
4-6	5.1	6.5	3.1	1.2	2.2	0.3	3.5	1.4	
7-10	3.1	3	2.8		0.3		0.9	0.3	
11-16	0.5	1.2	0.5	0.3			0.2	0.5	
16-	0.2	0.7							
Total	25.9	21.2	11.8	3.7	11	5.3	14.6	6.5	



January



February



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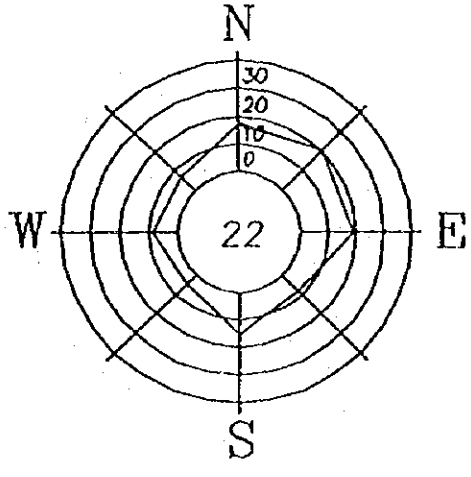
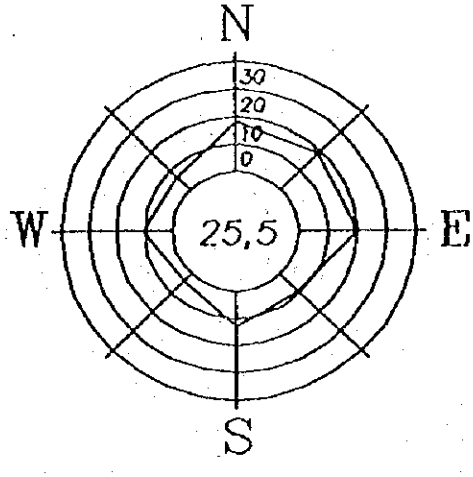
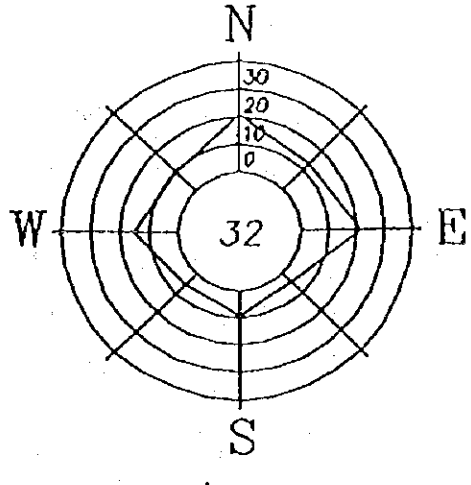


April

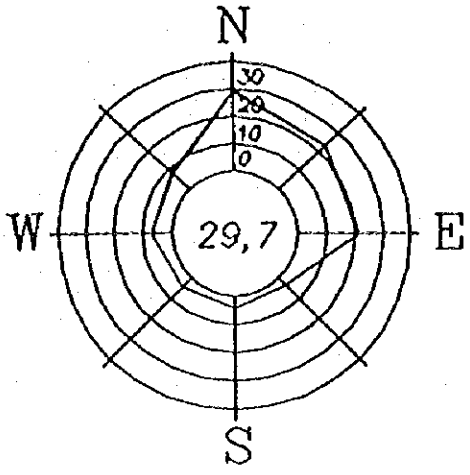


May

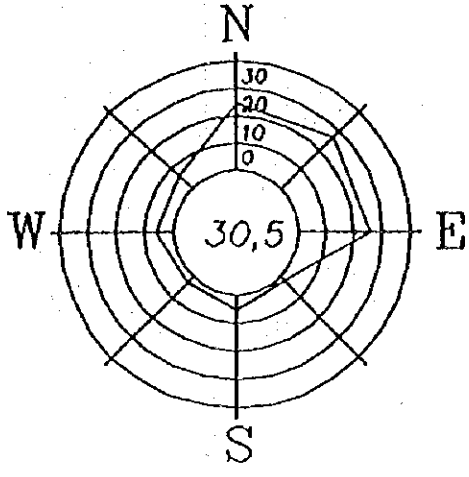


June

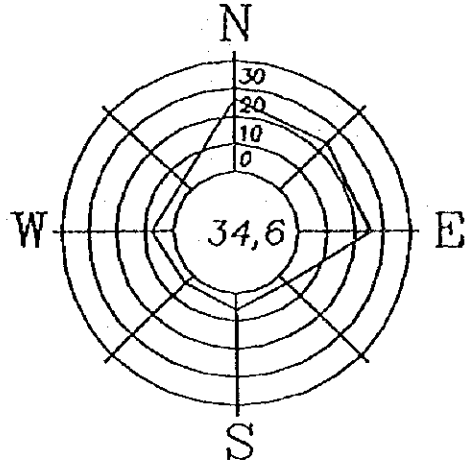
Figure9-2-2-1 Wind Rose in Velocity(Galabovo 1983-1992)



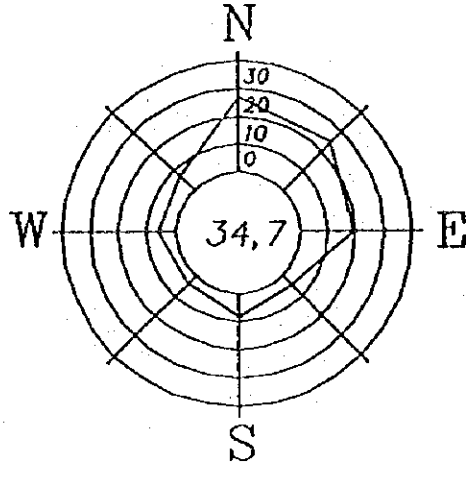
July



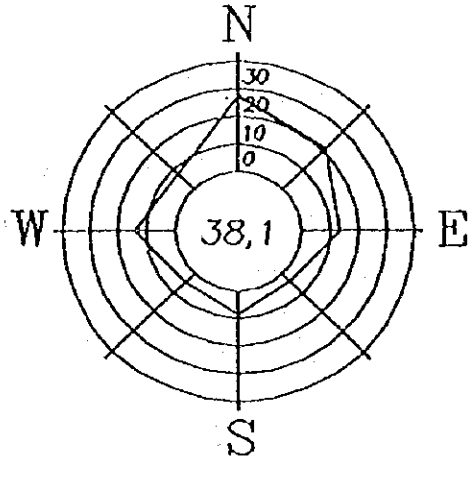
August



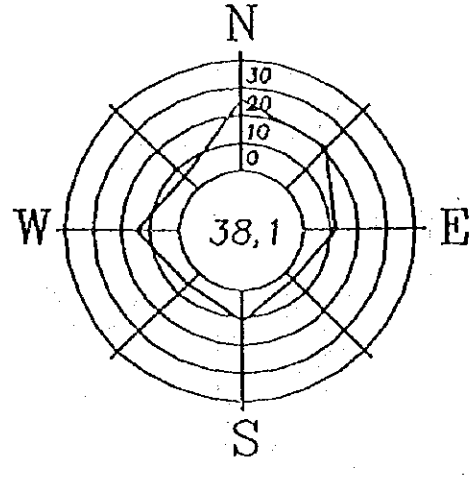
September



October



November



December

9.2.3 Atmospheric Environment

(1) Present Situations in Bulgaria

(a) The administration for environmental protection in Bulgaria is undertaken totally by the Ministry of Environment inaugurated in 1990. As affiliated organizations of the Ministry of Environment, sixteen local environmental bureaus established throughout the country are measuring the environmental concentrations and amount of emission in the relevant management territories at stationary observation stations, or by means of mobile measurement vehicles (environment monitor cars) and so forth.

(b) All of the observation data are collected and integratedly managed in the environmental protection information center located in the capital city (Sofia).

(c) The situations of air pollutants emitted from thermal power plants and district heating power plants in Bulgaria are presented in Table 9-2-3-1. According to the data in 1993, the amount of dust emission and that of SO_x mission are approximately 166,000ton/year and 1.22 million ton/year, respectively.

While the amount of dust emission decreased by about 14,000ton/year in 1993 from about 180,000ton/year in 1992 on one hand, that of the SO_x increased by as much as about 290,000 ton/year from about 930,000ton/year on the other hand. This fact is considered to show that sufficient countermeasures have not been taken to reduce the amount of SO_x emission.

(d) "Yearbook of Environment State in the Republic of Bulgaria 1993" published by the Ministry of Environment is attached to the situations of air pollutant emitted from themal power plants and district heating power plants are indicated in Figures 9-2-3-1~9-2-3-3. The amount of air pollutant emissions, namely, all of the amount of dust, sulfur oxides (SO_x) and nitrogen oxides (NO_x) in the Garabovo area under this study tends to be large.

(2) Present Situation of Atmospheric Environment Quality

(a) Flue gas from the boilers of NO.1 Power Plant is dischaged out of a 180m high chimney through electrostatic precipitators. Since there is no flue desulphurization facility installed, the amount of SOx emission substantially exceeds the emission standard. Coal drying facilities are provided only with cyclone type dust collector of which dust collecting efficiency is so low as even 60%. Therefore, the power plant is operated while paying a penalty because of extremely high SO_X and dust concentration. Moreover,dust arises due to dispersion of ash from the ash disposal yard.

(b) Since both No.2 and No.3 power plants also are provided with only electrostatic precipitators and no desulfurization equipment as boiler flue gas treatment, they are operated while paying a penalty imposed upon excess emission of SOx. The current emission level of Maritsa East Nos.1 through 3 Power Plants are shown in Tables 9-2-3-2～9-2-3-4.

(c) The above-mentioned items are considered to constitute the prevailing factors giving impacts upon atmospheric environment quality in the area covered under this study.

(d) Around the group of Maritza Thermal Power Plants, three stationary observation stations, namely, one observation station per power plant, are provided.

(e) The distance between each observation plant and power plant is given below, and an approximate location of observation station is shown in Figure 9-2-3-4:

Garabovo Observation Station	:	About 5km south west of ME-1
Polski Gradetz Observation Station	:	About 8km south of ME-2
Mednikarvo Observation Station	:	About 2km south of ME-3

(f) The data measured in 1993 at the stationary environment observation stations (Galabovo, Polski gradetz and Medinicarbo)installed by the Ministry of Environment are presented in Figures.9-2-3-5～9-2-3-10.

The concentration of SOx in Garabovo tends to be hight and exceeds the environmental standards in January, February and August. The concentration of dust also tends to be hight and exceeds the environmental standards in October and November.

According to the meteorological observation data obtained from the Meteorological Observation Station around the Rozovkladenetz Lake, the yearly mean most frequent wind direction is northeast, and this means that wind is blowing from the Maritsa East No.1 Power Plant to the fixed observation station at Garabovo. Judging from the fact that there is not any other pollutant emission source than the power plant, therefore, the concentrations of SO_2 and dust at the Garabovo Observation Station is deemed to be raised due largely to the smoke discharged from the power plant or the ash dispersed from the ash disposal yard.

(g) The concentration of SO_2 at all of the three sites tends to be hight. The concentration is deemed to be raised by burning of coal (Briquette) for home heating.

(h) As far as the amount of NO_x is concerned, the environmental standards are satisfied at all of the monitoring points.

Table 9-2-3-1 Issues of Harmful Substances during The Production of Electric and Thermal Energy

Type of fuel Harmful Substances (t/year)	Hard Fuels	Liquid Fuels	Gaseous Fuels	Total 1993	Total 1992	Total 1991
SOx	1.095.180	121.460	—	1.216.640	929.700	1.102.340
NOx	57.620	16.710	9.610	83.940	89.100	76.700
Dust	166.340	—	—	166.340	180.640	172.000
Methane and non-metal volatile organic compound	740	520	350	1.610	1.680	1.260
CO	2.980	1.320	1.320	5.620	5.900	—
CO_2	24.517.340	70.922.120	3.470.140	35.079.600	35.561.400	—
N_2O	6.600	1.250	200	8.050	7.660	—

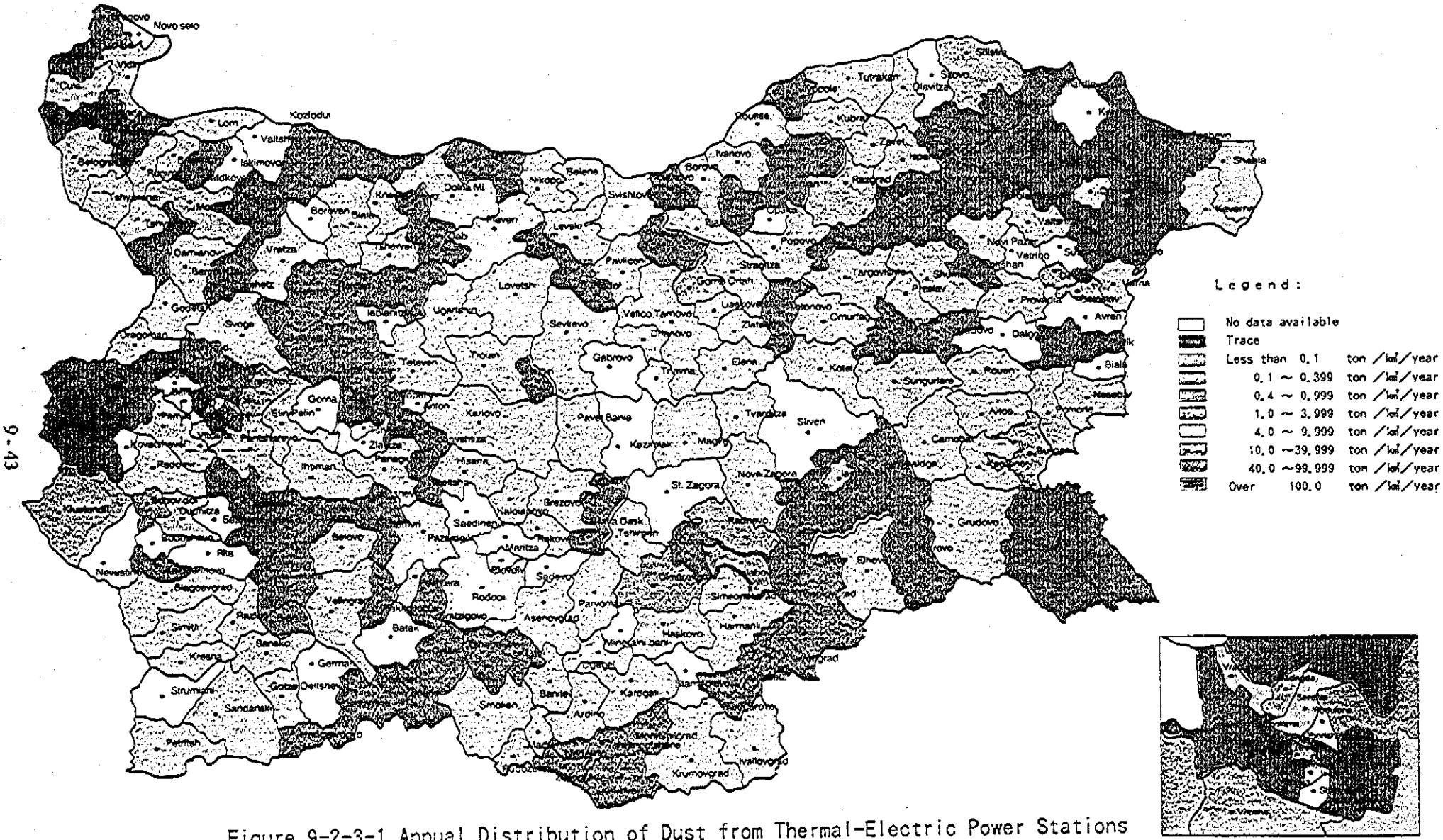
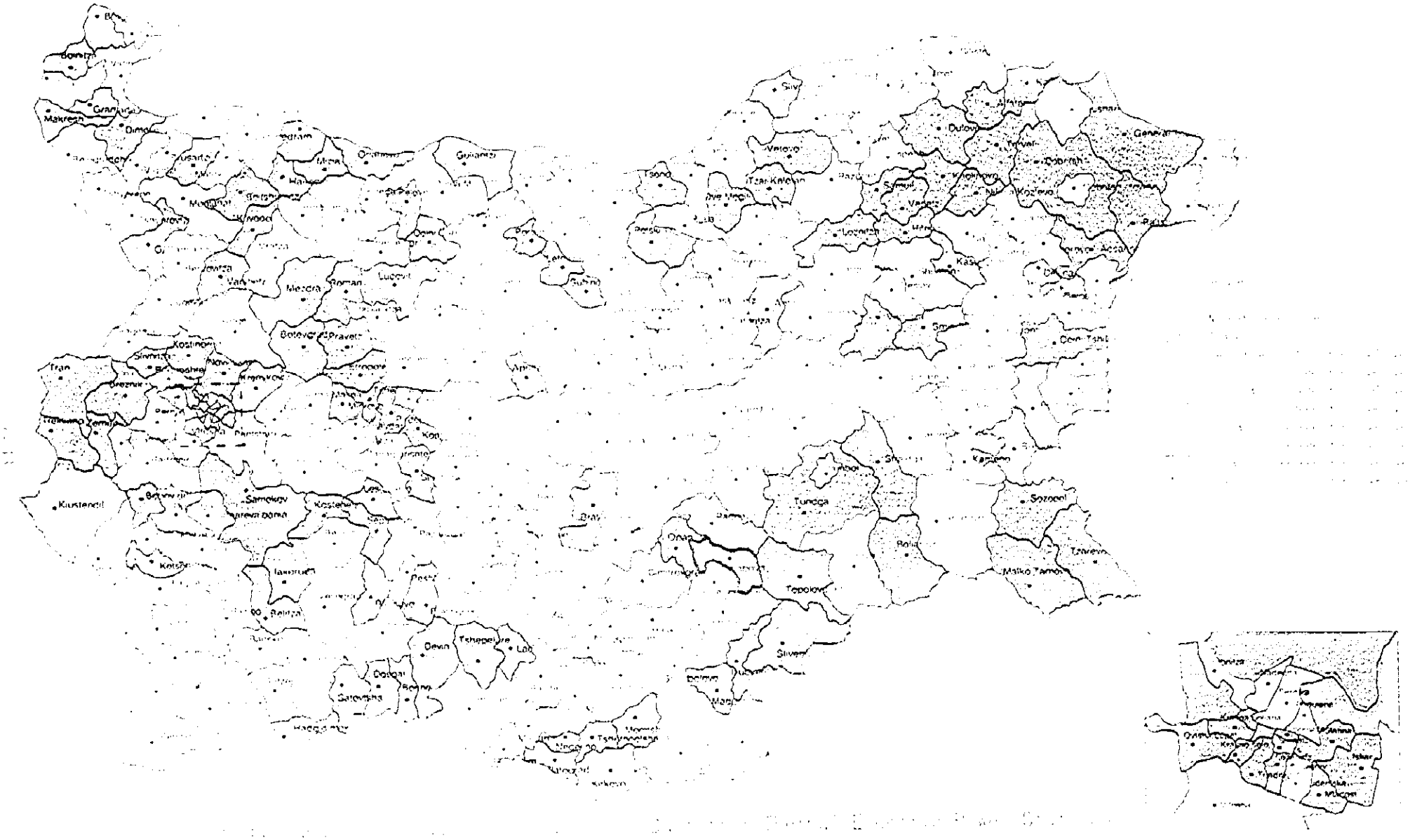


Figure 9-2-3-1 Annual Distribution of Dust from Thermal-Electric Power Stations (TEPS), Industrial TEPS and Industry in Bulgaria



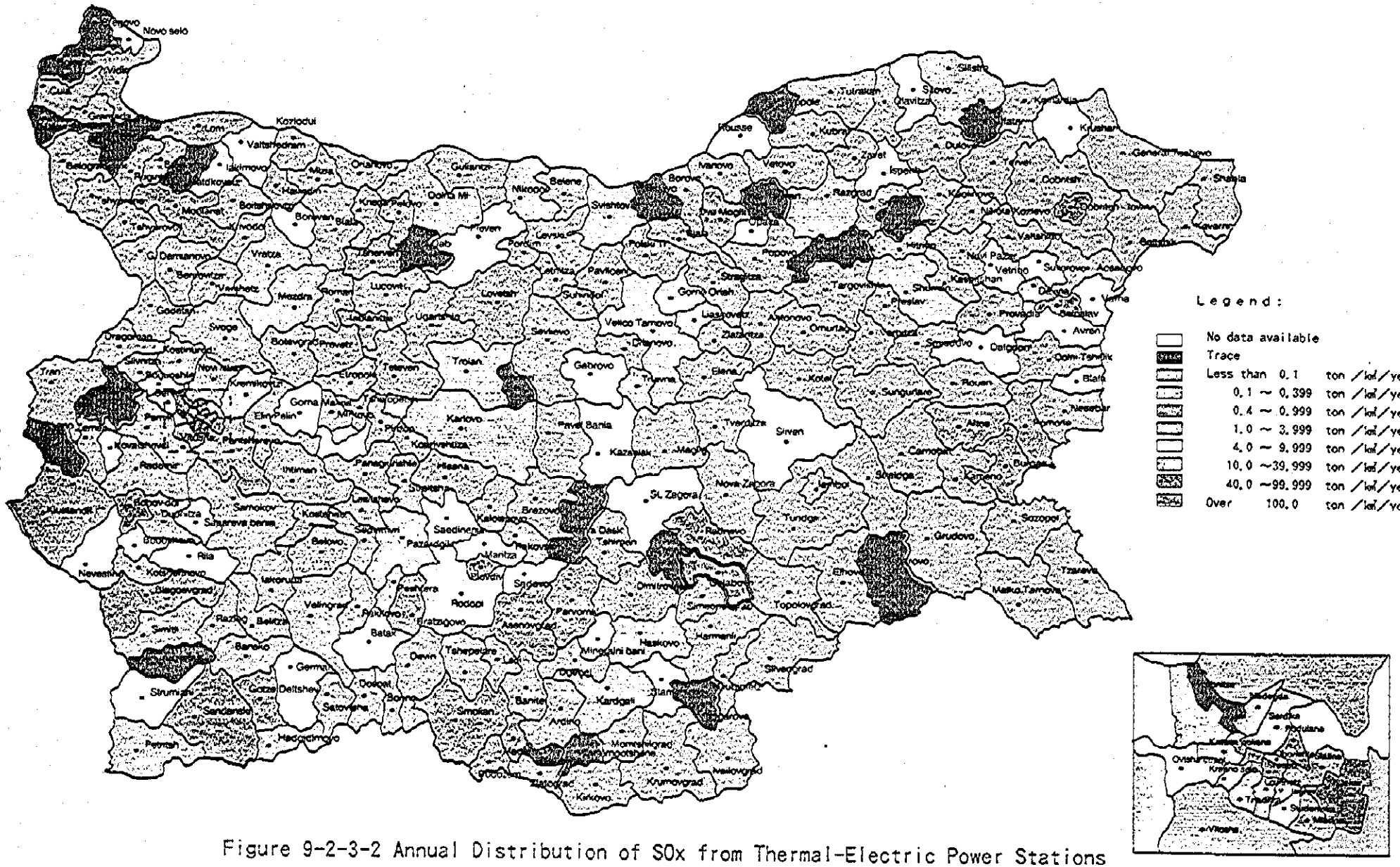


Figure 9-2-3-2 Annual Distribution of SOx from Thermal-Electric Power Stations (TEPS), Industrial TEPS and Industry in Bulgaria

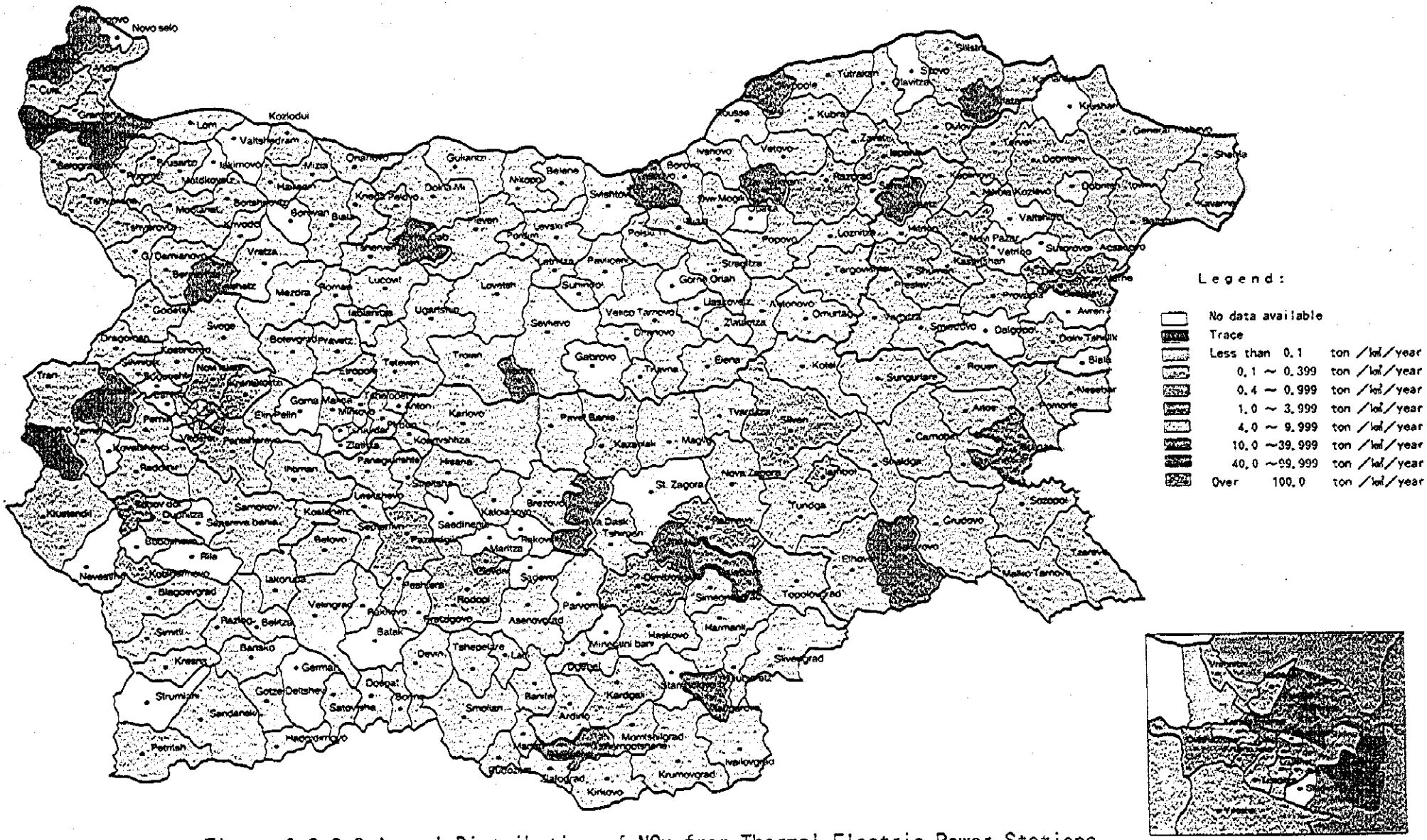


Figure 9-2-3-3 Annual Distribution of NOx from Thermal-Electric Power Stations (TEPS), Industrial TEPS and Industry in Bulgaria

[illegible] Annual Discharge [illegible] NOx from Thermal Electric Power Stations
[illegible] TEPS and Industry in Bulgaria

Table 9-2-3-2 Current Emission Level of Mariza East #1 TPP

(Unit: mg/m³N)

	Dryer		#6 Boiler	
	Current Emission Level	Emission Standard	Current Emission Level	Emission Standard
SO_2	15,200	1,000	13,220 - 15,520	3,500
NO_2	200	——	500	1,000
Dust	7,340 - 22,150	200	168 - 218	200

Table 9-2-3-3 Current Emission Level of Mariza East #2 TPP

(Unit: mg/m³N)

	#3 Boiler	#8 Boiler	Emission Standard
	Current Emission Level		
SO_2	12,560 - 13,830	12,240 - 13,630	3,500
NO_2	360	370	1,000
Dust	250	250	200

Table 9-2-3-4 Current Emission Level of Mariza East #3 TPP

(Unit: mg/m³N)

	#4 Boiler	Emission Standard
	Current Emission Level	
SO_2	11,180 - 11,940	3,500
NO_2	190	1,000
Dust	120 - 140	200

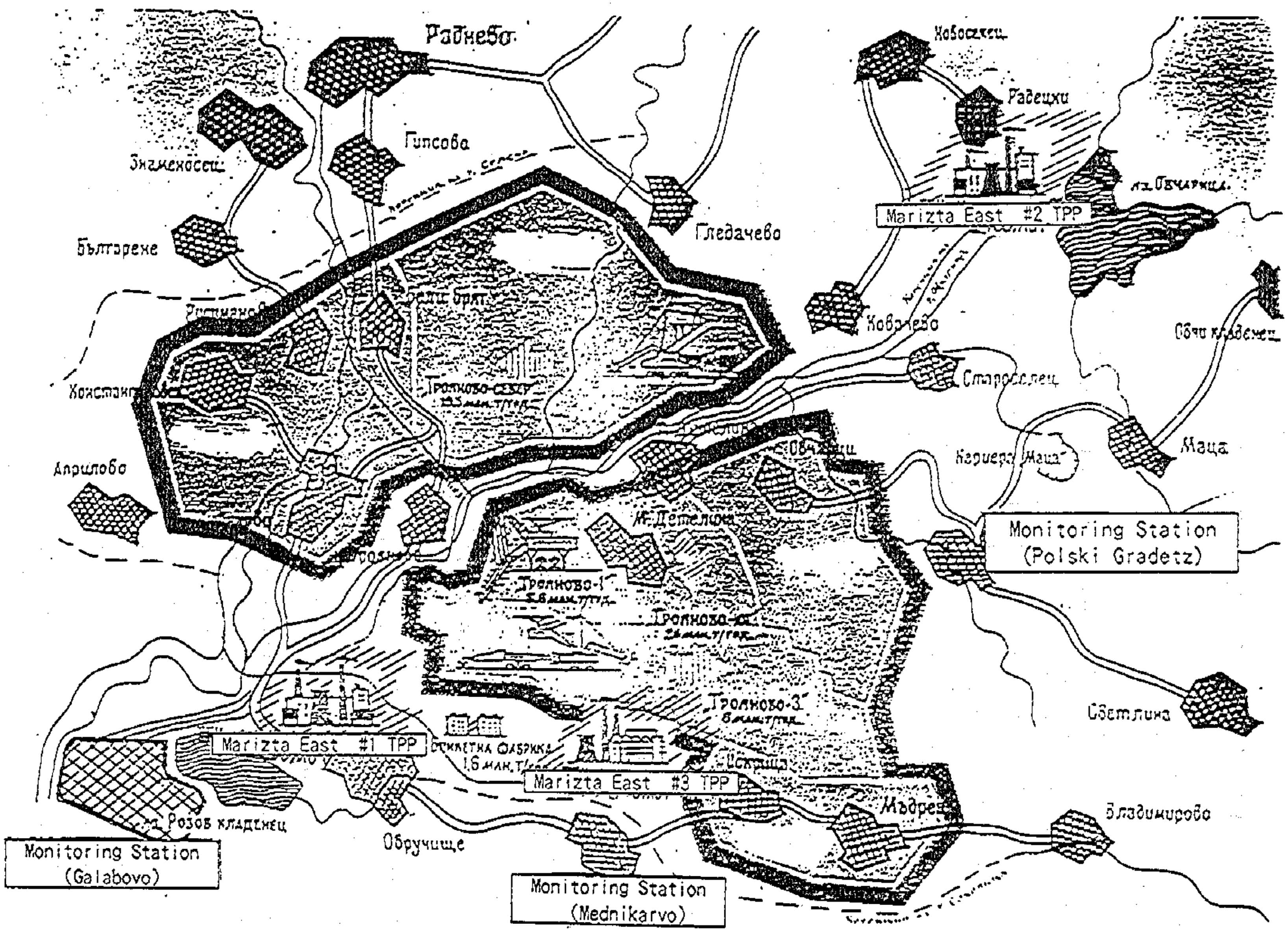
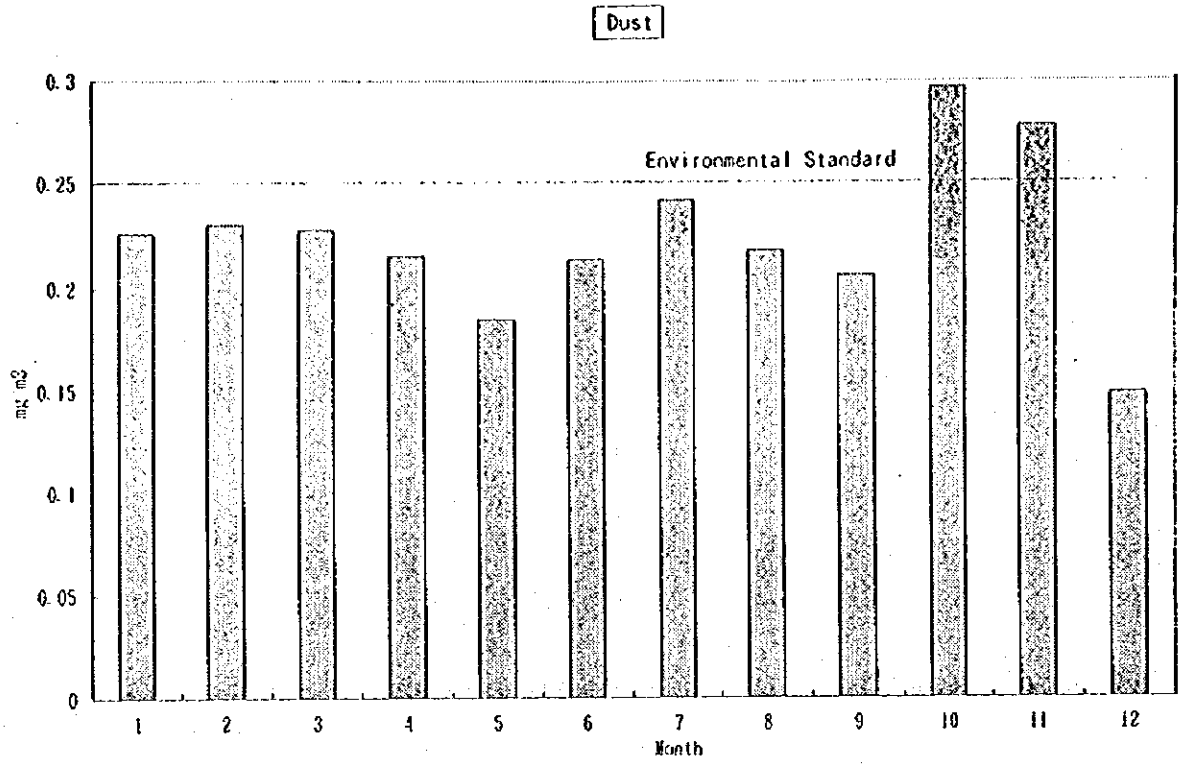


Figure9-2-3-4 Environmental Monitoring Station



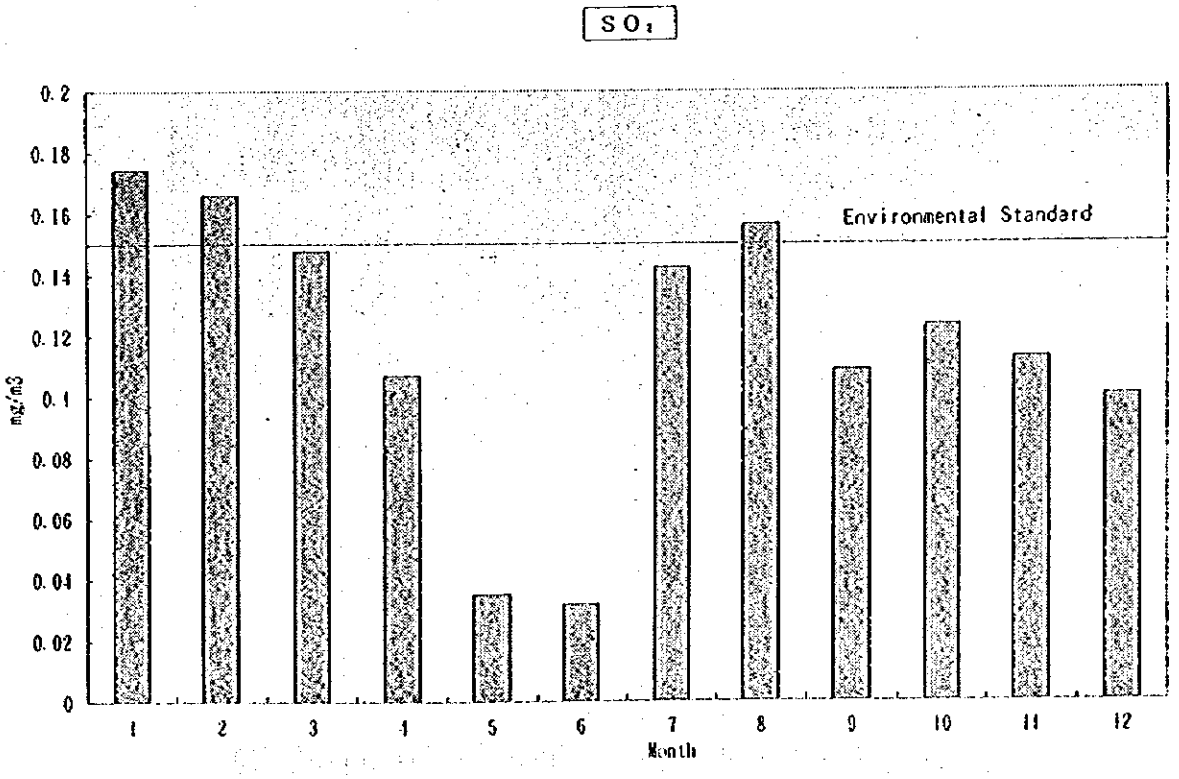


Figure 9-2-3-5 Monitoring Record (Galabovo, 1993)

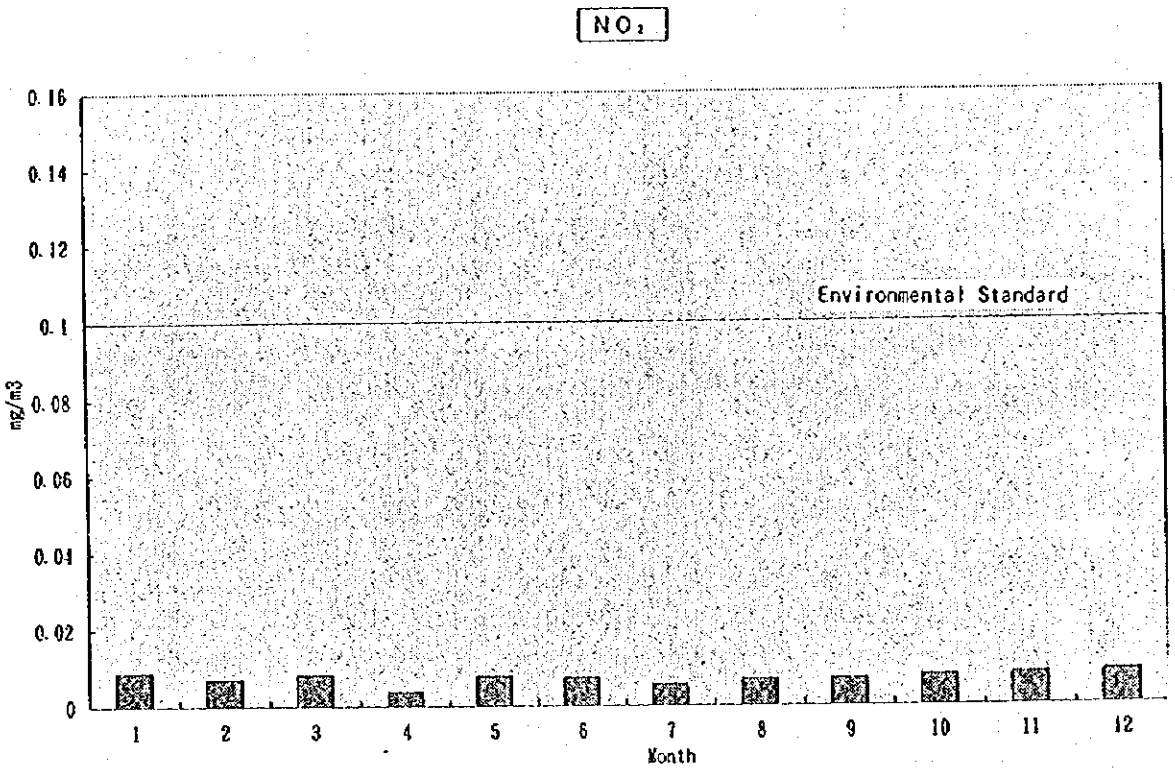


Figure 9-2-3-6 Monitoring Record (Galabovo, 1993)

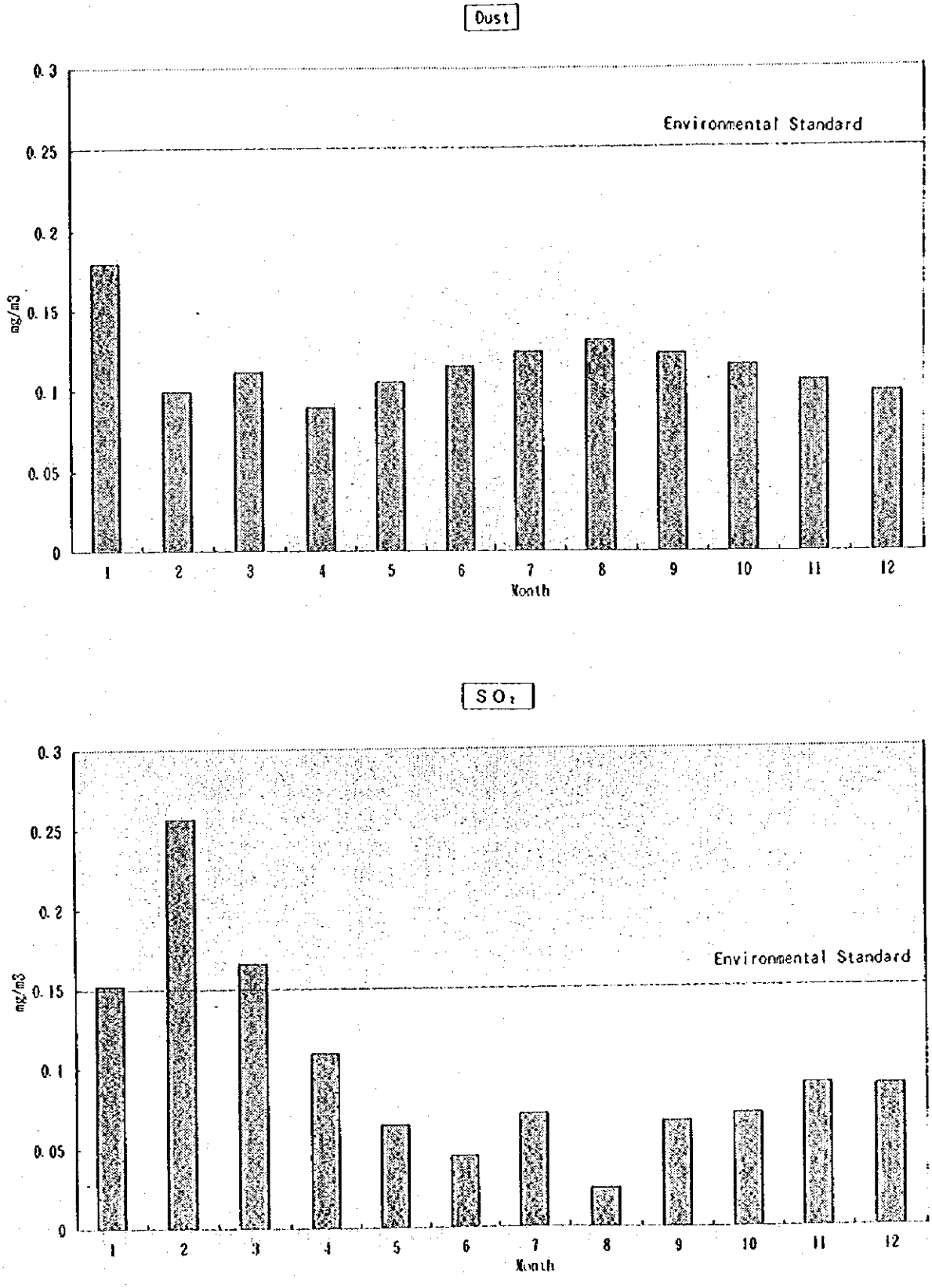


Figure 9-2-3-7 Monitoring Record (Polski Gradetz, 1993)

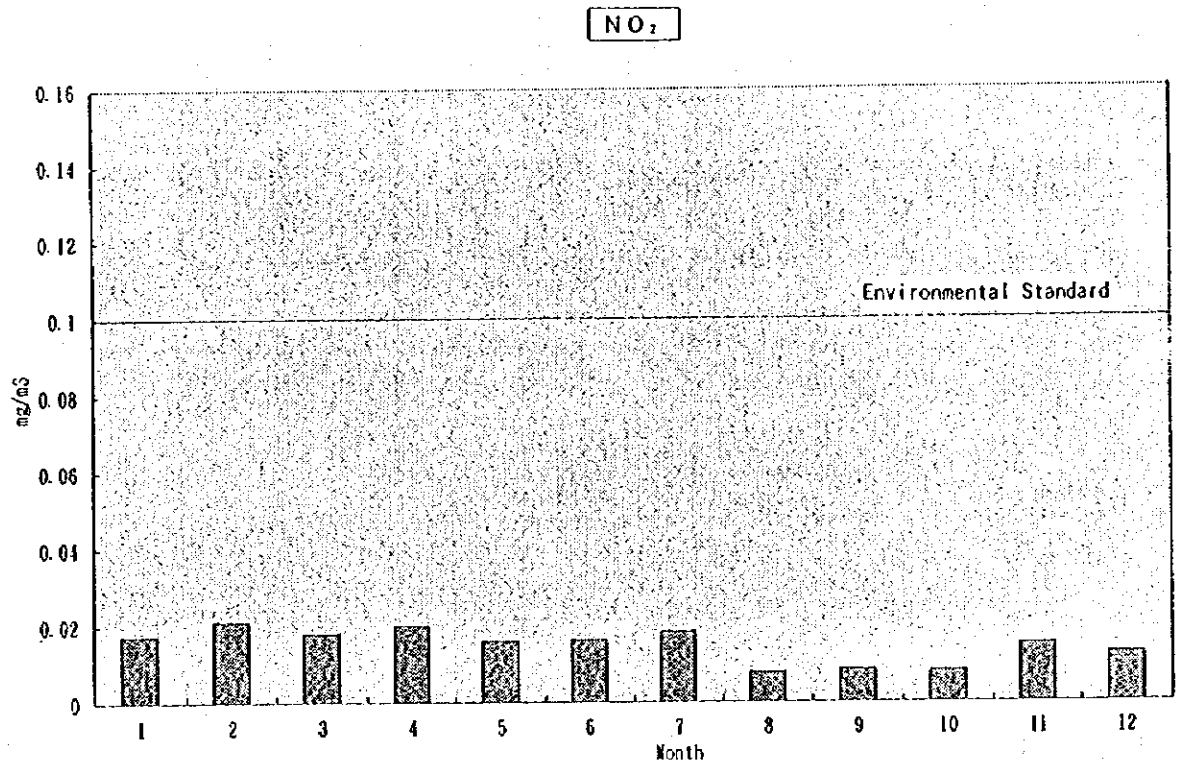


Figure 9-2-3-8 Monitoring Record (Polski Gradetz, 1993)

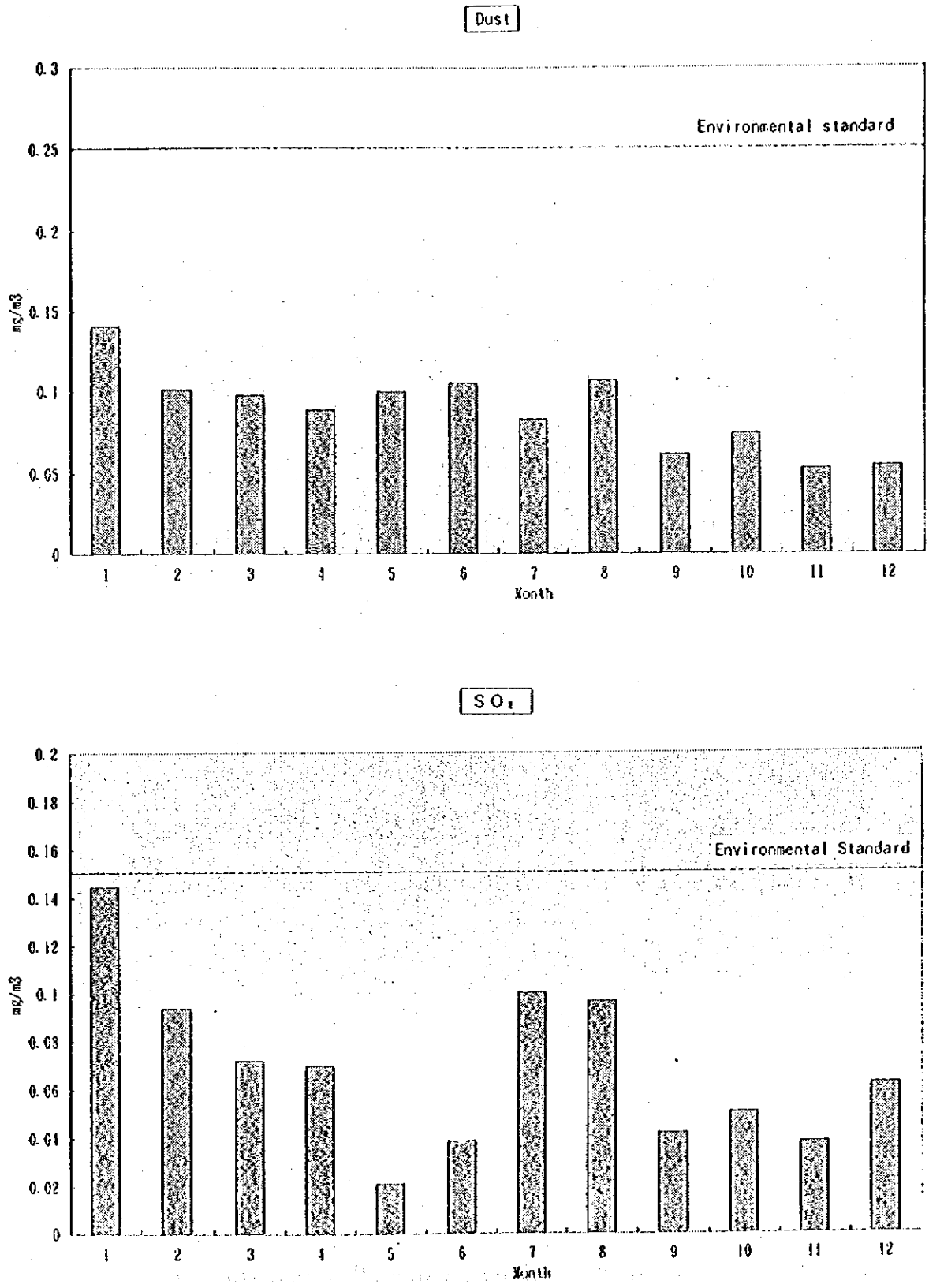


Figure 9-2-3-9 Monitoring Record (Mednikarovo, 1993)

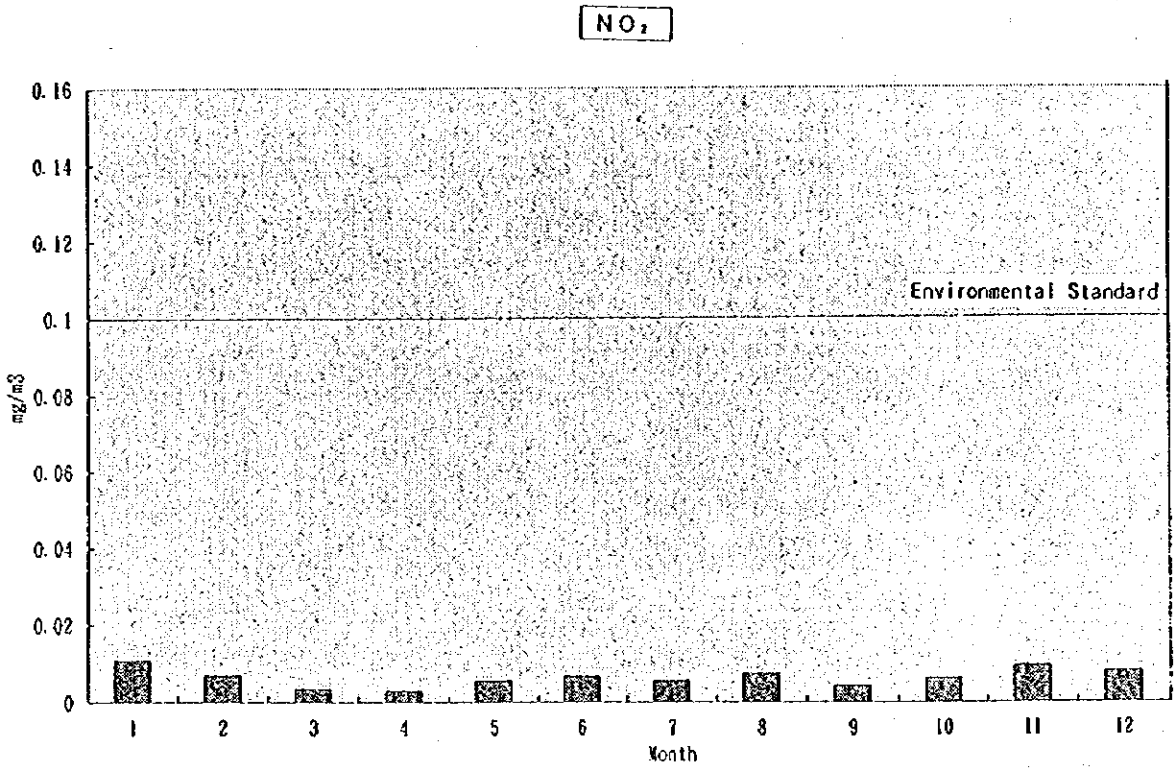


Figure 9-2-3-10 Monitoring Record (Mednikarovo, 1993)

9.2.4 Water Quality

(1) Present Situations of the Planned Area

(a) No waste water treatment equipment is installed in the No.1 Thermal Power Plant.

- Waste water from the power plant is disposed totally in the ash disposal yard.
- Waste water in the ash disposal yard is recycled as ash transfer water.
- Permeated water in the ash disposal yard, transfer water overflowing from the center pump station and supernatant water from sedimentation pond is discharged into the Sazlijka River running around the power plant.

(b) No waste water treatment equipment is installed in Nos.2 and 3 Thermal Power Plants, too and the waste water from these power plants is also poured into a tributary of the Sazlijka River.

(c) Finally, the Sazlijka River joins the Maritza River.

(2) Present Situations of Water Quality

(a) As the data of water quality in the Sazliika River (around the Maritza East No.1 Power Plant) are presented in the Tables 9-2-4-1～9-2-4-3, the hydrogen ion concentration is within a range from pH 7.2～7.9. The hardness contents tend to be as high as 7.2～10.6meq/liter.

(b) As the data of water quality in the Rozovkladenetz Lake are presented in Tables 9-2-4-4 and 5 the concentration of nitrate nitorogen (NO_3-N) tends to become as high as 16～47 mg/liter. The lake will be entrophicated increasingly as the amount of nitrogen, phosphorus and other nutritious substances increases, and the lake water will be lacking in adoptability as water source. Since water pollutants are easily accumulated in the lakes, marshes and other closed water areas with less exchange of their water with other external water system, it will be required to take countermeasures as appropriate for keeping and improving the water quality.

(c) Presented in Tables 9-2-4-6 and 9-2-4-7 are the water quality data downstream and upstream of the Sokolitza River (around the No.3 Power Plant).

The amount of suspended matter is larger at the point downstream of the Maritza East NO.3 Power Plant than upstream of the plant. This is deemed to be caused by the impact of waste water from the Maritza East No.3.

(3) Site Measurement

(a) Sampling Period

Summer : 25 Jul., 1995 ~ 27 Jul., 1995
Winter : 25 Jul., 1995 ~ 27 Jul., 1995
Spot : 28 Nov., 1995, 7 Dec., 1995

(b) Sampling Point

① Summer and Winter

Sazliika River	:	upstream and downstream of power plant
Rozovkladenetz Lake	:	near the power plant discharge port and the opposite bank

② Spot

Sazliika River	:	Ponping station
Rozovkladenetz Lake	:	Sampling Line in cooling water ponping station
Percolating Wate	:	Permeated water channel in the ash disposal yard.
Transfer Water	:	Pit at transfer water ponping station

(c) Testing Method

The testing methods for water quality is shown in Table 9-2-4-8.

(d) Sampling Result

Presented in Tables 9-2-4-9,10 and 11 is water analysis of water quality.

① Summer

(I) Sazliika River :

The hydrogen ion concentration is within a range from pH7.33~7.79. The concentration of biochemical oxygen demand is within a range from 12.88~16.4mg/l. The toxic substance is a trace.

(II) Rozovkladenetz Lake :

The lake water temperature is 29°C. The hydrogen ion concentration is within a range of pH8.35~8.54. The chemical oxygen demand is within a range from 5.8~5.9mg/l. The toxic substance is a trace.

② Winter

(I) Sazliika River :

The hydrogen ion concentration is within a range from pH7.6~7.82. The concentration of BOD is within a range from 8.06~8.80mg/l. The toxic substance is a trace.

(II) Rozovkladenetz Lake :

The lake water temperature is within a range from 8.1~8.3°C. The hydrogen ion concentration is within a range from pH7.8~7.94. The COD contents tend to be as high as 15.8~17.2mg/l. The toxic substance is a trace.

③ Spot Measurements

The following items are not meeting the water quality standards of Bulgaria concerning the permeating water and circulating water of the existing ash disposal yard; EC (electric conductivity), SS (suspended solids), SO^{4-} (sulfate ion) and total hardness. DO (dissolved oxygen) and ammonia nitrogen of the Sazliika River, and SO^{4-} of the Rozov Kladenets Dam Lake also exceed the Bulgarian water quality standards. The water quality of the Sazliika River is deemed to be within the national standards even when the permeating water and circulating water of the existing ash discharging areas as well as the water of the Rozov Kladenets Dam Lake flow into the Sazliika River, because the water quality standards of Bulgaria have been set for the rivers.

And, in the case of the Sazliika River, there is a possibility that DO (dissolved oxygen) is reduced by the sediment on the bottom of pit while the sampling is made after the water has gone through pits and other areas. The actual values in the river are through to be within the standards, judging from the measured results conducted in summer and winter shown in Table 9-2-4-9 and 9-2-4-10.

(4) Recommendation

It is recommended to make a preliminary study on the effluent standards which will be introduced in the future through the current water quality standards are set for the rivers.

When trying to take measures at the originating point of waste water, it is natural to study the effect including the testing results of the reduction effect on the actual waste water. However, among the above items that do not meet the standards, SS, SO^{4-} and total hardness

can be reduced through the coagulating sedimentation method, and EC would be automatically reduced in the process.

Concerning the Sazliika River, NH_4-N (ammonia nitrogen) and DO, which are deemed to be caused by dealt with. However, these could reduced by the improvement of the sewage treatment facilities.

A low DO value means aggravating pollution by organic matters or status of deoxidization. The DO level is an important factor for aquatic such as fish, and a certain level of DO is needed for their survival. Usually there are aerobic microorganisms in the river which play a self-purification function of oxidizing decomposition of organic matters, and oxygen is needed during this process. Separate treatment of life waste water and reduction of the inflow of salts will be the countermeasures.

It is important to plan and implement the countermeasures collectively by uniting the towns and business enterprises as a group, since countermeasures at the originating point of waste water are not effective in terms of their contribution to the quality of the river water when they are conducted by a single business enterprise.

Table 9-2-4-1 Analysis of Water from Sazlika River

Sampling point - Upstream, near the ME-1 PS(1992, 1993)

Parameter	Unit	Quarters' 1992			
		I	II	III	IV
Electrical conductivity	µS/cm	1068	1016	771	1010
pH	-	7.6	7.6	7.6	7.6
Oxidability	mg O_2/l	10	8	8	6
Dissolved Oxygen	mg/l				4
Fe (Total)	mg/l	0.67	0.76	0.64	0.49
Cl^-	mg/l	35	32	29	37
SO_4^{2-}	mg/l	313	309	267	314
PO_3	mg/l	3.6	2.3	3.3	4.2
Hardness (Total)	meq/l	9.3	8.5	7.3	9.2
Oils	mg/l	5.0	4.7	4.0	2.8
Parameter	Unit	Quarters' 1993			
		I	II	III	IV
Electrical conductivity	µS/cm	1135	1008	925	1205
pH	-	7.7	7.9	7.7	7.7
Oxidability	mg O_2/l	8	9	7.8	7.6
Fe (Total)	mg/l	0.44	0.75	0.66	0.6
Mn	mg/l	0.18			
B	mg/l	0.245			
Cd	mg/l	Tr			
Pb	mg/l	Tr			
As	mg/l	Tr			
Cr (Total)	mg/l	Tr			
Cu	mg/l	Tr	Tr	Tr	Tr
Cl^-	mg/l	41	41	34	38
SO_4^{2-}	mg/l	357	235	230	254
PO_3	mg/l	3.3	4.0	4.6	4.2
Hardness (Total)	meq/l	10.1	9.1	8.3	9.0
Oils	mg/l	Tr	Tr	Tr	Tr

Table 9-2-4-2 Analysis of Water from Sazliika River

Sampling point - Upstream, near the ME-1 PS(1994, 1995)

Parameter	Unit	Quarters' 1994			
		I	II	III	IV
Electrical conductivity	µS/cm	1047	868	812	984
pH	-	7.7	7.6	7.5	7.5
Oxidability	mg O_2/l	10	10	7.6	7.6
Cl^-	mg/l	38	38	30	40
SO_4^{2-}	mg/l	234	258	189	290
PO_3	mg/l	4.2	4.7	4.4	3.5
Hardness (Total)	meq/l	9.5	8.7	7.2	8.9

Parameter	Unit	Quarters' 1995			
		I	II	III	IV
Electrical conductivity	µS/cm		1196	923	
pH	-		7.7	7.7	
Oxidability	mg O_2/l		6.8	6.9	
Fe (Total)	mg/l		0.73	0.79	
Cl^-	mg/l		37	26	
SO_4^{2-}	mg/l		314	200	
PO_3	mg/l		2.8	3.3	
Hardness (Total)	meq/l		9.2	7.5	

Table 9-2-4-3 Analysis of Water from Sazliika River

Sampling point - Downstream, near the ME-1 PS(1992, 1993)

Parameter	Unit	1992	1993
Dissolved solids	mg/l	1025	
Suspended solids	mg/l	97	
pH	-	7.6	7.2
Oxidability	mg O_2/l	18	21
Dissolved Oxygen	mg/l	6.4	4.2
NO_3 - N (Nitrates)	mg/l	2.3	1.4
Mn	mg/l		0.28
B	mg/l		0.312
Cd	mg/l		Tr
Pb	mg/l		Tr
As	mg/l		Tr
Cr (Total)	mg/l		Tr
SO_4^{2-}	mg/l		528
PO_3	mg/l		7.2
Hardness (Total)	meq/l		10.6
Oils	mg/l		0.02

Table 9-2-4-4 Analysis of Water from Lake "Rozov kladenetz"(1992, 1993)

Parameter	Unit	Quarters' 1992			
		I	II	III	IV
Electrical conductivity	µS/cm	1495	1452	1107	1245
pH	-	7.9	7.9	7.9	8.0
Oxidability	mg O_2/l	5.2	5.2	5.9	4.8
NO_3 - N (Nitrates)	mg/l	45	35	16	41
Fe (Total)	mg/l	0.19	0.17	0.13	0.15
Cl	mg/l	52	55	46	47
SO_4	mg/l	742	776	679	672
PO_3	mg/l	1.10	1.15	0.64	1.56
Hardness (Total)	meq/l	16.7	15.7	13.6	14.4
Oils	mg/l	5.0	4.7	4.0	2.8
Parameter	Unit	Quarters' 1993			
		I	II	III	IV
Electrical conductivity	µS/cm	1488	1472	1374	1343
pH	-	8.3	7.5	8.5	9.2
Oxidability	mg O_2/l	4.5	4.4	5.9	6.4
NO_3 - N (Nitrates)	mg/l	47	38		
Fe (Total)	mg/l	0.19	0.18	0.16	0.22
Mn	mg/l		0.06		
Be	mg/l		Tr		
B	mg/l	0.704	0.380		
Cd	mg/l	Tr	Tr		
Pb	mg/l	0.019	0.043		
As	mg/l	Tr	Tr		
Cr	mg/l	Tr			
Se	mg/l		0.18		
Cu	mg/l	Tr	Tr	Tr	Tr
Cl	mg/l	51	55	51	52
SO_4	mg/l	724	739	675	684
PO_3	mg/l	1.04	1.34	1.51	1.16
Hardness (Total)	meq/l	16.0	15.9	13.6	16.0

Table 9-2-4-5 Analysis of Water from Lake "Rozov kladenetz"(1994, 1995)

Parameter	Unit	Quarters' 1994			
		I	II	III	IV
Electrical conductivity	µS/cm	1320	1348	1450	1181
pH	-	8.6	8.3	8.5	7.9
Oxidability	mg O_2/l				4.8
Fe (Total)	mg/l	0.43	0.22	0.20	0.21
Cu	mg/l	Tr	Tr	Tr	Tr
Cl	mg/l	53	55	50	58
SO_4	mg/l	780	603	619	594
PO_3	mg/l	2.12	1.83	2.32	2.03
Hardness (Total)	meq/l	15.7	14.6	13.9	13.9

Parameter	Unit	Quarters' 1995	
		I	II
Electrical conductivity	µS/cm	1335	1215
pH	-	7.9	8.4
Oxidability	mg O_2/l	4.0	5.4
Fe (Total)	mg/l	0.25	0.18
Cu	mg/l	Tr	Tr
Cl	mg/l	47	42
SO_4	mg/l	534	472
PO_3	mg/l	2.39	1.23
Hardness (Total)	meq/l	12.0	11.5

Table 9-2-4-6 Analysis of water from Sokolitza River

Sampling point - Upstream, near the ME-3 PS(1994)

Parameter	Unit	Quarters' 1994			
		I	II	III	IV
Dissolved solids	mg/l	358	700	877	444
Suspended matters	mg/l	16	22	54	12
pH	-	7.84	7.82	7.68	7.75
Oxidability	mg O_2/l	5.9	5.9	6.1	4.6
Dissolved Oxygen	mg/l	8.4	5.0	5.5	6.2
Fe (Total)	mg/l	0.16	0.24	0.18	0.30
Oils	mg/l	3.3	4.1	3.7	3.0

Table 9-2-4-7 Analysis of Water from Sokolitza River

Sampling point - After merging of effluents of waste water

of the ME-3 PS to the River(1994, 1993)

Parameter	Unit	Quarters' 1994				1995
		I	II	III	IV	I
Dissolved solids	mg/l	2193	2185	1881	2610	902
Suspended matters	mg/l	240	59	82	180	145
pH	-	8.07	8.23	8.14	7.84	7.86
Oxidability	mg O_2/l	17.3	12.6	31.6	14.3	13.7
Dissolved Oxygen	mg/l	5.5	6.0	5.7	6.7	9.3
Fe (Total)	mg/l	0.48	0.34	0.23	0.88	0.76
Oils	mg/l	3.0	3.1	4.4	4.5	2.2

Table9-2-4-8 Testing Methods for Water Quality

Parameter	Method	Unit	Detecting Limitation	Standard Value Class 3
Temperature	Thermometer	°C		
pH	Potentiometric	-	1-14	6-9
Biochemical Oxygen Demand (BOD)	BGS 17.1.4.07-78	mg/l	6000	25
Chemical Oxygen Demand (COD)	BGS 17.1.4.16-79 (Oxidation with $KMnO_4$)	mg/l	100	40
Suspended Matters	BGS 17.1.4.07-77, Gravimetric	mg/l		100
Dissolved oxygen (DO)	BGS 17.1.4.08-78 (with $KMnO_4$)	mg/l	>0.2	>2
No. of Coliform Group Bacteria		-		<0.001
No. of Total Group Bacteria		-		$<10^6$
No. of Cocciform Group Bacteria		-		
Cd (Cadmium)	Atomic Absorption Spectrophometric - Perkin Elmer	mg/l	0.005-10	0.02
CN (Cyanide)	Colourimetric BGS 72 14-78	mg/l	0.001-5	0.1
Phosphorous (total content as PO_4)	Colourimetric BGS 72 10-78	mg/l	0.1-10	3 (PO_4)
Pb (Lead)	Atomic Absorption Spectrophometric - Perkin Elmer	mg/l	0.01-10	0.2
Cr6+(Hexavalent Chromium)	Colourimetric BGS 72 12-78	mg/l	0.03-5	0.1
Arsenic	Atomic Absorption Spectrophometric - Perkin Elmer	mg/l	0.01-10	0.2
Total Mercury	ICP Spectro Flame	mg/l	0.002-5	0.005
Alkyl Mercury		mg/l		
Polychlorinated Biphenyl (PCB)	EPA-625, Hewlett-Packard GC/MSD, Split-splitless Infector, SIM Node	ng/l	35-35000	-

Table9-2-4-9 Water Analysis by Sampling Period

25 Jul. 1995 - 27 Jul. 1995

Parameter	Unit	Sampling point			
		Sazliika River		Lake Rozovkladenetz	
		I (Upstream)	II (Downstream)	I (Discharge)	II (Opposite)
Temperature	°C	23.6	23.7	29	29
pH	-	7.33	7.79	8.35	8.54
Biochemical Oxygen Demand (BOD)	mg/l	16.4	12.88	7.76	17.28
Chemical Oxygen Demand (COD)	mg/l	6.3	7.0	5.9	5.8
Suspended Matters	mg/l	26	32	24	15
Dissolved oxygen (DO)	mg/l	3.50	3.72	5.4	4.8
No. of Coliform Group Bacteria	-	0.01	0.01	0.01	0.01
No. of Total Group Bacteria	-	159.10^3	165.10^3	53.10^3	122.10^3
No. of Cocciform Group Bacteria	-	0.01	0.01	0.1	0.01
Cd (Cadmium)	mg/l	<0.005	<0.005	<0.005	<0.005
CN (Cyanide)	mg/l	ND	ND	ND	ND
Phosphorous	mg/l	1.6	1.3	1.0	0.85
Pb (Lead)	mg/l	ND	ND	ND	ND
Cr6+(Hexavalent Chromium)	mg/l	<0.03	<0.03	<0.03	<0.03
Arsenic	mg/l	<0.01	<0.01	<0.01	<0.01
Total Mercury	mg/l	<0.002	<0.002	<0.002	<0.002
Alkyl Mercury	mg/l				
Polychlorinated Biphenyl (PCB)	ng/l	41.94	39.08	<35	<35

Table9-2-4-10 Water Analysis by Sampling Period

4 Dec. 1995 - 6 Dec. 1995

Parameter	Unit	Sampling point			
		Sazliika River		Lake Rozovkladenetz	
		I (Upstream)	II (Downstream)	I (Discharge)	II (Opposite)
Temperature	°C	7.4	7.5	8.1	8.3
pH	-	7.60	7.82	7.80	7.94
Biochemical Oxygen Demand (BOD)	mg/l	8.80	8.06	5.68	7.12
Chemical Oxygen Demand (COD)	mg/l	31.6	30.4	15.8	17.2
Suspended Matters	mg/l	32	35	58	65
Dissolved oxygen (DO)	mg/l	2.20	2.00	8.50	8.30
No. of Coliform Group Bacteria	-	10	10	10	10
No. of Total Group Bacteria	-	-	-	53. 10^3	122. 10^3
No. of Cocciform Group Bacteria	-	-	-	-	-
Cd (Cadmium)	mg/l	<0.005	<0.005	<0.005	<0.005
CN (Cyanide)	mg/l	ND	ND	ND	ND
Phosphorous	mg/l	2.32	2.11	1.35	1.24
Pb (Lead)	mg/l	ND	ND	ND	ND
Cr6+(Hexavalent Chromium)	mg/l	<0.03	<0.03	<0.03	<0.03
Arsenic	mg/l	<0.01	<0.01	<0.01	<0.01
Total Mercury	mg/l	<0.002	<0.002	<0.002	<0.002
Alkyl Mercury	mg/l				
Polychlorinated Biphenyl (PCB)	ng/l	41.94	39.08	<35	<35

Table 9-2-4-11 Measured Data about qualities of the Waters from the Slag and Ash disposal, and The Sazlika River and The Rozov Kladenets Dam Lake

Indicators	Analysis Place	Measure Unit	The Sazlika River	Rozov Kladenets Dam Lake	Permeated Water from Ash Pond	Recycled Water from Ash Pond	Bulgaria Standard (III)
Temperature	MEI	°C	8.2	9	17	8.5	
Colour	MEI	-	Yellow, clean	White, clear	Colorless, clear	Brown, muddy	
Smell	MEI	-	Algae-smelling	Algae-smelling	Odorless	Earth-smelling	
pH	MEI	-	7.73 (15°C)	7.76 (15°C)	7.86 (20°C)	8.03 (15°C)	6-9
DO	MEI	mg/l	1.47	7.4	2.2	9.2	≧2
EC	MEI	mS/cm	0.803 (18°C)	1.232 (13°C)	2.03 (28°C)	2.127 (15°C)	1.6
COD	MEI	mg/l	27.2	16.8	3.16	19.3	40
Dissolved substance	MEI	mg/l	648	1,169	3,026	2,315	1,500
SS	MEI	mg/l	53	24	453	223	100
Oil product	MEI	mg/l	0.5	0.5	ND	ND	15
Hardness	Japan	mgeqv/l	79	12.1	25.4	20.9	14
Cl^-	Japan	mg/l	49	52	57	55	400
SO_4^-	Japan	mg/l	340	670	1,900	1,600	400
T-Fe	Japan	mg/l	0.18	0.1	0.11	4.5	5
Mn	Japan	mg/l	0.09	0.12	0.96	0.44	0.8
NH_4-N	Japan	mg/l	9.6	0.6	<0.1	<0.1	5
NO_3-N	Japan	mg/l	7.9	3.2	0.1	6.9	20
NO_2-N	Japan	mg/l	3.7	0.74	1.1	<0.01	
T-N	Japan	mg/l	21.3	4.6	1.2	7	
$NaNO_3$	Japan	mg/l	48	19	0.6	42	
PO_4	MEI	mg/l	1.93	1.35	0.39	0.48	2
P (as PO_4)	Japan	mg/l	1	0.61	0.022	0.075	3
Se	Japan	mg/l	<0.005	<0.005	<0.005	0.005	0.01
Be	Japan	mg/l	<0.01	<0.01	<0.01	<0.01	0.002
V	Japan	mg/l	0.01	0.02	ND	0.04	1
Mo	Japan	mg/l	0.02	0.1	0.39	0.16	3
Ba	Japan	mg/l	0.04	0.05	0.04	0.15	4
B	Japan	mg/l	0.14	0.5	1.4	0.98	
Ag	Japan	mg/l	<0.01	0.01	<0.01	0.01	0.01
Pb	Japan	mg/l	<0.01	<0.01	<0.01	<0.01	0.2
SiO_3	MEI	mg/l	15.99	10.1	8.54	17.51	
Si	Japan	mg/l	6.6	4	3.2	8.2	
T-Cr	Japan	mg/l	<0.01	<0.01	<0.01	<0.01	
$Cr6^+$	Japan	mg/l	<0.01	<0.01	<0.01	<0.01	0.1
Cd	Japan	mg/l	<0.003	<0.003	<0.003	<0.003	0.02
CN	Japan	mg/l	<0.1	<0.1	<0.1	<0.1	1
Zn	Japan	mg/l	0.04	0.02	0.03	0.04	10
Ni	Japan	mg/l	<0.01	<0.01	<0.01	<0.01	1
As	Japan	mg/l	<0.002	<0.002	0.002	0.007	0.2
T-Hg	Japan	mg/l	<0.0005	<0.0005	<0.0005	<0.0005	0.003
R-Hg	Japan	mg/l	<0.0005	<0.0005	<0.0005	<0.0005	
PCB	Japan	mg/l	<0.0005	<0.0005	<0.0005	<0.0005	
O-P	Japan	mg/l	<0.1	<0.1	<0.1	<0.10	

*1 Sampling date: MEI-28th 11, 1995, Japan-7th, 12, 1995

9.2.5 Noise

Table 9-2-5-1(1)(2) shows the results of noise measurements at existing work positions at ME-1.

Table 9-2-5-2 shows the results of noise measurement at the site boundary of the premises (measuring points are shown in Figure 9-2-5-1) which are required for future noise forecast work.

There is not the noise standard at the site boundary in Bulgaria. Comparing measured noise levels at the boundary with the highest admissible noise levels in industrial district - 70 dB(A) in the daytime, 60 dB(A) at night (Hygienic Norms No. 0-64) - as reference, measured levels at following boundary points are over the admissible one ; boundary No.16 in the daytime, boundary No. 13,16,17,18 at night. These high measured data are due to existing transformers, neiboring briquet factory and much traffic.

It is judged that noise levels at residential areas are lower than those of reference admissible owing to reduction effect of distance.

Table 9-2-5-1(1) Measurement Result of Equivalent Noise Level According to Scale (A)

Code of W.P	Working place	Measured dB (A)	Norm dB (A)	Exceeding dB (A)
	TPP "Maritsa East I"			
I.	Department "Coal Feed"			
1.0	Control board	61.4	85	-
2.0	Covered unload	-	-	-
2.1	Working coal-shuttle feeder	39.4	85	4.4
2.2	No working coal-shuttle feeder	72.3	85	-
2.3	Multi coal-shuttle feeder	90.3	85	5.3
2.4	Band conveyer	96.5	85	11.5
3.0	Raw coal track	-	-	-
3.1	Transporter 2 AB - before crusher	95.4	85	10.4
3.2	Transporter B AB - after crusher	96.6	85	11.6
3.3	Reversible conveyer	89.6	85	4.6
3.4	Crusher coarse crusher	93.4	85	8.4
4.0	Dry track	-	-	-
4.1	Transporter 3 AB - before crusher	87.4	85	2.4
4.2	Transporter 5 AB - after crusher	87.6	85	2.6
4.3	Crusher small crush	85.6	85	0.6
II.	Department "Drying"			
5.0	Feeders crude coal	87.0	85	2.0
6.0	Drying drums	92.8	85	7.8
7.0	Ash section	88.5	85	3.5
8.0	Transporter 9 AB	87.3	85	2.3
9.0	Transformer 12	88.1	85	3.1
10.0	Cyclones and small ventilators	92.3	85	7.3
11.0	Elevation +6.50 drying furnaces 1st and 6th	88.2	85	3.2
11.1	Control board	64.3	85	-

Table 9-2-5-1(2) Measurement Result of Equivalent Noise Level According to Scale (A)

Code of W.P	Working place	Measured dB (A)	Norm dB (A)	Exceeding dB (A)
III.	Department "Drying"			
12.0	Elevation "0"	-	-	-
12.1	Crushers	86.9	85	1.9
13.0	Elevation "8"	-	-	-
13.1	Boilers 3rd and 4th	92.6	85	7.6
13.2	Technological board No. 1	76.7	85	-
13.3	Technological board No. 2	72.3	85	-
14.0	Mazut economy	-	-	-
14.1	Elevation "0" - heaters	88.7	85	3.7
14.2	Elevation "-6" - Pumps	94.6	85	9.6
15.0	Excavatar's station	-	-	-
15.1	Pumps	89.9	85	4.9
16.0	Smoke ventilators and ventilators	87.6	85	2.6
17.0	Workshop (corner grid)	98.2	85	13.2
18.0	Control Board at mazut economy	74.9	85	-
IV.	"Turbine" Department			
19.0	Elevation "0"	-	-	-
19.1	Turbine No.1	90.4	85	5.4
19.2	Turbine No.2	89.3	85	4.3
20.0	Elevation +3.50 m	93.4	85	8.4
21.0	Elevation +6.50 m	95.6	85	10.6
22.0	Elevation +8.00 m	-	-	-
22.1	El. generator No.1	93.4	85	8.4
22.2	El. generator No.2	92.3	85	7.3
22.3	Technological board No.1	76.7	85	-
22.4	Technological board No.2	72.3	85	-
23.0	Lakeside pump station	93.0	85	8.0
24.0	Traveling crane at turbine Department	92.2	85	-
25.0	Repair shop	72.3	85	-
26.0	Elevation "14" main steam collector	101.0	85	16.1

Table 9-2-5-2 Noise Measured Results at Boundary

dB(A)

No.	Daytime	Night	No.	Daytime	Night
(1)	50.5	48.4	(14)	57.0	60.0
(2)	47.6	43.2	(15)	61.0	58.6
(3)	55.4	51.4	(16)	71.0	68.1
(4)	58.7	50.7	(17)	61.0	64.7
(5)	54.6	52.3	(18)	60.0	61.4
(6)	50.8	44.6	(19)	57.6	60.0
(7)	51.4	56.2	(20)	56.8	58.9
(8)	59.7	56.2	(21)	53.1	55.6
(9)	59.3	54.5	(22)	53.8	54.9
(10)	63.2	55.6	(23)	51.8	51.6
(11)	60.6	56.4	(24)	49.5	45.3
(12)	56.5	56.6	(25)	49.0	41.0
(13)	59.3	61.5	(26)	50.4	42.7

Note: 1) Measured date: Daytime 1995.6.28 15:00, Night 1995.6.29 21:00
2) During taking night datum at (7) - (23), there was influence of traffic.

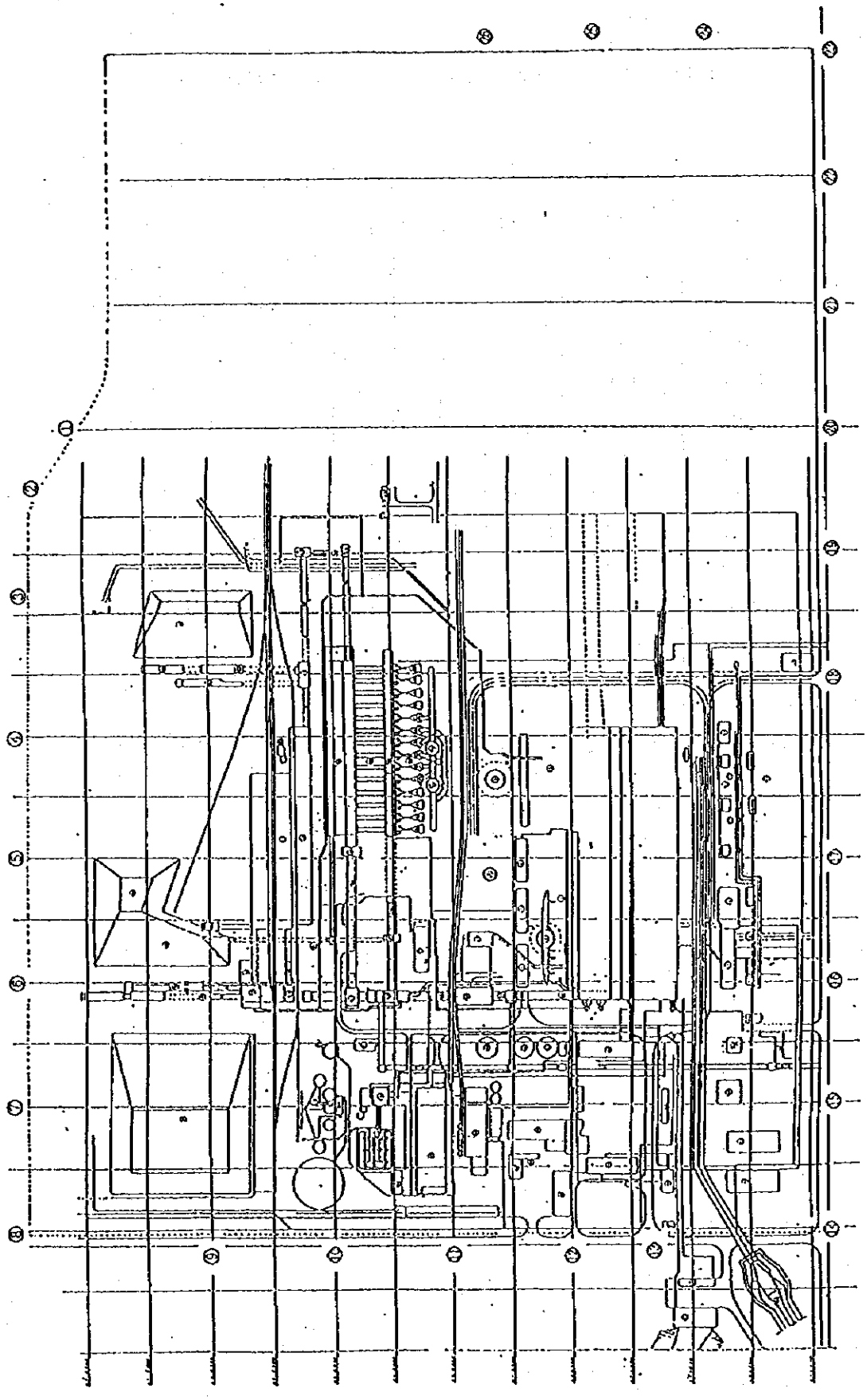


Figure 9-2-5-1 Noise measuring points